Use of the IAEA Safety Standards in the development of Finnish nuclear and radiation safety legislation and regulatory guides

IAEA

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Marja-Leena Järvinen
Content

• Introduction

• Comprehensive renewal of the YVL Guides

• Comprehensive renewal of the Finnish Radiation Act and underlying regulations and guides

• New nuclear safety mandatory requirements issued by STUK
Introduction: The Finnish approach

• The Radiation Act is the responsibility of the Ministry of Social Affairs and Health and the Nuclear Energy act is the responsibility of the Ministry of the Employment and Economy

• STUK issues guides in two series
  – Radiation safety
  – Nuclear safety

• Security is included both in the nuclear and radiation safety regulations and guides

• Safeguards and on-site emergency preparedness are included in the nuclear safety regulations and guides

• Off-site emergency preparedness is based on different legislation, STUK has issued guides for radiological situations approved by the Ministry of Interior
Nuclear power plants in Finland

Fennovoima Ltd
• New utility, no operating reactors
• DiP approved for FA1, Hanhikivi Site

Olkiluoto NPP (TVO)
• 2 operating units - ABB BWRs
• OL3 (EPR) under construction
• DiP approved for OL4
• Interim Spent Fuel Storage at site
• L/ILLW repository
• Posiva “Onkalo”

Loviisa NPP (Fortum)
• 2 operating units – VVERs
• Interim Spent Fuel Storage at site
• L/ILLW repository

Photo: TVO

Photo: Fortum
Finnish nuclear legislation and safety requirements

- **Nuclear Energy Act**
  - “nuclear energy utilisation shall be safe”;
  - “licensee is responsible for safety”, other principal safety req’s (including security and on-site EP)

- **Nuclear Energy Decree**
  - administrative details for licensing and regulatory oversight

- **Government Decrees**
  - mandatory requirements for Nuclear safety, Emergency preparedness, Nuclear security, Nuclear waste management
  - present general principles, fundamental technical requirements, radiological acceptance criteria etc.

- **YVL Guides**
  - status as Reg. Guides in USA
  - present detailed technical requirements, acceptable practices, guidance for licensee-STUK interaction, STUK’s oversight

**Now:**
- Legally mandatory requirements

**In future:**
- A new level, STUK mandatory requirements, 1st January 2016
Evolution of the Finnish YVL Guides in 1975 - 2013

NPP design principles

- General design principles of a nuclear power plant, 1976
  - 55 criteria
  - Based on 10CFR50, Appendix A

- YVL 1.0 Safety criteria for design of nuclear power plants, 1982 (revised 1996)

- YVL 2.0 Systems design for nuclear power plants, 2002

- YVL B.1 Safety design of a nuclear power plant, 2013
Main phases of the renewal of legislation (2006-2008) and YVL Guides (2008-2013)

• Revised Nuclear Energy Act and four new Government Decrees were issued in 2008
  – Needed as a basis for the overall revision of YVL Guides
• Structure for the YVL Guides system was confirmed, **October 2008**
  – Scope of each guide was identified in the first phase, DPPs were prepared for each guide
  – Internal structure of guides was defined
• Original schedule: YVL Guides ready by the **end of 2011**
• After the TEPCO Fukushima accident a new schedule was confirmed
• **New Government Decrees on nuclear safety and emergency preparedness** issued **October 25, 2013**
• New YVL Guides issued **December 1, 2013**
Overall objectives of the renewal project

• New structure for the whole YVL Guides system (no model) and standard format for single guides (IAEA as a model)

• Compact presentation of requirements
  • numbered requirements, descriptive text only as needed
  • additional clarifications in a justification memorandum (separately for each guide)

• Elimination of undue prescriptiveness

• Consistent terminology (IAEA as a model) and coherence with the Government Decrees and between different guides
  – All the definitions used in the guides were collected into a separate document being a part of the YVL Guide system (corresponding to IAEA Glossary)
Main references used in the renewal of YVL Guides

The most essential national and international references used in the renewal of YVL Guides were

- Finnish nuclear and radiation legislation

- **IAEA Safety Standards (Safety Requirements, Safety Guides)**

- **WENRA Reference Levels (2008)**
  - every WENRA reference level was taken into account in the YVL Guides in a traceable way

