STUK

GUIDE **YVL 3.0** / 9 APRIL 2002

PRESSURE EQUIPMENT OF NUCLEAR FACILITIES

continues

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Authorisation

By virtue of the below acts and regulations, the Radiation and Nuclear Safety Authority (STUK) issues detailed regulations that apply to the safe use of nuclear energy and to physical protection, emergency preparedness and safeguards:

- Section 55, paragraph 2, point 3 of the Nuclear Energy Act (990/1987)
- Section 29 of the Government Resolution (395/1991) on the Safety of Nuclear Power Plants
- Section 13 of the Government Resolution (396/1991) on the Physical Protection of Nuclear Power Plants
- Section 11 of the Government Resolution (397/1991) on the Emergency Preparedness of Nuclear Power Plants
- Section 8 of the Government Resolution (398/1991) on the Safety of a Disposal Facility for Reactor Waste
- Section 30 of the Government Resolution (478/1999) on the Safety of Disposal of Spent Nuclear Fuel.

Rules for application

The publication of a YVL guide does not, as such, alter any previous decisions made by STUK. After having heard those concerned, STUK makes a separate decision on how a new or revised YVL guide applies to operating nuclear power plants, or to those under construction, and to licensees' operational activities. The guides apply as such to new nuclear facilities.

When considering how new safety requirements presented in YVL guides apply to operating nuclear power plants, or to those under construction, STUK takes into account section 27 of the Government Resolution (395/1991), which prescribes that *for further safety enhancement, action shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology.*

If deviations are made from the requirements of the YVL guides, STUK shall be presented with some other acceptable procedure or solution by which the safety level set forth in the YVL guides is achieved.

Translation. Original text in Finnish.

1 General

The reliable operation and integrity of the pressure equipment of nuclear facilities have a major bearing on the safety of the facilities. The safety level set for the pressure equipment of nuclear facilities is based on the Nuclear Energy Act (990/1987) and on regulations issued by virtue of the Act. Requirements for the assurance of primary circuit and containment integrity are given in Government Resolution No. 395/1991.

According to section 6 of the Nuclear Energy Act (990/1987):

The use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property.

According to section 60 of the Nuclear Energy Act:

By virtue of this Act pressure equipment at nuclear facilities are controlled as follows:

1. *pressure equipment, particularly designed for nuclear facilities, whose malfunction may cause a radioactive release (nuclear pressure equipment);*
2. *other pressure equipment at nuclear facilities (non-nuclear pressure equipment); unless otherwise decreed hereafter.*

Where technical requirements for non-nuclear pressure equipment at nuclear facilities, demonstration of safety and other preconditions for their placing on the market are concerned, the provisions of the Pressure Equipment Act (869/1999) are in force.

According to section 60a of the Nuclear Energy Act:

The Radiation and Nuclear Safety Authority (STUK) approves manufacturers of nuclear pressure equipment for their duties and inspection organisations or testing organisations for duties pertaining to the control of pressure equipment at nuclear facilities.

A prerequisite for the approval of an inspection and testing organisation is that the inspection or testing organisation is operationally and economically independent and that it carries liability insurance. In addition, the inspection organisation and testing organisation shall have an advanced quality system, a competent and experienced personnel as well as appropriately qualified methods, facilities and equipment for manufacturing and operation.

If the operation of the manufacturer, inspection organisation or testing organisation of pressure equipment falls short of stipulated requirements and conditions, or of those stated in a decision of approval, the Radiation and Nuclear Safety Authority (STUK) may withdraw its approval. If justified by reasons pertaining to the assurance of safety, the Radiation and Nuclear Safety Authority (STUK) may, after having granted the corporation or establishment concerned a hearing, change the requirements and conditions established in its decision of approval.

According to section 117 of the Nuclear Energy Decree (161/1988):

As regards pressure equipment, the Radiation and Nuclear Safety Authority (STUK) must in particular:

1. *set detailed requirements for the safety of nuclear pressure equipment;*
2. *carry out control and inspection to ensure that the design, manufacture, placement, installation, operation, maintenance and repair of nuclear pressure equipment comply with safety requirements and regulations;*
3. *set more detailed requirements for the manufacture of nuclear pressure equipment and for related quality assurance;*
4. *carry out control and inspection to ensure that the placement, installation, operation, maintenance and repair of non-nuclear pressure equipment comply with safety requirements and regulations; as well as*
5. *set requirements pertaining to the licence-holder's actions and procedures for assuring the safety of pressure equipment in nuclear facilities, as well as monitor the implementation of the requirements.*

According to section 117a of the Nuclear Energy Decree:

The bases for the safety level required of the installation, operation and placement of pressure equipment at nuclear facilities are in accordance with the provisions of section 6 of the Nuclear Energy Act.

On demand, the manufacturer of nuclear pressure equipment must be able to demonstrate that

a piece of pressure equipment and its planned design and manufacture meet the requirements set for the safe use of nuclear energy.

The design organisation and the manufacturer of nuclear pressure equipment as well as testing and inspection organisations shall consider the safety culture and quality assurance requirements set out in Government Resolution No. 359/1991:

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 organisations 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.

Advanced quality assurance programmes shall be employed in all safety-related design, construction and operation activities of a nuclear power plant.

