

Control of nuclear fuel and other nuclear materials required in the operation of nuclear power plants

1	General	3
2	Scope	3
3	Licensing procedure	4
4	Regulatory control by STUK	5
4.1	Fuel safety control	6
4.1.1	Power company's quality assurance programme for fuel	6
4.1.2	Fuel design and fabrication	6
4.1.3	Fresh and spent fuel transport	6
4.1.4	Fuel handling and storage	7
4.1.5	Fuel initial loading and reloading	7
4.1.6	Use of fuel	7
4.2	Safeguards	8
4.2.1	Design information on the facility and safeguards; a Facility Attachment to the Agreement Between Finland and the IAEA on Safeguards (Treaty Series of the Statutes of Finland 2/72)	8
4.2.2	Manual of accounting for and control of nuclear materials	8
4.3	Physical protection	8
5	References	9

This Guide is valid as of 1 September 1991 until further notice. This Guide replaces Guide YVL 6.1 issued on 23 April 1978.

Second, Revised Edition
Helsinki 1993
Erweko Painotuote Oy
ISBN 951-47-7462-0
ISSN 0783-2427

Authorization

The Finnish Centre for Radiation and Nuclear Safety (STUK) issues detailed regulations concerning the safety and physical protection of nuclear power plants and safeguards by virtue of Section 55, paragraph 2, point 3 of the Nuclear Energy Act (990/87) as well as Section 29 of the Decision of the Council of State on the General Regulations for the Safety of Nuclear Power Plants (395/91) and Section 13 of the Decision of the Council of State on the General Regulations for Physical Protection of Nuclear Power Plants (396/91).

The YVL guides are rules an individual licensee or any other organization concerned shall comply with unless some other acceptable procedure or solution is presented to STUK by which the safety level laid down in an YVL guide is achieved.

Translation. Original text in Finnish.

1 General

Control of nuclear fuel (hereinafter referred to as "fuel") and other nuclear materials required in the operation of a nuclear power plant aims to ensure that

- fuel is designed and fabricated so that it can be used safely and that fuel and other nuclear materials are used, handled, stored and transported safely (safety control)
- nuclear fuel or other nuclear material under Finland's control (including fuel covered by Finland's international treaties in the nuclear energy sector) and of Finnish origin or which has been produced in Finland, is not used for nuclear weapons or explosives or for any unknown purposes and Finnish juridical or physical persons do not take part in the implementation abroad of such projects in the nuclear energy sector as further nuclear proliferation (safeguards) and that
- sufficient physical protection exists to safeguard the use of fuel and other nuclear materials, their storage and transport against illegal activities (control of physical protection).

This control is based on the nuclear energy and radiation protection legislation, the regulations issued by virtue of them, the decisions of the the Council of State taken by virtue of the nuclear energy legislation as well as Finland's international treaties in the nuclear energy sector or contractual arrangements between governments. The Finnish Centre for Radiation and Nuclear Safety (STUK) acts as the regulatory authority.

2 Scope

Nuclear materials mean nuclear substances (special fissionable materials and source

materials suitable for the production of nuclear energy, such as uranium, plutonium and thorium) as well as other materials, components, equipment, information and agreements with bearing on nuclear proliferation or which are subject to the obligations of Finland's international treaties in the nuclear energy sector (Section 2, paragraph 1, points 4 and 5 of the Nuclear Energy Act 990/87).

This Guide summarizes the general requirements for a nuclear power plant's nuclear material control. Detailed requirements are presented in the relevant YVL guides.

The following items are subject to safeguards

- nuclear fuel (procurement, design, fabrication, transport, possession, storage, handling, production, use)
- the nuclear power plant structures, components and activities necessary to achieve the above objectives of control
- other nuclear substances required in plant operation (e.g. the uranium in fission chambers which are required for reactor core neutron flux measurements)
- the information, civil agreements (contracts of employment excluded) and components and equipment which have been classified as nuclear materials referred to in the nuclear energy legislation.