- **WENRA Safety Objectives for new NPPs (2010)**

- **WENRA RHWG Report “Safety of new NPP designs” (March 2013)**

- relevant industrial standards (mm. ISO, IEC, EN)
The preparation process of YVL Guides

- The main process was not changed for the renewal project
  - DPP
  - L1 sent for internal comments and to support group
  - L2 sent to stakeholders for external comments
  - L3 external comments considered, sent for internal review
  - L4 sent to Advisory Commission(s) for review
  - L5 “Final draft” to DG for approval

- For collecting comments and making resolutions similar procedures are used as IAEA is using in the development of IAEA SS’s

- **New**: extranet service open to general public and experts
  - L2 and L4 and their translations were published on the extranet service
Other reviews

Also other generic reviews were performed in the renewal project

1. Independent external reviews
   • Consistency of requirements concerning management systems and quality plans
   • Comparisons between relevant IAEA Requirements documents and YVL Guides (VTT for NPP Design Requirements)
   • Comparison between the WENRA Report on new NPP designs and YVL Guides (VTT)

2. Independent internal reviews
Important changes in the Finnish nuclear safety requirements

- A severe accident at a NPP shall not cause the need for extensive protective measures of the public nor cause long-term restrictions on the use of extensive areas of land and water,
- Introduction of a new DiD sub-level following the WENRA model, independence of the protection levels
- Diversification of the ultimate heat sink
- The removal of the decay heat in reactor and spent fuel pools for the duration of three days independently of external power and water supply in a situation caused by a rare external event or a disturbance in the internal electrical supply system
- Enhancement of the on-site EP (multiple units, long duration, severe environmental conditions)
- Requirements concerning provisions for severe accidents already existed in the legislation and YVL Guides, therefore no major changes concerning requirements for containment were introduced
## DiD levels, event categories and frequencies

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<th>Event Category</th>
<th>Frequency Conditions</th>
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<td><strong>Level 2</strong></td>
<td>Anticipated operational occurrences (DBC 2)</td>
<td>$f &gt; 10^{-2}/a$</td>
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<td><strong>Level 3a</strong></td>
<td>Postulated accidents Class 1 (DBC 3)</td>
<td>$10^{-2}/a &gt; f &gt; 10^{-3}/a$</td>
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<td>DEC A – CCF combined with DBC2 / DBC3</td>
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<td></td>
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<td>DEC B – Complex failure combination</td>
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<td>DEC C – Rare external event</td>
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<td><strong>Level 4</strong></td>
<td>Severe accidents (SA)</td>
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<td></td>
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<td>CDF &lt;10^{-5}/a; LRF &lt; 5×10^{-7}/a</td>
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The new set of YVL Guides

Safety, security and safeguards in the same set of YVL Guides

There are 45 YVL Guides under five topics:

- A Safety management of a nuclear facility
- B Plant and system design
- C Radiation safety of a nuclear facility and environment
- D Nuclear materials and waste
- E Structures and equipment of a nuclear facility

YVL Guides are available in English at STUK website


Acceptance criteria for radioactive releases / max doses to general public in different event categories

- **DBC 1, Normal operation**
  - radiation dose limit 0,1 mSv / year for the entire site
- **DBC 2, Anticipated operational occurrences**
  - radiation dose limit 0,1 mSv
- **DBC 3, Class 1 postulated accidents**
  - radiation dose limit 1 mSv
- **DBC 4, Class 2 postulated accidents**
  - radiation dose limit 5 mSv
- **DEC, Design extension conditions**
  - radiation dose limit 20 mSv
- **SA, Severe accidents**
  - no extensive protective measures for the public
  - no long-term restrictions on the use of extensive areas of land and water
  - release < 100 TBq Cs-137 equivalent
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<th>C Radiation safety of a nuclear facility and environment</th>
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<td>B.2 Classification of systems, structures and components of a nuclear facility</td>
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<td>E.3 Pressure vessels and piping of a nuclear facility</td>
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**Collected definitions of YVL-guides**: same data is shown both as the collection and within the guides.
The safety level

IAEA

– The new Finnish nuclear safety requirements are at least as stringent as the existing IAEA Requirements documents