If pressure equipment contain dangerous fluid or gas, not only the requirements of this guide shall be considered but also those of the Chemicals Act (744/1989), the Explosives Act (263/1953) and the Decree (59/1999) issued by virtue of the two Acts.

This guide presents requirements pertaining to pressure equipment, their control and inspection. It applies to the pressure equipment of nuclear facilities, with the following exceptions: transportable pressure equipment, pressure equipment only needed in the construction of a nuclear facility or serving only maintenance duties carried out by the personnel as well as pressure equipment excluded from regulatory control and inspections in accordance with instructions or decisions given by the Radiation and Nuclear Safety Authority (STUK). The requirements of this guide also apply to reactor pressure vessel internals and the steel containment. Detailed requirements pertaining to the pressure equipment of nuclear facilities are presented in other YVL guides.

2 Definitions

For the purposes of this guide

1. *an installation construction plan* presents the connecting of pressure equipment and their supports to the rest of the system
2. *a notified body* is an organisation that has been reported under Pressure Equipment Directive 97/23/EC of the European Parliament and of the Council of the European Union
3. *qualification* is the validation of instructions, components and personnel
4. *user inspectorate* is an organisation designated by the Ministry of Trade and Industry
5. *a commissioning inspection* is an inspection conducted in accordance with Guide YVL 3.7 and prior to the commissioning of the pressure equipment of a nuclear facility.
6. *a classification document* is a classification document as referred to in Guide YVL 2.1
7. *a licensee* is a licensee as referred to in section 9 of the Nuclear Energy Act (990/1987)
8. *a dossier for an item of pressure equipment* is a file of documents in accordance with section 5 of the Ministry of Trade and Industry Decision (953/1999) on Pressure Equipment and contains all protocols plus other essential documentation pertaining to an item of pressure equipment
9. *pressure equipment* are vessels, piping and other technical assemblies in which overpressure exists, or within which it may develop, as well as technical entities intended to protect pressure equipment
10. *a construction inspection* is an inspection in accordance with Guide YVL 1.15
11. *pressure equipment subject to registration* are pressure equipment to be registered under section 3 of the Ministry of Trade and Industry Decision (953/1999) on Pressure Equipment
12. *a STUK-approved inspection organisation* is an inspection organisation approved in accordance with Guide YVL 1.3
13. *a STUK-approved testing organisation* is a testing organisation approved in accordance with Guide YVL 1.3
14. *design parameters* denote the loads or loadings and temperature on which the dimensioning of pressure equipment is based

15. *design bases* are requirements, definitions and fundamentals pertaining to the design and operation of systems and pressure equipment.
16. *non-nuclear pressure equipment* are pressure equipment classified in Class EYT (non-nuclear) in accordance with Guide YVL 2.1
17. *a nuclear facility's pressure equipment* denote its nuclear and non-nuclear pressure equipment
18. *nuclear pressure equipment* are pressure equipment classified in Safety Classes 1, 2, 3 or 4.

3 Regulatory control of pressure equipment of nuclear facilities

3.1 Regulatory authority

By virtue of the Nuclear Energy Act and Decree, STUK regulates the use of pressure equipment of nuclear facilities and the manufacturing of nuclear pressure equipment. STUK's activities as the authority regulating the use of nuclear energy are described in Guide YVL 1.1.

The purpose of regulatory control is to assure compliance with the requirements of legislation, licence conditions, YVL guides and STUK's decisions.

STUK's regulatory activities comprehensively encompass system conceptual design, equipment design, manufacturing, installation, commissioning, operation and maintenance as well as decommissioning.

3.2 Pressure equipment design

STUK controls the operation of organisations designing nuclear pressure equipment by assessing the functionality of their quality management systems, by conducting independent reference analyses, by assessing compliance with design-related quality management principles and by assessing the quality of the design work. The safety principles to be followed at a nuclear facility and the facility's design bases shall be considered in the design of nuclear pressure equipment

STUK assesses the design for adequate strength of the primary circuit and the steel containment structure during the review of the construction and operating licence applications and by reviewing the strength analyses contained in the construction plans of the pressure equipment in question. STUK's regulatory activities pertaining to strength assurance are described in Guide YVL 3.5.

3.3 Pressure equipment manufacturing

The manufacturer of nuclear pressure equipment shall have STUK's approval for the manufacturing according to Guide YVL 3.4. The licensee submits an approval application to STUK. Pressure equipment manufacturing includes by definition also the installation, repair and modification of pressure equipment. STUK controls the operational preconditions and operation of the manufacturers of nuclear pressure equipment.

STUK controls the licensee's own manufacturing activities onsite and assesses the licensee's procedures relating to the procurement and manufacturing of pressure equipment. The assessment seeks to verify that operation complies with the requirements and that the level of requirements and control is correct.

3.4 Pressure equipment inspection and testing

STUK approves an inspection and testing organisation to carry out tasks relating to the pressure equipment of nuclear facilities according to Guide YVL 1.3. STUK controls the operation of the inspection and testing organisations to verify the appropriateness of their activities and to assure that all the necessary information is passed on to STUK.

3.5 Pressure equipment control during plant life time

To assure the reliable operation and safe use of pressure equipment, STUK controls the licensee's operational preconditions and activities relating to the operation, maintenance and the subsequent documentation of pressure equipment.

