Radiation Safety in New Build
Mission:
Protecting people, society, environment, and future generations from harmful effects of radiation

Duties:
Regulation
Research
Services

Offices:
Helsinki
Rovaniemi
NPP site inspectors

Organisation:

DG’s office 9
Public Communication 4
Emergency Preparedness 4
Expert Services 8

Nuclear Waste and Materials Regulation 25
Nuclear Reactor Regulation 99
Radiation Practices Regulation 44
Research and Environmental Surveillance 97
Non-ionising Radiation 10

Administration, Internal Services and Information Management 61

Figures indicated number of staff in 2008. About 360 still a total in 10/2010, Nuclear regulation more than 1/3 of activities.
Outline

- Licensing of a NPP in Finland
- Regulatory platform on radiation safety
- Review of radiation safety issues in Olkiluoto 3 reactor project

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- New NPP initiatives and projects, progress until 2010 (preliminary safety assessment, including new site alternatives)
Nuclear power plants in Finland

Olkiluoto NPP (TVO)
- 2 operating units - ABB BWRs
- OL3 (EPR) under construction
- Application for OL4

Lovisa NPP (Fortum)
- 2 operating units - VVERs
- Application for LO3 (rejected)

Fennovoima Ltd
- New utility, no operating reactors, Application for FV1 (2 alternative sites)
**OL3 - licensing Steps**

- **Feasibility studies** *(by utility)*
  - Political debate on whether using nuclear energy is for the overall good of society
  - Government decision and Parliament ratification/rejection
  - STUK’s preliminary safety assessment

- **Decision in Principle - issued in May 2002**
  - Government decision and Parliament ratification/rejection
  - STUK’s preliminary safety assessment

- **Construction License - Issued in February 2005**
  - Government Decision
  - STUK’s Safety assessment on the acceptability of Technical principles and requirements of the plant

- **Construction - ongoing phase**
  - Review and approval of the detailed design
  - Oversight of manufacturing
  - Oversight of construction, installation and commissioning on site, resident inspectors
  - Construction Inspection Programme

- **Operating license**
  - Government Decision
  - STUK’s safety assessment on the technical and organisational aspects of the as build plant

- **Decision in Principle**

- **Bidding & site preparation**

- **Construction License**

- **Operating License**

- **Operation**

- **Nuclear commissioning**
OL3 Project - General

- OL3 is a turn key project; owner and operator (Licensee) is TVO and constructor/vendor is consortium of Areva and Siemens

- Project is progressing but is more than three years behind the original schedule; Lessons learnt, e.g.:
  - Design should be as ready as possible prior construction (no “design as you go”)
  - Qualification of a new construction or manufacturing method may take time
  - Key to success is adequate human resources, expertise and experience within all stakeholders (vendor, subcontractor, licensee, regulator)
  - Management of requirements, design configuration and modifications should be systematic

Photos: TVO
STUK’s Nuclear Reactor Regulation (NRR), used resources for OL3

Number of staff at NRR

Number of staff is currently ~ 110

Full time equivalents on oversight
Radiation safety related YVL Guides

- STUK issues detailed regulations concerning the safety of NPPs in YVL Guides
- Several YVL Guides concern radiation safety issues (siting, radiation safety aspects in design of NPPs, radiation protection of workers, radiation monitoring systems, monitoring of discharges, limitation of public exposures, meteorological measurements, radiation monitoring in the environment, emergency preparedness)
- YVL 7.18, Radiation Safety Aspects in the Design of NPPs (2004):
  - general design principles: e.g., materials, shielding, design target for collective dose, accident situations
  - radiation safety issues in layout design
  - radiation safety issues in system design
- All YVL Guides are currently under revision, new guides should be published by end of 2011
Radiation safety issues reviewed in the OL3 construction license phase

- sources, lay-out, shielding
- primary system material specification
- primary coolant chemistry
- fuel integrity
- maintenance planning
- collective dose estimation
- on-site habitability during accidents
- releases during normal operation and the use of BAT principle
- accident analyses and radiological consequences
- conceptual design of radiation monitoring system
- waste management issues
Primary system material selection

- Co-60 is typically causing most of workers’ doses
- Cobalt hard-facing (stellite) minimisation vs. increase of technical risk and loss of operating experience
- Minimising residual cobalt content in primary system materials, e.g. in stainless steels and SG tubing material
- Stellite and residual cobalt inside the RPV have the largest impact on workers’ radiation doses
Target for collective dose (YVL 7.18)

- Design criterion for annual personnel collective dose:
  
  < 0.5 manSv / 1 GWe averaged over the plant life
  
  < 0.8 manSv / year for OL3 (1600 MWe)

- EUR document requirement for EPR: target for annual collective effective dose averaged over the plant life is 0.5 manSv / year

- ALARA principle should be also applied in the design

- OL3 (12 months cycle): 0.43 manSv/year (PSAR phase) / 0.38 manSv/year (more detailed analysis during construction)
Annual collective doses

- Olkiluoto 3 (1600 MW) design criterion in YVL Guide
- Olkiluoto 3 PSAR target value

Olkiluoto (BWR)
PWR (NEA/ISOE)
Loviisa (PWR)
Siemens Konvoi
Framatome N4
Limitation of radioactive releases from a nuclear power plant (Government Decree 733/2008 and Regulatory Guide YVL 7.1)

- Acceptance criterion for radioactive releases / max doses to general public for normal operation:
  - radiation dose limit 0.1 mSv / year for the entire site

- Radioactive discharges shall be reduced using best available techniques (BAT principle) + ALARA principle

- Anticipated events: radiation dose limit 0.1 mSv

- Design basis accidents: radiation dose limits 1 mSv (class 1) and 5 mSv (class 2)

- Severe accidents: no acute health effects, tolerable long term contamination (Cs-137 release < 100 TBq)
Olkiluoto 3 - discharge abatement

- Operating and R & D experiences from reference plants (N4 & Konvoi) => realistic improvements (BAT)
  - Fuel design
  - Materials in the primary systems
  - Coolant chemistry & purification
  - Gas treatment
  - Liquid waste treatment
  - Ventilation and filtration

- Reference plant values of actual discharges <=> ALARA
On-site habitability during accidents

- Regulatory guide YVL 7.18 requires analyses of the possible radiation sources and estimates of emergency worker doses.