WENRA

– The WENRA SRLs (2008) are implemented with the new YVL Guides
– WENRA Safety Objectives for new reactors (2010) and WENRA report Safety of new NPP designs (2013) were taken into account in the new regulations

Lessons from the TEPCO Fukushima Daiichi accident

– all available information from the Fukushima accident and different review reports were considered in drafting YVL Guides, also the IAEA Action Plan and the WENRA report Safety of new NPP designs were considered

The new Finnish nuclear safety requirements ensure a high level of safety, the requirements are very advanced and up-to-date as well as demanding in international comparison
Safety/security- interface in the YVL Guides

1. Responsibility for the regulatory control of safety and security lies within the same organisation (STUK)

2. Ensuring the safety/security interface
   - The development process for all of the YVL Guides is the same
   - Safety and security expertise of the organisation is used in the preparation
   - Advisory Committees review the YVL Guides
   - Principle: Safety and security measures must be designed and implemented in an integrated manner; security measures do not compromise safety and vice versa

3. Important YVL Guides to manage the interface
   - A.1 Regulatory oversight of safety in the use of nuclear energy
   - A.3 Management system for a nuclear facility
   - A.4 Organisation and personnel of a nuclear facility
   - A.11 Security of a nuclear facility
   - A.12 Information security management of a nuclear facility
   - B.1 Safety design of a nuclear power plant
   - D.2 Transport of nuclear materials and nuclear waste
Use of IAEA security documents

• The following IAEA documents have been considered in the preparation of YVL A.11:
  – IAEA NSS No. 20 (Fundamentals)
  – IAEA NSS No. 13 (INFCIRC 225/Rev 5)
  – IAEA NSS No. 4 (Sabotage)
  – IAEA NSS No. 8 (Insider Threats)
  – IAEA NSS No. 16 (Identification of Vital Areas)

• YVL A.12 covers
  – Computer Security as defined in IAEA NSS 17 Computer Security at Nuclear Facilities (Cyber security)
  – Information Security as defined in IAEA Implementing guide Protection and Confidentiality of Sensitive Information in Nuclear Security (NST022)
Guiding principles

The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience and safety research and advances in science and technology.

The new guidance will be taken into use simultaneously

- New YVL guides are applied as such to the new NPPs i.e. those for which Decision in Principle was made in 2010
- For the operating NPPs or other nuclear facilities and the NPP under construction an implementation decision is made
  - the approach is the same as in the PSR or licence renewal or publication of an updated YVL guide
  - the nuclear facility is reviewed against new YVL Guides
  - the modifications considered reasonably practical are implemented

**STUK received the licensees assessment of the fulfilment of the requirements 31th December 2014.**
STUK’s project for implementation decisions

Project targets:
- harmonized decisions on the application of new YVL Guide requirements for operating nuclear facilities
- consistency of the decision making
  - cross-cutting issues such as quality management, lay-out, security, application of PRA, life cycle of the fuel

Information will also be stored for future use in oversight activities
- Separate decisions are made for each YVL Guide and each facility

Time schedule and resources:
- initial review of licensee submittals 28.2.2015
- implementation decisions by 31.8.2015
- estimated resource needs for review and assessment 3-4 man-years

Connections to
- LO1/2 PSR in 2016, OL1/2 renewal of the operating licence in 2018 and OL3 operating license application review (probably during 2016)
- Fukushima lessons learned action plans
Renewal of the Finnish radiation legislation and regulatory guides (ST Guides)

Scope

– Total renewal of the Finnish radiation legislation at the same time as the implementation of the EU BSS directive 2013/59/Euratom

Organization of the work

– Work is led by the Ministry of Social Affairs and Health

An administrative steering group covering all stakeholders nominated by the Ministry for 15 January 2015 – 30 June 2017

– 8 subgroups of experts (stakeholders) dealing with different subjects

– ministries, STUK, National Supervisory Authority for Welfare and Health, Aalto university, Finnish Medical Association, etc.
STUK’s pre-project to help work of the Ministry

1. STUK has its own pre-project to help work of the Ministry
   – Preparation of drafts for a Radiation Act and requirements (Decrees, STUK regulations)
   – Development of requirements management tools and methods for the work