STUK maintains a register of pressure equipment subject to registration to control the periodic inspections of the equipment. STUK oversees the inspections of the registered pressure equipment by approving their periodic inspection plans prior to the carrying out of the inspections

and by reviewing the periodic inspection reports.

STUK controls the licensee's activities in pressure equipment life management. The most important ageing phenomena are erosion, corrosion, thermal ageing and wear. For the purposes of control, the licensee shall submit to STUK for information the necessary statements and reports on the maintenance of safety-significant pressure equipment. In addition, STUK controls the monitoring of the size and number of loads causing fatigue in the most significant pressure equipment and the monitoring of the embrittlement of RPV materials as described in Guides YVL 3.5 and YVL 3.9. The purpose of control is to assure that pressure equipment continuously meet their design bases.

4 Obligations of the licensee and subcontractors

4.1 Obligations of the licensee

The licensee shall have unambiguously defined operating principles and instructions for the procurement, location, installation, commissioning, operation, inspection and functional testing of pressure equipment. The licensee shall maintain documents showing the equipment design bases and design parameters.

The licensee shall have in his employment persons with expert knowledge of the structure, operation and maintenance of pressure equipment. The licensee shall see to it that pressure equipment are operated, maintained and monitored in accordance with regulations as well as the operating and maintenance instructions of the manufacturer or importer.

The licensee shall assure that factors affecting safety have been considered in the design, manufacturing, inspection and use of a nuclear facility's pressure equipment. This requires systematic procedures to list pressure equipment requirements, to work them into design criteria and to assure their fulfilment. The licensee shall verify the competence of design organisations in accordance with his own quality management system.

The licensee shall ascertain that sufficient information on the design, manufacturing and inspection of pressure equipment is available to other participating organisations.

Prior to the commencement of manufacturing, the licensee shall submit the construction plans of nuclear pressure equipment to STUK for approval in three copies, unless otherwise stated in this guide or in a STUK decision as regards Safety Class 3 and 4 pressure equipment. All parties to the delivery chain shall have approved the construction plans. If the entire final structural plan of equipment subject to inspection by STUK cannot be submitted prior to the commencement of their manufacturing, the plan's essential parts shall be submitted early enough, however.

The licensee shall see to it that all manufacturing plans as well as related approvals and conditions are considered in the construction inspection of pressure equipment.

The licensee shall define by what procedures pressure equipment manufacturers and vendors as well as their subcontractors are assessed, chosen and supervised. Licensee's obligations pertaining to the control of manufacturing are presented in Guide YVL 1.14. When signing procurement agreements on non-nuclear pressure equipment, the licensee shall ascertain that the installation, use and registration requirements of each item of pressure equipment are considered. The licensee shall ascertain that the inspections and control of nuclear pressure equipment required in YVL guides and STUK's decisions can be implemented.

The licensee shall have a receiving inspection procedure to verify during delivery prior to installation or storage the compliance of pressure equipment with the requirements. The licensee shall arrange the inspection of pressure equipment in accordance with the requirements of the construction plan and YVL guides and assure the approval of installation-related plans prior to the commencement of installation work. If non-conformities from approved construction plans or procedures are observed during pressure equipment manufacturing, testing, inspection, location or installation, the licensee shall assess their safety importance and, if necessary, initiate corrective actions. If the non-implementation of corrective actions can be justified the licensee shall apply for an exemption from STUK or a

STUK-approved inspection organisation, using the same procedure as was used during the handling of the original plan. Grounds for the acceptability of a non-conformity shall be provided in the application.

If necessary, the licensee shall request from STUK for the registration of pressure equipment during their commissioning inspection. Essential documents pertaining to the approval and inspection of the pressure equipment shall be gathered in a file of documents called a dossier for pressure equipment. The dossier is subject to the approval of a STUK representative during registration and it shall be filed for the entire service life of the pressure equipment.

The licensee shall maintain a record of the nuclear facility's pressure equipment in which all pressure equipment, heat exchangers and steam boilers are given, system by system. On the list are to be marked the component identification, name, room safety class, pressure equipment class, design pressure and temperature as well as volume and contents of the pressure equipment. The pressure equipment list shall indicate who conducts periodic inspections and whether pressure equipment are subject to registration. The list shall be submitted to STUK for information during the nuclear facility's commissioning phase and changes made to it are to be submitted annually.

The licensee shall designate from among his personnel a supervisor for registered pressure equipment and, if necessary, his deputy. The designation is subject to notice to STUK. The supervisor shall follow the use and condition of the pressure equipment and shall also arrange for the follow-up of their use. His duties are defined in section 23 of Ministry of Trade and Industry Decision No. 953/1999. He shall report to the licensee all matters of significance relating to the use or condition of each item of pressure equipment. The supervisor shall have qualifications appropriate for the job and also sufficient expert knowledge of the construction, use and maintenance of the pressure equipment. The licensee shall provide the supervisor with the prerequisites facilitating the supervision of the condition and safety of the pressure equipment and shall make available to him information on the use and condition of the pressure equipment.

The licensee shall use his pressure equipment in accordance with section 22 of Ministry of Trade and Industry Decision No. 953/1999. In the operation of a nuclear facility, the provisions of the Technical Specifications (TTKE), the Final Safety Analysis Report (FSAR), YVL guides and STUK's decisions shall also be observed.

