

Quality assurance for nuclear power plants

1	General	3
2	Quality assurance programmes	3
2.1	Quality policy	3
2.2	Quality assurance requirements	3
2.3	Establishment of quality assurance programmes	4
2.4	Implementation of quality assurance	4
3	Regulatory control of quality assurance by the Finnish Centre for Radiation and Nuclear Safety	4
4	References	5

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Authorization

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

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.

1 General

According to Section 2 of the Decision of the Council of State on the general regulations for the safety of nuclear power plants (395/91), quality assurance shall refer to all the planned and systematic actions necessary to provide adequate confidence that a component, plant or activity will satisfy given requirements. The prerequisites essential for efficient quality assurance are clearly defined responsibility and authority, proven methods of work and management, good working conditions, the personnel's responsible attitude and familiarity with own duties as well as systematic reporting and keeping of records.

Quality assurance applies to all activities and organizations which affect the safety of nuclear power plants (such as design, component manufacture, on-site construction and installation, start-up tests, commissioning and operation).

Quality assurance activities are described in quality assurance programmes.

This guide presents the general requirements for the quality assurance programmes required of the organizations which participate in nuclear power plant design, construction and operation as well as for the establishment, implementation and control of these programmes. This guide also applies to other nuclear facilities as well as to nuclear fuel and waste management.

The licencing and regulatory control procedure which applies to nuclear power plant design, construction and operation is presented in Guide YVL 1.1.

2 Quality assurance programmes

2.1 Quality policy

The applicant/licensee and other organizations affecting the safety of the nuclear power plant shall present, in documents confirmed by the utility's management, the objectives of their quality policy and their commitment to high

quality and safety culture. It shall be ensured by training and guidance that quality assurance is correctly understood and implemented.

2.2 Quality assurance requirements

The Decision of the Council of State on the general regulations for the safety of nuclear power plants contains i.a. the following requirements for the planning and implementation of quality assurance:

- When designing, constructing and operating a nuclear power plant, an advanced safety culture shall be maintained which is based on the safety oriented attitude of the topmost management of the organizations in question and on motivation of the personnel for responsible work. This presupposes well organised working conditions and an open working atmosphere as well as the encouragement of alertness and initiative in order to detect and eliminate factors which endanger safety (§ 4).
- Advanced quality assurance programmes shall be employed in all activities which affect safety and relate to the design, construction and operation of a nuclear power plant (§ 5).
- In design, construction and operation, proven or otherwise carefully examined high quality technology shall be employed to prevent operational transients and accidents (preventive measures) (1st paragraph of § 13).
- The systems, structures and components important to safety shall be designed, manufactured, installed and operated so that their quality level and the inspections and tests required to verify their quality level are adequate considering any item's safety significance (2nd paragraph of § 21).
- In all activities affecting the operation of a nuclear power plant and the availability of components, a systematic approach shall be applied for ensuring the plant operators' continuous awareness of the

state of the plant and its components (1st paragraph of § 24).

Detailed quality assurance requirements for nuclear power plant operation are stated in Guide YVL 1.9.

Detailed quality assurance requirements for nuclear fuel are stated in Guide YVL 6.7.

2.3 Establishment of quality assurance programmes

The applicant/licensee shall establish quality assurance programmes for nuclear power plant design, construction and operation. In addition, the applicant/licensee shall ensure that

- only suppliers and organizations with the prerequisites and will for high quality performance and with clearly defined procedures related to quality assurance may participate in the performance of duties which affect the safety of the nuclear power plant, and that
- a quality assurance programme shall be required from the facility's main supplier, the supplier of fuel as well as other organizations taking part in the design, manufacture, installation and commissioning of the facility, whose activities affect the safety of the nuclear power plant.

STUK considers it acceptable that, when establishing quality assurance programmes, the general quality assurance recommendations presented in IAEA Standard 50-C-QA /1/ are taken as a starting point. In case Standard 50-C-QA is deviated from, it shall be demonstrated that the quality assurance procedures adopted ensure sufficient quality. Detailed quality assurance requirements to be taken into account when applying Standard 50-C-QA are presented in the YVL guides.

The quality assurance programmes shall describe, as regards the relevant organization's every area of responsibility, the duties, responsibilities and procedures related to quality, safety and reliability according to which a sufficiently high level of quality of the

nuclear power plant project is aimed to be achieved.