Activities relating to fuel and other nuclear materials require special licences as referred to in the nuclear energy legislation. The licencing procedure is described in Section 3 of this Guide.

The licences define licenced activities relating to fuel and other nuclear materials. The various phases of the activities may in general be commenced only after STUK has

granted a special approval for the activities in question. Section 4 of this Guide describes the control of fuel and other nuclear substances required in the operation of a nuclear power plant. Due to the variety of other nuclear materials, the activities relating to them and the international treaty obligations, the requirements applicable to these materials are presented on a case by case basis when reviewing the licence applications.

Guide YVL 1.1 describes how the regulatory control of fuel and other nuclear materials relates to other control of nuclear power plants exercised by STUK. Regulatory control of nuclear waste is addressed in category 8 of the YVL guides.

3 Licencing procedure

The nuclear materials licencing procedure related to nuclear power plants and their operation is described below.

1. Nuclear facility licences (construction and operating licence)

The licencing procedure concerning the construction of a nuclear power plant is presented in Sections 31 to 32, 35 and 37 to 40 and the licencing procedure concerning its operation in Sections 33 to 34 and 36 to 40 of the Nuclear Energy Decree. According to Section 20 of the Decree, the holder of a construction or operating licence is, unless specifically otherwise provided by the mentioned licences, entitled to possess, manufacture, produce, handle, use and store on-site also nuclear substances and wastes required during or generated in consequence of the plant's operation, as well as the materials, components and equipment referred to in Section 8 of the Decree, without a special licence. Even then the licences issued impose restrictions on i.a. the quality and quantity of these operations.

2. Licences for components and equipment

The components and equipment referred to in Section 2, paragraph 1, point 4 and in paragraph 3 of the Nuclear Energy Act to which the Act applies are defined in Section 8 of the Nuclear Energy Decree so that they refer to the components and equipment mentioned i.a. in points 2 and 5.2 of Appendix A to the Decree.

The Act applies to the components and equipment referred to in point 5.2 only if, prior to the import of the components and equipment, based on a treaty in the nuclear energy sector between Finland and some other state, the authorities of the two countries have agreed between themselves and at the request of the foreign authority concerned that the component or equipment in question will, in connection with import, become subject to the provisions of the agreement.

The licencing procedure concerning the export and import of components and equipment is enacted in Sections 50 to 55 of the Nuclear Energy Decree.

A construction and operating licence entitles to the possession, fabrication, production, handling, use and storage on-site of components and equipment required in nuclear power plant operation unless specifically otherwise provided by these licences.

The licencing procedure concerning the transfer of components and equipment is enacted in Sections 41, 48 to 49 of the Nuclear Energy Decree.

A licence is not required for the transfer of a component or equipment mentioned in point 2 of Appendix A if the applicant has the aforementioned construction or operating licence and the component or equipment will be for use in this nuclear facility (Section 19 of the Decree). The holder of the

aforementioned export licence also does not need a special licence for the transfer of such a component or equipment (Section 21 of the Decree).

3. Import and export licences for fuel and other nuclear substances

The granting of a licence and the documents and licences to be attached to the application are enacted in Sections 50 to 55 of the Nuclear Energy Decree.

4. Transport licences for fuel and other nuclear substances

The granting of a licence and the documents and licences to be attached to the application are enacted in Sections 56 to 60 of the Nuclear Energy Decree.

5. Transfer licences for fuel and other nuclear substances

The granting of a licence and the documents and licences to be attached to the application are enacted in Sections 41, 48 and 49 of the Nuclear Energy Decree. The holder of the export licence mentioned above (in point 3) does not need a special licence for the transfer of such nuclear substance (Section 21 of the Decree).

6. Licences concerning agreements

The agreements referred to in Section 2, paragraph 1, point 5 of the Nuclear Energy Act, to which the Act applies, are defined in Section 9 of the Nuclear Energy Decree.