The licensee shall see to it that time limits are observed in the conducting of periodic inspections. He shall ensure that prerequisites for the appropriate carrying out of the inspections exist. The safe conducting of pressure equipment internal inspections in particular shall be ensured.

In the design of a nuclear facility, the safety impact of the ageing of structures, components and materials important to safety shall be evaluated with a sufficient safety margin. In addition, provision shall be made for the follow-up of the ageing of structures, components and materials and, if necessary, for their replacement or repair.

In order to appropriately implement the life management of a nuclear facility's pressure equipment, the licensee shall have systematic procedures to follow, assess and develop activities pertaining to the life management of pressure equipment. Organisational responsibilities relating to pressure equipment life management shall be unambiguous, with sufficient guidelines on related procedures.

The licensee shall qualify the necessary manufacturing and repair procedures in accordance with the YVL guides. The safety of the pressure equipment shall be assured by timely repairs or replacements.

4.2 Obligations of the design organisation

Organisations responsible for the design of nuclear pressure equipment shall arrange their operations in accordance with an applicable quality management system and shall employ professionally skilled personnel with sufficient training and experience. Design organisations shall have sufficient expert knowledge in the strength of materials, in construction materials and manufacturing technology as well as practical knowledge of the necessary calculation methods and design standards. The quality management system shall cover procedures relating to pressure equipment design.

The design procedures shall consider the re-

quirements imposed on pressure equipment and the necessary review to assure the adequacy of the requirements and design data. These requirements shall consider the provisions of the YVL guides and of the Technical Specifications as well as the general quality level determined for the plant unit's pressure equipment.

In the design of pressure equipment, the realisation of the ALARA principle in particular during periodic inspections and repairs shall be considered.

The high quality required of nuclear pressure equipment may pose manufacturing-related specific requirements that have to be taken into account in design.

The prerequisites for verification, qualification, monitoring, inspection and testing during the manufacturing of nuclear pressure equipment as well as for inspection and testing during operation shall be considered in design.

The potential failure mechanisms of pressure equipment, and their prevention, shall be considered.

The design activities shall be regularly evaluated and consequently developed. STUK controls the operational preconditions and the quality of the design organisations of the licensee and of others by assessing their quality management systems and by making independent reference analyses. The organisations shall be prepared for such potential assessments and analyses.

4.3 Obligations of the pressure equipment manufacturer

Under section 60 a of the Nuclear Energy Act, the manufacturer of nuclear pressure equipment is approved to his duties by STUK. The approval procedures are described in Guide YVL 3.4. The manufacturer shall have an applicable quality management system and competent and experienced personnel in his employ plus appropriately qualified methods, equipment and tools, as required by his operations.

For the manufacturing of nuclear pressure equipment, the manufacturer shall have on hand a construction plan that is in accordance with equipment-specific YVL guides and the decisions pertaining to them.

The manufacturer of nuclear pressure equipment shall see to it that inspections and testing, as required in an approved inspection plan, are carried out. For the assessment of nuclear pressure equipment manufacturing, manufacturing control and inspection, modules that are intended to verify the compliance of the equipment with the requirements in accordance with pressure equipment legislation and which the manufacturer has in use may be utilised. The licensee and the manufacturer shall assess whether the level of requirements set out in the YVL guides is met.

As regards the inspection and testing of nuclear pressure equipment, the manufacturer of pressure equipment shall ascertain that the inspection and testing organisations carrying out the work have been granted the approvals required in Guide YVL 1.3. The manufacturer shall establish the causes of faults and non-conformities detected during manufacturing, assess their meaning and take the necessary corrective actions. Any non-conformities and actions relating to them shall be reported in accordance with the manufacturer's quality management system. The manufacturer shall prepare a non-conformity report in case they were for a justified reason not repaired. The non-conformity report is subject to approval by the licensee as well as by a STUK-approved inspection organisation or STUK, using the same procedure as is used for a construction plan. Any departures from the requirements of the YVL guides are always subject to STUK's approval.

Only approved construction and welding materials may be used in the manufacturing of pressure equipment of nuclear facilities. The requirements pertaining to the construction and welding materials of nuclear pressure equipment as well as the related approval procedures are given in Guide YVL 3.9. The receiving of construction materials shall be appropriately arranged.

The manufacturer or importer of pressure equipment shall provide the licensee with operating and maintenance manuals.

4.4 Obligations of the inspection organisation

An inspection organisation carries out pressure equipment inspections and compliance assessments under authorisations granted by STUK and as commissioned by the licensee. The inspection organisation's task is to independently

assure the implementation of safety requirements such as legislation, licence conditions, YVL guides, STUK's decisions and licensee instructions.

Guide YVL 1.3 describes the authorisation procedures, operational preconditions and control of domestic and foreign inspection organisations and inspectors. An inspection organisation inspecting the pressure equipment of nuclear facilities must have a advanced quality management system, skilled and competent personnel as well as the systems, equipment and facilities required for operation.

The inspection organisation shall file the construction plans it has approved as well as the related approval decisions and memoranda stating the grounds for the decision plus other inspection documents for a period of ten years. The approval decision plus the memoranda shall be sent to the licensee for attachment to the dossier for pressure equipment.