2. Survey of the needs of stakeholders and experience concerning the existing legislation and regulatory oversight
   – licensees, radiation safety officers, dosimetry services, and training organizations of radiation safety officers
   – the report has been finished in June 2015
   – to be publication in STUK series of reports in Finnish

3. Lessons learned from the renewal of YVL Guides
   – Systematic collection and workout of the lessons learned
   – Implementation to STUK processes in renewing the ST Guides after the renewal of the legislation
Requirements Management

Applications of requirements management methods

- Requirements of the renewed YVL Guides were transferred into a requirement management system
  - Application of the new YVL Guides to existing plants
  - Periodic Safety Reviews
  - Inspection planning
  - Change management

Requirements management tools for development of the regulations

- New tools developed in STUK for the renewal of the radiation legislation and regulations
Traceable review of the IAEA safety standards and guides using the requirements management tool

Library of reference documents such as legislation and requirements, EU directives, IAEA safety standards etc.

IAEA GSR Part 3 text

Content of IAEA GSR Part 3, Different kind of views can be chosen
Software assisted (RETKI = Regulations Tool Kit) preparation of the drafting of the Radiation Act

Library of the drafts of the new legislation

Text of the draft of the new law

Justification of the paragraph

EU directive article 1 in English and Finnish shown

Link with the article of EU directive and new paragraph
STUK mandatory regulations

An amendment of the Nuclear Energy Act and the Radiation Act was prepared to extend the authorities of STUK, HE 320/2014

- The Parliament approved the proposed changes to these Acts in March 2015 and the President of Finland confirmed the Acts in May 2015
- STUK issues mandatory technical requirements on the mandate given in the Radiation Act and the Nuclear Energy Act
- The change of the Nuclear Energy Act and Radiation Act come in force 1st July 2015 except particular paragraphs in the Nuclear Energy Act

The four Government Decrees of nuclear legislation will be replaced by STUK’s regulations the 1st January 2016

- The acceptance criteria such as public dose limits are shifted to the Nuclear Energy Decree
- The Nuclear Energy Act paragraph 7 q § authorizes STUK to issue mandatory requirements on 27 topical areas
- STUK cannot regulate other authorities’ measures thus such requirements need to be issued by the Nuclear Energy Decree
VALMA project

Goal is to prepare STUK’s mandatory regulations according to the modification in the Nuclear Energy Act (....) before the end of 2015

– to replace current Government Decrees
  • on Safety of NPPs (717/2013)
  • on Emergency Preparedness (716/2013)
  • on Security in the Use of Nuclear Energy (734/2008)
  • on the Safety of Disposal of Nuclear Waste (736/2008)
– to develop a new STUK’s mandatory regulation
  • on Safety of Mining and Milling Practices for producing Uranium and Thorium

VALMA project

– project plan approved 31<sup>th</sup> March 2015
– 20 experts working in the project
– five working groups were formed to develop the requirement documents
– project manager, principal advisor on nuclear safety from the Legal Affairs and Safety Regulations (LAS) unit
VALMA project activities

STUK mandatory regulations

– no change in the basic structure and content of the requirements
– each Government Decree will be replaced by a STUK Mandatory Requirement document

The safety level of the new STUK mandatory regulations

– No changes in the safety level compared to Government Decrees
– Harmonization of the waste management requirements with the Nuclear Safety requirements
  • Some lessons learned from the review and assessment of the Posiva construction license application will be implemented (structure)
– Some minor updating of Nuclear Security requirements
– Ensuring the consistence of the whole set of requirements

Other activities

– Justification memorandums
– Development of the format for the STUK mandatory regulations
Development of the STUK mandatory regulations

Process aspect

– Licensees and other stakeholders have nominated their representatives to the interface groups following the change process
– STUK shall hear the ministries and other stakeholders as well as the STUK’s Advisory Bodies when developing the requirements
– MME shall issue modifications to Nuclear Energy Decree before STUK can issue the STUK mandatory regulations

STUK internal surroundings

– Lessons learned from the renewal of the YVL Guides included in planning phase
– Work space for the project group
– External and Internal communication included in the project plan
VALMA project milestones and timeable
Thank You!

www.stuk.fi