The licencing procedure concerning the concluding and execution of civil agreements is enacted in Sections 71 to 73 of the Nuclear Energy Decree.

7. Licences concerning information

The information presented in Section 2, paragraph 1, point 4 of the Nuclear Energy

Act to which the Act applies is defined in Section 8 of the Nuclear Energy Decree in such a way that it means the information mentioned in points 4 and 5.4 of Appendix A to the Decree.

The procedure of granting export and import licences concerning information are enacted in Sections 50 to 55 of the Nuclear Energy Decree and the procedure for licencing the possession and transfer of information is enacted in Sections 71 to 73 of the Nuclear Energy Decree.

Sections 11 to 18 of the Nuclear Energy Decree define activities which have, due to the insignificant amount of nuclear substance or the purpose of its use, been exempted from licence. In cases defined in the Decree, such activities shall be notified to STUK pursuant to Sections 131 to 133 of the Decree.

According to Section 8 of the Nuclear Energy Act, the Ministry of Trade and Industry shall, when requested, give a binding advance ruling as to whether the intended activity requires that a licence be applied.

4 Regulatory control by STUK

A general description of fuel safety control, safeguards and control of physical protection is given below. STUK's audits which are part of this control are contained in the regulatory control of the nuclear power plant. Part of the audits are contained in the periodic inspection programme and part are special inspections. The special inspections are conducted on the basis of the licensee's inspection requests and their reports on measures related to nuclear materials.

4.1 Fuel safety control

4.1.1 Power company's quality assurance programme for fuel

The fuel shall satisfy stringent quality requirements to ensure sufficient safety and reliability. An approved quality assurance programme shall thus be observed in all activities affecting fuel quality. The quality assurance programme shall cover the procurement, control of design and fabrication, transport, handling, receiving, storage and use of the fuel.

Prior to the commencement of fuel fabrication the power company shall obtain STUK's approval for the fuel quality assurance programme. The quality assurance manual shall be forwarded to STUK not later than one year prior to the commencement of fuel fabrication. Fabrication is considered to have commenced when the cutting and/or machining into their final shape of fuel assembly parts or the fabrication of pellets from powder is started.

STUK controls the implementation of the quality assurance programme as part of the nuclear power plant's periodic inspection programme and by special inspections.

The requirements for the quality assurance programme are presented in Guide YVL 6.7 Quality assurance of nuclear fuel.

4.1.2 Fuel design and fabrication

The approval procedure for fuel design and fabrication contains the following phases:

a) Pre-inspection of fuel design and fabrication

The pre-inspection documentation relating to fuel design and fabrication is subject to STUK's approval prior to the commencement of fuel fabrication.

b) Control of fuel fabrication

At its discretion, STUK conducts inspections relating to quality assurance of fuel design and fabrication, the fabrication and quality control methods, sub-contracts as well as quality control of the fuel batches fabricated.

c) Control of the receiving inspection at the nuclear power plant

The receiving inspection programme for fuel is subject to STUK's approval. STUK oversees the receiving inspections at its discretion.

Detailed requirements for nuclear fuel design and fabrication are presented in Guide YVL 6.2. Guide YVL 6.3 describes in detail STUK's regulatory control procedure and the requirements related to the time-limits associated with regulatory control.

4.1.3 Fresh and spent fuel transport

The general prerequisites for transport are:

- a valid transport licence for the transport shall exist
- a responsible manager, approved by STUK for the job, has been designated for the transport
- an insurance or some other special guarantee in accordance with the Nuclear Liability Act is in force
- the transport, safety and accident preparedness plans have been approved by STUK
- the package type and the individual transport packages have duly been approved
- potential licence conditions concerning fuel transport have been met.

The holder of a transport licence shall notify STUK of the fuel transport not later than three weeks prior to the commencement of the transport and shall refer to the decisions,

certificates of approval and licences by virtue of which the transport is planned to be made.