When, during its inspection activities, the inspection organisation detects non-conformant pressure equipment, or equipment having other shortcomings or drawbacks affecting safety, it shall report its observations to the manufacturer, the licensee and, if necessary, to STUK. The inspection organisation shall supervise the completion of possible corrective actions and shall report the non-conformities as required in subsection 4.3.

The inspection organisation shall report to STUK annually its pressure equipment inspections and shall report without delay any significant shortcomings or drawbacks affecting safety.

4.5 Obligations of the testing organisation

A testing organisation's task is to conduct non-destructive testing on pressure equipment as authorised by STUK and as commissioned by the licensee or the pressure equipment manufacturer. The procedure for the approval of domestic and foreign testing organisations as well as the requirements for their operation are explained in Guide YVL 1.3. Guide YVL 3.8 sets forth requirements for the in-service inspections of Safety Class 1 and 2 pressure equipment and for the qualification of inservice inspection systems.

A testing organisation shall have an advanced quality management system, skilled and competent personnel and such systems, equipment and facilities required for testing in accordance with approved plans. The testing organisation shall carry out the testing of a nuclear facility's pressure equipment in accordance with approved inspection plans. It shall register any faults or shortcomings it detects in pressure equipment during testing and which fail to fulfil the approved standard. The organisation shall report any detected faults and shortcomings to the client.

Only accredited testing organisations may carry out destructive testing.

5 Pressure equipment inspections

5.1 Inspection areas

For the purposes of this guide, pressure equipment inspections denote the below inspections:

- construction plan review
- manufacturing control/inspection
- pressure equipment construction inspection
- location plan review
- installation construction plan review
- installation construction inspection
- commissioning inspection
- periodical and in-service inspections
- repair plan review
- repair work construction inspection
- modification plan review
- modification construction inspection
- other periodic inspections.

Pressure equipment inspections are conducted either by STUK or by a STUK-approved inspection organisation, as presented below:

1. STUK normally conducts the above inspections on Safety Class 1 and 2 pressure equipment. In addition, STUK carries out commissioning inspections on all nuclear pressure equipment and Class EYT (non-nuclear) pressure equipment subject to registration (section 3 of Ministry of Trade and Industry Decision No. 953/1999). STUK also inspects periodic inspection plans and reports on nuclear pressure equipment and registered non-nuclear pressure equipment.

2. On the licensee's application, and at its own discretion, STUK may delegate inspections to an inspection organisation authorised in accordance with Guide YVL 1.3 and which has the prerequisites to carry out the below inspections:
   - review of construction plans, the construction inspection, review of location and installation construction plans as well as the installation construction inspection of Safety Class 3 and 4 pressure equipment
   - review of repair and modification plans for Safety Class 3 and 4 pressure equipment as well as for non-nuclear pressure equipment subject to registration.

3. On the licensee's application STUK delegates the below inspections to an inspection organisation that has been authorised in accordance with Guide YVL 1.3 and has the prerequisites to carry out the below inspections:
   - review of the location and installation construction plans as well as the installation construction inspection of non-nuclear pressure equipment subject to registration and of pressure equipment in accordance with sections 4 and 5 of Ministry of Trade and Industry Decision No. 938/1999
   - commissioning inspections of non-nuclear pressure equipment, which meet essential requirements in accordance with sections 4 and 5 of Ministry of Trade and Industry Decision No. 398/1999 and are not subject to registration.
   - manufacturing control of Safety Class 3 and 4 pressure equipment
   - periodic inspections of Safety Class 3 and 4 and non-nuclear pressure equipment subject to registration
   - construction inspections of the repairs and modifications of Safety Class 3 and 4 as well as non-nuclear pressure equipment subject to registration as well as of those in accordance with sections 4 and 5 of Ministry of Trade and Industry Decision No. 938/1999
   - review of repair and modification plans for pressure equipment in accordance with sections 4 and 5 of Ministry of Trade and Industry Decision No. 938/1999.

When delegating the inspections STUK specifically assesses the operational preconditions of the inspection organisation and the licensee as regards the requirements on the implementation, reporting and independent control of the inspections.

In connection with exceptionally significant repairs, modifications and process engineering modifications, and particularly if a hazard caused by common-cause failures is observed, STUK may require, case by case, the submission for its approval of those construction plans it has delegated to an inspection organisation, even as regards pressure equipment in Safety Classes 3 and 4 as well as non-nuclear pressure equipment subject to registration.

On the licensee's application STUK may grant exemptions from this division into inspection areas as regards some minor repairs and modifications as well as some actions relating to spare parts administration.

The onsite monitoring of non-nuclear pressure equipment in accordance with sections 4 and 5 of Ministry of Trade and Industry Decision No. 938/1999 and not subject to registration, and of non-nuclear pressure equipment in compliance with good engineering practice, as referred to in section 6 of the same decision, is the responsibility of the licensee who is to observe the manufacturer's operating and maintenance instructions and the procedures of his own quality management system.

The general principles of the division of inspection areas are given in the table in Appendix 1.

5.2 Construction plan review

A construction plan shall be drawn up for the manufacturing of nuclear pressure equipment,. The licensee is to submit the plan to STUK or a STUK-approved inspection organisation for approval. The plan shall state that the provisions of the YVL guides and the Safety Analysis Report have been met.