The quality assurance programmes shall present how the company concerned strives to develop and maintain a safety culture committed to high quality /2/ by the application of design, guidance, control, follow-up and by the evaluation of the records maintained of activities affecting quality.

2.4 Implementation of quality assurance

The licensee bears the overall responsibility for the taking into account of valid regulations and the provisions of the YVL guides in the quality assurance programmes of various organizations. The licensee bears principal responsibility also for adherence to the established quality assurance requirements and for the achievement of a sufficiently high level of quality.

The licensee's quality assurance programme shall state the procedures by which the licensee ensures implementation and viability of the quality assurance activities of the organizations referred to in sub-section 2.3.

The licensee and other organizations referred to in sub-section 2.3 shall maintain an organizational unit independent of other units and which is vested with sufficient authority and status to develop, maintain and control quality assurance. The quality assurance programmes shall state the procedures for controlling the implementation and viability of quality assurance.

3 Regulatory control of quality assurance by the Finnish Centre for Radiation and Nuclear Safety

According to Section 35 of the Nuclear Energy Decree (161/88), when applying for a construction licence, the applicant shall

submit to the Finnish Centre for Radiation and Nuclear Safety a description of quality assurance for the construction of the nuclear facility (quality assurance programme during design and construction). The quality assurance programme shall be forwarded to STUK for approval. The quality assurance programme presents the systematic measures which the organizations taking part in the design and construction of the nuclear facility apply in their operations which affect quality.

Review of the quality assurance programmes of other organizations taking part in the facility project to a significant degree are addressed in the relevant YVL guides or STUK decides separately on their review in connection with the review of e.g. manufacturing licences, construction plans or inspection rights.

Quality assurance programmes for nuclear fuel are forwarded to STUK in accordance with Guides YVL 6.1 and YVL 6.3.

According to Section 36 of the Nuclear Energy Decree, when applying for an operating licence, the applicant shall submit to STUK a quality assurance programme for the operation of the nuclear facility. The quality assurance programme and subsequent amendments thereto shall be forwarded to STUK for approval.

In addition to document review, STUK controls the implementation of quality assurance by quality assurance audits focused on the activities of the applicant/licensee and other organizations. The implementation of quality assurance is also controlled in connection with other inspections related to the various sectors of the facility project.

4 References

- 1 IAEA Safety Series No 50-C-QA, Safety Standards, Code on the Safety of Nuclear Power Plants: Quality Assurance, Vienna
- 2 IAEA Safety Series No. 75-INSAG-4, Safety Culture, Vienna
- 3 IAEA Safety Series No. 50-SG-QA1, Safety Guides, Establishing of the quality assurance programme for a nuclear power plant project, Vienna
- 4 IAEA Safety Series No. 50-SG-QA2, Safety Guides, Quality assurance records system for nuclear power plants, Vienna
- 5 IAEA Safety Series No. 50-SG-QA3, Safety Guides, Quality assurance in the procurement of items and services for nuclear power plants, Vienna
- 6 IAEA Safety Series No. 50-SG-QA4, Safety Guides, Quality assurance during site construction of nuclear power plants, Vienna
- 7 IAEA Safety Series No. 50-SG-QA5, Safety Guides, Quality assurance during commissioning and operation of nuclear power plants, Vienna
- 8 IAEA Safety Series No. 50-SG-QA6, Safety Guides, Quality assurance in the design of nuclear power plants, Vienna
- 9 IAEA Safety Series No. 50-SG-QA7, Safety Guides, Quality assurance organization for nuclear power plants, Vienna
- 10 IAEA Safety Series No. 50-SG-QA8, Safety Guides, Quality assurance in the manufacture of items for nuclear power plants, Vienna
- 11 IAEA Safety Series No. 50SG-QA10, Safety Guides, Quality assurance auditing for nuclear power plants, Vienna
- 12 IAEA Safety Series No. 50-SG-QA11, Safety Guides, Quality assurance in the procurements, design and manufacture of nuclear fuel assemblies, Vienna

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 Qualifications of nuclear power plant personnel, 12 Jan. 1978

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 (in Finnish)

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

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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

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YVL 6.1 Nuclear fuel and other nuclear material control at nuclear power plants, 19 June 1991 (in Finnish)

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

YVL 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)

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YVL 7.1 Limitation of public exposure from nuclear installations, 7 Oct. 1987

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 releases of radioactive materials 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 Health physics programmes in nuclear power plants, 21 April 1981

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

YVL 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

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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