STUK oversees the execution of fuel shipments at its discretion.

The control of transport and packages is more closely described in Guides YVL 6.4 and YVL 6.5. Detailed safety regulations concerning the packaging and transport of nuclear materials are presented in the transport code for hazardous materials. As regards nuclear substances and other radioactive materials, the code is based on IAEA's recommendations for the transport of radioactive materials /1/. STUK acts as the competent authority in Finland as regards the transport of radioactive materials.

4.1.4 Fuel handling and storage

STUK controls the handling and storage of fuel at the nuclear power plant. This control contains

- a review of the plans for and analyses of the handling and storage systems
- a review of the pre-inspection documentation for components and structures
- supervision of the components and structures manufacturing and performance of structural and commissioning inspections
- witnessing of the start-up tests of the handling and storage systems
- a review of the handling and storage instructions
- inspections of the handling and storage systems and their use at discretion and as part of the periodic inspection programme of nuclear power plants.

The design requirements for fuel handling and storage as well as STUK's regulatory procedure are explained in more detail in Guide YVL 6.8.

4.1.5 Fuel initial loading and reloading

In connection with fuel loading STUK reviews

- the loading application together with i.a. the attached loading plan
- the documentation for fuel and reactor behaviour during the next operating period.

The approval of the loading application is a prerequisite for the opening of the reactor pressure vessel cover and the loading operations.

STUK oversees the loading operations at its discretion and inspects in the end the core configuration to verify its conformity with the approved plans.

The closing of the reactor pressure vessel cover may be started after STUK has approved of the documentation for the behaviour of the reactor and fuel in the next operating period and when a positive inspection result has been entered in STUK's protocols concerning the reactor pressure vessel and nuclear materials.

The requirements for refuelling are explained in more detail in Guide YVL 1.13.

4.1.6 Use of fuel

Surveillance of the use of fuel is focused on the monitoring of fuel power histories and the quantity of fission products present in the primary circuit, monitoring of fuel behaviour and integrity, as well as investigations conducted on spent fuel. The programme for surveillance of the use of fuel is subject to STUK's approval prior to the initial loading of the reactor.

STUK controls the use of fuel and reactor operation as part of the periodic inspection programme of nuclear power plants.

The requirements for the surveillance of the use of fuel are explained in more detail in Guide YVL 6.6.

4.2 Safeguards

4.2.1 Design information on the facility and safeguards; a Facility Attachment to the Agreement Between Finland and the IAEA on Safeguards (Treaty Series of the Statutes of Finland 2/72)

The applicant for a licence shall forward the facility's design information to STUK for approval together with the application for a construction licence. The design information is given on forms available from STUK.

After having approved of the design information, STUK forwards it to the IAEA. On the basis of the design information the IAEA and STUK prepare a draft Facility Attachment as required in the safeguards agreement. The Facility Attachment is an agreement between the Finnish authorities and the IAEA on communication, accounting for and control of nuclear material in respect of a specific facility/facilities or a material balance area. STUK requests from the power company a statement about the draft Facility Attachment. After having approved of the draft Facility Attachment, STUK forwards it to the Ministry of Trade and Industry which implements it in cooperation with the IAEA.

4.2.2 Manual of accounting for and control of nuclear materials

In association with the procurement, transport, use, handling and storage of nuclear materials the licensee shall, for his part, arrange for the necessary control for the prevention of the proliferation of nuclear weapons and the fulfillment of the obligations of Finland's international treaties related to this control. To accomplish this, a manual describing the facility level system of accounting for and control of nuclear

materials shall be prepared, maintained and developed.

As regards the import, storage and handling of fuel, the system of accounting for and control of nuclear materials is subject to STUK's approval before the import of fuel and the whole system is subject to STUK's approval before the loading of fuel is commenced.

STUK oversees the implementation of the system. Documentation, notifications and reports which relate to this control are forwarded to STUK.