The construction plan shall always be submitted to STUK for approval if it does not meet the requirements of the YVL guides, or STUK's decisions. All departures from the requirements of the YVL guides and how the safety level required in them is achieved shall then be described. The contents of the plans and the requirements

presented therein are described in the following guides: YVL 1.2, YVL 1.8, YVL 2.6, YVL 3.1, YVL 3.3, YVL 3.5, YVL 3.9, YVL 5.2, YVL 5.3, YVL 5.4, YVL 5.6, YVL 5.7 and YVL 7.18. In the construction plan review, the following features of a piece of pressure equipment are checked, among others: safety class, validity of design bases, design parameters, acceptance criteria, choice of construction materials, strength calculations, suitability of manufacturing method, scope and requirement level of the inspection plan, accessibility for periodic and in-service inspections and vendor summary of how the design criteria have been met.

As regards non-nuclear pressure equipment, the provisions of the Pressure Equipment Act (869/1999) are applied to the technical requirements for construction plans and manufacturing and to the demonstration of safety.

During the construction plan review attention is paid to the operational preconditions of the equipment and to their qualification in forthcoming operational conditions.

The construction plan decision for nuclear pressure equipment sets forth, if necessary, the conditions and requirements that apply to the construction of pressure equipment and their inspection, as required by safety and stipulated instructions.

5.3 Manufacturing control/inspection

The quality of pressure equipment cannot be totally verified by post-manufacturing inspection measures conducted in accordance with an inspection plan. Manufacturing control is needed to assure and verify quality.

The scope of manufacturing control of nuclear pressure equipment is in accordance with Guide YVL 1.14, which sets forth requirements on the manufacturing control of nuclear pressure equipment. The manufacturing of non-nuclear pressure equipment is controlled by an assigned, notified body or a user inspectorate under the Pressure Equipment Act.

5.4 Pressure equipment construction inspection

A construction inspection in accordance with Guide YVL 1.15 shall be conducted on nuclear pressure equipment after manufacturing. The compliance with the requirements of non-nuclear pressure equipment is assessed by an assigned, notified body or a user inspectorate in accordance with regulations issued under the Pressure Equipment Act. The construction inspection of nuclear pressure equipment comprises the following: verification of pressure equipment compliance with the requirements against the construction plan, review of the manufacturing documentation, a construction inspection, checking of the results of strength verification tests as well as a pressure test.

5.5 Location plan review

The licensee shall submit to STUK for approval a plan for both nuclear and non-nuclear pressure equipment, stating the location of the equipment and justifying the safety of their location.

Pressure equipment shall be located, and the surrounding rooms and structures designed and implemented such that, a possible pressure discharge during a failure situation or an operational disturbance would cause the least possible damage. If need be, the necessary safety analyses relating to the matter as well as a risk assessment shall be made and structural supports or shields constructed to restrict damage.

In the location plan, the location of electrical and I&C equipment important to safety shall be given and the effects of possible pressure equipment failures on their reliable operation shall be assessed. The location and accessories of pressure equipment shall facilitate the appropriate use, inspection and maintenance of the pressure equipment. In their locating also possible risks to the facility and personnel from the contents of the pressure equipment shall be considered. Locating shall be implemented in detail such that all pressure equipment form a safely operating assembly. In the locating of the pressure equipment, radiation protection requirements, accessibility as required in Guide YVL 3.8 and the separation requirements of subsystems shall be considered.

5.6 Installation construction plan review

An installation construction plan shall be drawn up for the installation of a nuclear facility's pressure equipment. The licensee shall obtain approval for the plan prior to the commencement

of the installation. A description of the pressure equipment connections to other systems, the supports of the equipment and possible shields shall be attached to the installation construction plan. Detailed requirements are given in Guide YVL 3.1.

5.7 Installation construction inspection

Pressure equipment installations shall be verified in a construction inspection that is in accordance with Guide YVL 1.15. Component-specific YVL guides give detailed requirements for the various component types.

5.8 Commissioning inspection

Before the commissioning of pressure equipment, their readiness for operation shall be verified in accordance with Guide YVL 3.7. Matters pertaining to the pre-operational testing of nuclear power plants are accounted for in more detail in Guide YVL 2.5.

It is verified by the commissioning inspection that all pressure equipment belonging to an inspection entity, as well as their installation, location and operation are in accordance with approved plans. After repairs and modifications, the readiness for operation of pressure equipment is assessed by inspections corresponding to the commissioning inspection.

The licensee shall gather into a dossier all essential documents pertaining to the approval and inspection of pressure equipment subject to registration. The licensee shall carefully maintain the necessary records pertaining to inspections, including radiographic films plus other necessary samples, as long as the pressure equipment in question are in operation. On the basis of the dossier, a representative of STUK assesses the technical characteristics and quality of pressure equipment subject to registration.

Nuclear pressure equipment and registered non-nuclear pressure equipment may be taken into use after they have been approved by a STUK representative in a commissioning inspection. In addition, a STUK representative may approve the use of pressure equipment for a specified time period. The dates and types of the forthcoming periodic inspections of registered pressure equipment are established in their commissioning inspections.

In connection with the registration of pressure equipment, the following information is stamped on the registration plate of pressure equipment: location code, serial number, pressure test date and test pressure, minimum and maximum allowable operating temperature as well as inspector's stamp. Registration is carried out adhering to the limits given in section 3 of Ministry of Trade and Industry Decision No. 953/1999. However, pressure equipment may be test operated prior to the commissioning inspection for adjustments and operational readiness testing, provided that sufficient care is taken in the process.

