FINNISH CENTRE FOR RADIATION AND NUCLEAR SAFETY
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Translation

Limitation of public exposure from nuclear installations

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1 General

In order to keep the exposure of the population in the vicinity of nuclear installations as low as achievable,the releases of radioactive materials from nuclear installations shall be maintained as low as practicable. In addition, it shall be ensured in particular that dose limits and other derived limits will not be exceeded /1/.

General provisions on radiation protection applicable to nuclear installations are set forth in the Radiation Protection Act (174/57, 1/65), the Decree on Radiation Protection (328/57, 393/58, 545/68) and the Decision (594/68) of the Ministry of Social Affairs and Health. They define the dose limits for persons living within the sphere of influence of a radiation source as well as certain concentration limits derived from the dose limits which may not be exceeded when releasing radioactive materials into the environment. When a nuclear power plant or a related installation which contains radioactive materials in quantity is concerned, however, the authorities will, under the Decision 594/68, separately determine the limits applicable to the discharge of radioactive effluents.

The Guide YVL 7.2 /2/ deals with the evaluation of population doses received in the vicinity of nuclear power plants and the Guide YVL 7.3 /3/ discusses the evaluation of the dispersion of radioactive releases. Nuclear power plant transient and accident analyses are dealt with in the Guide YVL 2.2 /4/ in which also the classes of operational transients and accidents used in this guide are defined and the requirements concerning their analysis as well as assumptions are presented.

Where quantities, units and their definitions are concerned, the standard SFS 4670/5 is referred to, as applicable.

2 Scope

This Guide sets forth the limitations concerning public exposure from nuclear installations and the releases of radioactive materials.

This guide handles releases from the viewpoint of doses to the public. Limitations concerning occupational doses are defined in the Guide 7.9 /6/.

In this guide, the word installation denotes all on-site nuclear power plant units including nuclear waste treatment facilities directly related to their operation as well as intermediate stores and repositories.

3 Dose and release limits

3.1 Design dose limits

3.1.1 Operational conditions

Individual Dose Limit:

Effective Dose Equivalent 0.1 mSv

It shall be shown by dose calculations that this limit will not be exceeded as a consequence of any one-year-long normal operation or any single anticipated operational transient.

The limit will be applicable to the Effective Dose-Equivalent Commitment received by an individual in the critical group. The assumptions concerning the individual in the critical group are set forth in the Guide YVL 7.2.

Collective Dose Limit:

Collective Effective Dose-Equivalent
5 manSv/GW_e (per installed electrical power)

It shall be shown by dose calculations that this limit will not be exceeded in consequence of any one-year-long normal operation or any single anticipated operational transient. This requirement runs parallel with the requirement concerning the Individual Dose Limit and in practice the requirement will take precedence which leads to the least releases of radioactive materials.

The limit is applied to the Global Collective Effective Dose-Equivalent Commitment to the population truncated at 500 years taking into account all on-site activities, including the treatment of reactor waste, intermediate storage and the operation of the repository as well as the intermediate storage and transportation of spent fuel in Finnish territory.

In calculating the Collective Dose, the effect of the C-14 nuclide shall be studied separately. A C-14 release estimate based on the best theoretical and practical knowledge shall be employed for the calculation. If the given Collective Dose Limit is exceeded, the situation shall be studied taking into account the limitations and assumptions presented in the references /7/ and /8/ on which the dose limit is based. It shall be further estimated what means there are available to limit a C-14 release.

3.1.2 Accidents

Individual Dose Limit for Postulated Accidents:

Effective Dose Equivalent 5 mSv

This limit is applicable to the Effective Dose Equivalent received by an individual in the critical group in consequence of a Postulated Accident from external radiation arising during one year and the simultaneous intake of radioactive materials by the individual.

Also collective doses received as the result of a Postulated Accident shall be analysed.

Individual Dose from Severe Accidents:

The release of radioactive materials caused by a Severe Accident which is analysed according to the Guide YVL 2.2 shall not be so extensive as to cause acute radiation effects to the local population or to restrict the use of extensive land and water areas in the long term.