The requirements placed on the system of accounting for and control of nuclear materials are presented in more detail in Guides YVL 6.9 and YVL 6.10.

4.3 Physical protection

The applicant/licencee shall prepare, maintain and develop physical protection arrangements by which it prevents, for its own part, any illegal activities directed against the operation of the nuclear power plant and against nuclear materials. These arrangements are set forth in the security plans devised for the construction and operation of the facility and the transport of fuel. The security plans are subject to STUK's approval.

The preliminary security plan for the construction and operation of the nuclear power plant shall be forwarded to STUK together with the application for the facility's construction licence. The plan shall be supplemented in the course of construction.

The security plan for operation shall be forwarded to STUK together with the application for the facility's operating licence.

STUK sees to it that the plans are implemented according to the documents submitted. STUK also controls the commissioning of the security systems and devices. The general requirements for the physical protection of nuclear power plants

are set forth in a Decision of the Council of State (396/91). The physical protection of nuclear power plants and fuel transports is presented in more detail in the relevant YVL guides.

5 References

- 1 Regulation of Safe Transport of Radioactive Materials (As Amended and Supplemented), IAEA Safety Series No 6.

YVL guides

General guides

YVL 1.0 Safety criteria for design of nuclear power plants, 1 Dec. 1982

YVL 1.1 The Finnish Centre for Radiation and Nuclear Safety as the regulatory authority in control of the use of nuclear energy, 27 Jan. 1992

YVL 1.2 Documents to be submitted to the Finnish Centre for Radiation and Nuclear Safety concerning the regulation of nuclear facilities, 22 May 1991 (in Finnish)

YVL 1.3 Mechanical components and structures of nuclear power plants. Inspection licenses, 25 March 1983

YVL 1.4 Quality assurance of nuclear power plants, 20 Sep. 1991

YVL 1.5 Reporting nuclear power plant operation to the Finnish Centre for Radiation and Nuclear Safety, 18 Aug. 1989

YVL 1.6 Nuclear power plant operator licensing, 3 March 1989

YVL 1.7 Duties important to nuclear power plant safety, personnel qualifications and training, 28 Dec. 1992 (in Finnish)

YVL 1.8 Repairs, modifications and preventive maintenance at nuclear facilities, 2 Oct. 1986

YVL 1.9 Quality assurance of nuclear power plant operation, 13 Nov. 1991 (in Finnish)

YVL 1.13 Regulatory inspections related to shutdowns at nuclear power plants, 9 May 1985

YVL 1.15 Mechanical components and structures in nuclear installations, Construction inspection, 16 April 1984

Systems

YVL 2.1 Safety classification of nuclear power plant systems, structures and components, 22 May 1992

YVL 2.2 Transient and accident analyses for justification of technical solutions at nuclear power plants, 7 Oct. 1987

YVL 2.3 Preinspection of nuclear power plant systems, 14 Aug. 1975

YVL 2.4 Over-pressure protection and pressure control during disturbances in the primary circuit and steam generators of a PWR plant, 19 Sept. 1984

YVL 2.5 Preoperational and start-up testing of nuclear power plants, 8 Jan. 1991 (in Finnish)

YVL 2.6 Provision against earthquakes affecting nuclear facilities, 19 Dec. 1988

YVL 2.7 Failure criteria for the design of a light-water reactor, 6 April 1983

YVL 2.8 Probabilistic safety analyses (PSA) in the licensing and regulation of nuclear power plants, 18 Nov. 1987

Pressure vessels

YVL 3.0 Pressure vessels in nuclear facilities. General guidelines on regulation, 21 Jan. 1986

YVL 3.1 Nuclear power plant pressure vessels. Construction plan. Safety classes 1 and 2, 11 May 1981

YVL 3.2 Nuclear power plant pressure vessels. Construction plan. Safety class 3 and class EYT, 21 June 1982