5.9 Periodic inspections

5.9.1 Periodic inspection intervals

The periodic inspections of registered pressure equipment are operational inspections, internal inspections and periodic pressure tests. Prior to the periodic inspection dates, the licensee shall submit to STUK for approval representative periodic plans specific to each item of pressure equipment.

On request of the licensee, STUK may postpone the dates of periodic inspections by 13 months at the most. If necessary, a representative of STUK may handle short-term inspection date postponements of less than six months on the basis of the licensee's proposal. A postponement does not affect the determination of subsequent inspection dates. The setting of inspection periods begins from the commissioning inspection. In case an inspection is held more than 13 months earlier than planned, the setting of inspection periods shall begin from the date of the inspection conducted on an earlier date.

During each inspection, the performer of the inspection determines the next pressure equipment inspection date. STUK records and confirms in the pressure equipment register the inspection dates and the changes made to them.

5.9.2 Operational inspection

The operational inspections of registered pressure equipment and steam boilers are performed at intervals of four and two years, respectively.

The operational inspections of nuclear power plant pressure equipment are aimed to facilitate

the safe and reliable operation of the equipment. An operational inspection encompasses the verification of the performance of equipment and equipment systems having a bearing on operational safety, such as safety devices, valves, regulating and measuring devices. In addition, the inspection of other pressure equipment accessories is included.

Inspection reports that are drawn up when periodic inspections are replaced by pressure equipment follow-up, or by a condition monitoring system, shall be presented during an operational inspection in case internal inspections have been entirely replaced.

The time period between operational inspections may be extended by one year at the most.

5.9.3 Internal inspection

Registered pressure equipment are internally inspected every four years. The internal inspection of pressure equipment made of reinforced plastic is performed every two years. In the internal inspection, the pressure equipment plus their accessories shall be checked for such faults or features as would endanger their safe use or compromise their reliable operation.

Internal inspection shall, where necessary, be complemented with other NDT methods.

On the application of the licensee, the time interval between internal inspections may be doubled at the most. Grounds for the safe and reliable use of pressure equipment during the extended inspection period shall be presented in the application. The interval between internal inspections is to be shortened, if necessary, according to the condition of the pressure equipment.

5.9.4 Periodic pressure test

Registered pressure equipment shall be given a pressure test during every second internal inspection.

In the pressure test, the leakproofness of the pressurised walls of the pressure equipment at test pressure shall be ascertained as well as the absence of safety-endangering deformations in their structure. Possible instructions issued by the manufacturer of the pressure equipment shall be considered when performing the test.

A fluid pressure test shall be conducted at a pressure not less than 1.3 times the maximum allowable operating pressure. The gas pressure test is conducted at a pressure 1.1 times the maximum allowable operating pressure. The pressure test can be carried out as a gas pressure test only in exceptional cases when, for structural reasons, the fluid pressure test is not possible within reason, or when not even small volumes of fluid are allowed inside the pressure equipment. For specific reasons, another test pressure may be approved for use.

The pressure testing of pressure vessels and their piping may not be required if their strength and integrity have been verified by an internal inspection. The licensee must obtain an approval for not conducting the pressure test. In the approval application, the grounds for not carrying out the pressure test shall be given. The assessment of the continuation of the exemption procedure shall be considered when drawing up plans for forthcoming internal inspections.

The time period between pressure tests may be doubled at the most.

As, during the designing of a nuclear facility's systems, reasonable preparations cannot be made for the periodic pressure tests of individual items of pressure equipment, the structural integrity and leaktightness of the equipment can be ascertained by periodic system pressure tests in accordance with the requirements of the design standard. Test pressure is then determined by the requirements of the design standard. A leakage test is specifically used for leak examination.

5.9.5 Replacement of periodic inspections with pressure equipment follow-up or a condition monitoring system

The internal inspections and pressure tests of pressure equipment subject to registration may be entirely or partly replaced by equipment follow-up in case inspection and testing is not reasonable due to the construction of the equipment. The licensee shall apply for STUK's approval of the follow-up. The application shall contain the following information: follow-up plan, inspections partly or completely to be replaced by the follow-up plus a justification for the verification of pressure equipment reliability and safety by means of follow-up. The follow-up plan shall include

procedures for its updating and development. The date of presenting follow-up results shall be given in the plan.

The periodic inspections of pressure equipment subject to registration may also be replaced with pressure equipment condition monitoring systems if the effects of the replacement correspond to a periodic inspection and the structure of the pressure equipment impairs efficient inspection. The licensee shall apply for STUK's approval of the condition monitoring system. The inspections to be replaced by the system, description of compensatory measures and the justification for ascertaining the reliability and safety of the pressure equipment by means of the system and the necessary measures shall be stated in the application. System description, the duties and competence requirements of those contributing to the activities as well as the maintenance of the measuring equipment required in the activities shall also be attached to the application. Compensatory measures shall be justified by risks arising from the inspection object and operation as well as by information gained from earlier inspections. The date of presenting the condition monitoring results shall be given in the programme.

The condition monitoring systems may be commissioned after the first periodic inspection has been conducted.