Concerning the long term effects, it shall be shown that a cesium release from the damaged reactor will not be in excess of 0.1 % of the cesium inventory. The release of other radionuclides shall not be so extensive as to cause, over a long period of time (a period of time which begins 3 months after an accident), a more extensive external and internal radiation dose total than the aforementioned cesium release.

3.2 Limitations during operation

3.2.1 Release limits and standard release rate

Each plant unit's Technical Specifications shall define the applicable release limits to ensure that the limits set for the Individual Dose and the Collective Dose in sub-section 3.1.1 will not be exceeded. The release limits shall be applicable to releases occurring during a period of one year but a release limit may be set for a shorter period as well. The steady release rate which corresponds to the release limit is called the Standard Release Rate.

Release limits shall be defined separately for the most important groups of radionuclides taking into account all the important radionuclides and all the release pathways. The limits shall be derived using the limits set forth in sub-section 3.1.1 employing models and parameters which are based on the best theoretical and practical knowledge as well as sufficient safety margins. If environmental monitoring shows, however, that population doses may exceed the limits set forth in sub-section 3.1.1, release limits shall be made more stringent in a way approved by the Finnish Centre for Radiation and Nuclear Safety.

3.2.2 Limitation of releases

Measures shall be taken to restrict releases in the way presented in sub-section 3.2.1 if the release rate exceeds the thresholds set forth below.

Reporting Threshold:

5 x Standard Release Rate
(averaged over a week at most)

Any release exceeding the threshold as well as its cause shall be mentioned in the plant daily report. Immediate corrective action shall be taken, if necessary, to restrict the release. If any operational error or accident is related to the event, a special report as prescribed in the Guide YVL 1.5 shall also be provided.

Release Threshold Requiring Corrective Action:

3 x Standard Release Rate
(averaged over a month at most)

If the radioactive materials release rate exceeds this threshold the plant operator is obliged to initiate measures as approved by the Finnish Centre for Radiation and Nuclear Safety for restricting the release.

Planned Releases:

The Finnish Centre for Radiation and Nuclear Safety shall be notified in advance of any planned temporary releases which would exceed the reporting threshold. The Finnish Centre for Radiation and Nuclear Safety may, on the basis of a plan submitted for approval by the licensee in advance, also give consent for a release which exceeds the release threshold and requires corrective action as mentioned above, within the framework of the annual release limit.

3.2.3 Interruption of plant operation

Release Limit Requiring Operational Shutdown:

Nuclear power plant operation shall be interrupted if it is obvious, on the basis of the conducted radiation monitoring measurements of releases or the environment, that the release limits defined in the Technical Specifications would be exceeded.

4 References and literature

1 Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, 1977.
2 Guide YVL 7.2, Evaluation of population doses in the environment of nuclear power plants.
3 Guide YVL 7.3, Evaluating the dispersion of radioactive releases from nuclear power plants under operating and accident conditions.
4 Guide YVL 2.2, Transient and accident analyses for justification of technical solutions at nuclear power plants.
5 Quantities and units of radioactivity and ionising radiation, SFS 4670, Suomen standardisoimisliitto (the Finnish Standards Association SFS), 1983-08-29.
6 Guide YVL 7.9, Health Physics programmes in nuclear power plants.
7 Basic Principles and Standards for the Limitation of Releases of Radioactive Substances from Nuclear Power Stations, Chapter 19 of Report on the Applicability of International Radiation Protection Recommendations in the Nordic Countries, The Radiation Protection Institutes in Denmark, Finland, Iceland, Norway and Sweden, 1976.
8 Application in the Nordic Countries of ICRP Publication 26, The Radiation Protection Institutes in Denmark, Finland, Iceland, Norway and Sweden, 1984.
9 Principles for Limiting Releases of Radioactive Effluents into the Environment, Safety Series No 77, IAEA, Vienna 1986.
10 Assigning a Value to Transboundary Radiation Exposure, Safety Series No 67, IAEA, Vienna 1985.

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