YVL 3.3 Supervision of the piping of nuclear facilities, 21 May 1984

YVL 3.4 Nuclear power plant pressure vessels. Manufacturing license, 15 April 1981

YVL 3.7 Nuclear power plant pressure vessels. Commissioning inspection, 12 Dec. 1991 (in Finnish)

YVL 3.8 Nuclear power plant pressure vessels. Inservice inspections, 9 Sept. 1982

YVL 3.9 Nuclear power plant pressure vessels. Construction and welding filler materials, 6 Nov. 1978

Buildings and structures

YVL 4.1 Nuclear power plant concrete structures, 22 May 1992 (in Finnish)

YVL 4.2 Steel structures for nuclear facilities, 19 Jan. 1987

YVL 4.3 Fire protection at nuclear facilities, 2 Feb. 1987

Other structures and components

YVL 5.3 Regulatory control of nuclear facility valves and their actuators, 7 Feb. 1991

YVL 5.4 Supervision of safety relief valves in nuclear facilities, 3 June 1985

YVL 5.5 Supervision of electric and instrumentation systems and components at nuclear facilities, 7 June 1985

YVL 5.7 Pumps at nuclear facilities, 27 May 1986

YVL 5.8 Hoisting appliances and fuel handling equipment at nuclear facilities, 5 Jan. 1987

Nuclear materials

YVL 6.1 Control of nuclear fuel and other nuclear materials required in the operation of nuclear power plants, 19 June 1991

YVL 6.2 Fuel design limits and general design criteria, 15 Feb. 1983

YVL 6.3 Supervision of fuel design and manufacture, 28 Feb. 1983

YVL 6.4 Supervision of nuclear fuel transport packages, 1 March 1984

YVI 6.5 Supervision of nuclear fuel transport, 1 March 1984

YVL 6.6 Surveillance of nuclear fuel performance, 5 Nov. 1990 (in Finnish)

YVL 6.7 Quality assurance of nuclear fuel, 11 Oct. 1983

YVL 6.8 Handling and storage of nuclear fuel, 13 Nov. 1991 (in Finnish)

YVL 6.11 Physical protection of nuclear power plants, 13 July 1992 (in Finnish)

YVL 6.21 Physical protection of nuclear fuel transports, 15 Feb. 1988 (in Finnish)

Radiation protection

YVL 7.1 Limitation of public exposure in the environment of and limitation of radioactive releases from nuclear power plants, 14. Dec. 1992

YVL 7.2 Evaluation of population doses in the environment of nuclear power plants, 12 May 1983

YVL 7.3 Evaluating the dispersion of radioactive releases from nuclear power plants under operating and in accident conditions, 12 May 1983

YVL 7.4 Nuclear power plant emergency plans, 12 May 1983

YVL 7.5 Meteorological measurements of nuclear power plants, 28 Dec. 1990 (in Finnish)

YVL 7.6 Measuring radioactive releases from nuclear power plants, 13 July, 1992 (in Finnish)

YVL 7.7 Programmes for monitoring radioactivity in the environment of nuclear power plants, 21 May 1982

YVL 7.8 Reporting radiological control of the environs of nuclear power plants to the Institute on Radiation Protection, 21 May 1982

YVL 7.9 Radiation protection of nuclear power plant workers, 14 Dec. 1992 (in Finnish)

YVI 7.10 Individual monitoring and reporting of radiation doses, 1 March 1984

YVI 7.11 Radiation monitoring systems and equipment in nuclear power plants, 1 Feb. 1983

YVL 7.14 Action levels for protection of the public in nuclear power plant accidents, 26 May 1976

YVL 7.18 Radiation protection in design of nuclear power plants, 14 May 1981

Radioactive waste management

YVL 8.1 Disposal of reactor waste, 20 Sept. 1991

YVL 8.2 Exemption from regulatory control of nuclear wastes, 19 March 1992

YVL 8.3 Treatment and storage of radioactive waste at the nuclear power plants, 1 July 1985