5.10 Inspections according to Guide YVL 3.8

Prior to their commissioning, Safety Class 1 and 2 pressure equipment plus their supporting structures and the internals of the reactor pressure vessel are to be subjected to pre-service inspections and after their commissioning to in-service inspections using NDT methods in accordance with Guide YVL 3.8. Testing organisations conducting inspections in accordance with Guide YVL 3.8 shall seek authorisation from STUK as required in Guide YVL 1.3. The in-service inspection system encompasses factors affecting the quality and results of NDT, such as testing personnel, inspection equipment plus software and inspection procedures, which shall be qualified and approved in accordance with Guides YVL 1.3 and YVL 3.8. The inspection-system-specific qualifications of the personnel of a testing organisation shall be identified in this connection. Inspections conducted in accordance with Guide YVL 3.8 may replace or complement other periodic inspections of pressure equipment if, by such means, a corresponding safety level is achieved. The procedure shall be justified and approved in connection with the periodic inspection plans of pressure equipment.

Risk-informed methods may be used in choosing the components to be inspected. The procedure is described in Guide YVL 3.8.

5.11 Repairs and modifications

An approval for a construction plan to repair and modify pressure equipment during their service life shall be obtained in accordance with subsection 5.1. The general requirements for repairs and modifications are given in Guide YVL 1.8 and those for manufacturing control in Guide YVL 1.14. Repairs and modifications are subject to a construction inspection in accordance with Guide YVL 1.15. Readiness for operation shall be ascertained by inspections corresponding to a commissioning inspection.

5.12 Other regular inspections

A condition monitoring programme shall be drawn up for the life management of a nuclear facility's pressure equipment in order to effectively assess the effect of their ageing on plant safety and to carry out corrective actions in a planned manner. The programme shall consider even those pressure equipment of a nuclear facility that are not subject to periodic or in-service inspection as required in subsection 5.9 or 5.10 of this guide. STUK supervises pressure equipment condition monitoring by assessing the programme's adequacy and appropriateness and by reviewing its implementation and results.

6 Pressure equipment decommissioning

The pressure equipment record shall be updated when pressure equipment are removed from service. Guide YVL 8.1 applies when pressure equipment classified as nuclear waste in accordance with Guide YVL 8.2 are removed from service.

7 References

1. Nuclear Energy Act (990/1987).
2. Nuclear Energy Decree (161/1988).
3. Government Decision (395/1991) on the general regulations for the safety of nuclear power plants
4. Pressure Equipment Act (395/1991).
5. Ministry of Trade and Industry Decision (953/1999) on pressure equipment safety.
6. Ministry of Trade and Industry Decision (938/1999) on pressure equipment.
7. Chemicals Act (744/1989).
8. Explosives Act (263/1953).
9. Decree (59/1999) on the industrial handling and storage of dangerous chemicals.

Appendix 1. Control of the pressure equipment of nuclear facilities and division of inspection areas. General principles

Control		
	Safety Classes 1–4	**EYT (non-nuclear)**
Conceptual design and systems plans	STUK	STUK
Construction design process	STUK	TL(§)
Pressure equipment manufacturers	STUK	TL(§)
Inspection organisations	STUK	TL(§)
Testing organisations	STUK	TL(§)
Ageing management	STUK	STUK
Periodic inspection plans	STUK	STUK
Periodic inspection reports	STUK	STUK
Pressure equipment register	STUK	STUK
Repair and modification process	STUK	STUK

Inspections							
	Safety Class				**Class EYT (non-nuclear)**		
	1	**2**	**3**	**4**	**Reg.**	**4–5§ ***	**6§ ***
Construction plan	STUK	STUK	STUK/TL	STUK/TL	TL(§)	TL(§)	TL(§)
Manufacturing control	STUK	STUK	TL	TL	TL(§)	TL(§)	TL(§)
Construction inspection	STUK	STUK	STUK/TL	STUK/TL	TL(§)	TL(§)	TL(§)
Location plan	STUK	STUK	STUK/TL	STUK/TL	TL	TL	LH
Installation construction plan	STUK	STUK	STUK/TL	STUK/TL	TL	TL	LH
Installation construction inspection	STUK	STUK	STUK/TL	STUK/TL	TL	TL	LH
Commissioning inspection	STUK	STUK	STUK	STUK	STUK	TL	LH
Periodic inspections	STUK	STUK	TL	TL	TL	LH	LH
Repair plans	STUK	STUK	STUK/TL	STUK/TL	STUK/TL	TL	LH
Construction inspections of repairs	STUK	STUK	TL	TL	TL	TL	LH
Modification plans	STUK	STUK	STUK/TL	STUK/TL	STUK/TL	TL	LH
Construction inspections of modifications	STUK	STUK	TL	TL	TL	TL	LH

STUK/TL = STUK or an inspection organisation approved by STUK
TL = an inspection organisation approved by STUK
TL(§) = a procedure in accordance with the Pressure Equipment Act plus regulations issued on the basis of the Act
LH = licensee inspection area

Reg. = a registered item of pressure equipment, as referred to in section 3 of Ministry of Trade and Industry Decision No. 953/1999
* an item of pressure equipment, as referred to in the relevant section of Ministry of Trade and Industry Decision No. 938/1999

The general principles presented in the Table are described in more detail in chapters 3 and 5 of this guide.