- Design stage habitability criterion: doses may not exceed the normal dose limits of a radiation worker (50 mSv).
OL3 accident management systems considered in habitability analyses

Emergency core cooling systems
Containment heat removal by sprays
Filtered containment venting system
Sampling systems
Regulatory oversight during OL3 construction

- Review of detailed system designs - including radiation safety aspects
- Oversight of construction and manufacturing of components
- Construction Inspection Programme:
  - e.g., project management, quality management, safety culture, quality control of construction activities, training of operating personnel, licensee’s inspection procedures, use of PRA, radiation safety requirements, I&C technology
- Participation in audits made by the licensee
- Topical inspections to the vendor’s design process - including radiation safety issues (1st inspection was made already during construction license phase)
- Oversight of commissioning
Licensing stages in Finland based on environmental and nuclear legislation

**Feasibility studies**
(by utility)

**Bidding & site preparation**

**Construction**

**Construction Permit**

**Decision in Principle**

**Operating License**

- **Decision in Principle**: political debate on whether using nuclear energy is for the overall good of society - Government decision and Parliament ratification/rejection - municipality acceptance - STUK’s preliminary safety assessment

- **Construction Permit**: Government Decision
  - STUK’s Safety assessment on the acceptability of Technical principles and requirements of the plant

- **Operating license**: Government Decision
  - STUK’s safety assessment on the technical and organisational aspects of the as build plant

- **Construction**: Oversight of construction to verify that approved principles and requirements are implemented

**Environmental Impact Assessment**
Fennovoima, new NPP project

- **Site Survey in 2007**
  - 30 areas in 10 municipalities
  - detailed assessment of 10 areas

- **EIA** process and land use planning **2008-2009**

4 candidate sites

- **SIMO**, Karsikoniemi headland
- **PYHÄJOKI**, Hanhikivi headland
- **KRISTIINANKAUPUNKI**, Norrskogen
- **RUOTSINPYHTÄÄ**, Kampuslandet & Gääddbergsön

- NPP project, 1500 - 1800 MW

- Government & Parliament, **2010 DiP 2 alternative sites**
Simo, Karsikkoniemi (20 - 30 km from Sweden)
Simo Karsikkoniemi and northern dimension

Lapland (arctic nature)

Industry, harbour

Kemi town & airport
Environmental Impact Assessment (EIA)

IN FINLAND:

- **Act** on Environmental Impact Assessment Procedure (EIA) (468/1994) and the Decree on EIA (713/2006)

  NPPs, Nuclear Waste disposal facilities, ..

- **Alternative candidate plant sites** may be simultaneously examined during the EIA process and further in the application for a Decision in Principle.

- Finland's **neighbouring countries shall be heard** where deemed necessary by virtue of the Convention on Environmental Impact Assessment in a Transboundary Context

  Parallel also a **hearing of land use plans** (Espoo Convention)
EIA programme and report (main issues)

- Effects of construction
- Land-use and landscape
- Effects on the **sea water and fishing**
- Noise etc
- **Waste** and their effects
- Effects on ground and bedrock and groundwater
- Effects on **plants, animals and nature protection areas**
- Traffic
- Electric power lines
- Social effects
EIA report, certain nuclear and radiation issues

- Project plan
- Radiation and health
- Radioactive releases, normal conditions
- Accident consequences and mitigation

The scope of to be considered is not exactly defined in legislation. Based on expert discussions, a release corresponding to the severe accident limit 100 % Noble gases & 1000 TBq I-131 & 100 TBq Cs 137 was analysed and presented in the EIA reports.

- Nuclear fuel cycle (waste disposal plan)
- Decommissioning

EIA IS EARLY PROCESS. INFORMATION THUS VERY GENERAL
Fennovoima NPP & Northmost Site - Simo DiP, STUK statement

- **Preliminary safety assessment**
  - Can be planned and constructed to fulfill Finnish regulations

- **Feasibility of the site**
  - **Northern conditions (meteo, see)**
    - Plant design
  - **Seismic data & requirements**
    - Plant design
  - **Air traffic (K-T airport)**
    - Plant design and air control
  - **Preparedness for emergencies**
    - Some new planning and tools

- **Fennovoima resources and skills**

- **Plant alternatives**
  - Areva EPR
  - Areva KERENA
  - Toshiba-Westinghouse ABWR
STUK contact to Stakeholders

- participation in official hearings on site (EIA & DiP)
- lectures invited by the municipalities concerned, and local education centres
- participation in critical discussion panels (with Greenpeace, Swedish Actors, local and national action groups)
- interviews to media (morning papers, radio, TV)

open web, questions/answers

Issues questioned:

- normal life and employment; agriculture (potatoes, tomatoes..), fishing, see water quality
- emergency planning zones, housing and traffic
- nuclear waste management
Fennovoima Company founded

preliminary site survey (>30 sites)

company local offices

4 alternative NPP site candidates

2 alternative candidates accepted >> 6/2011

EIA programme local hearings

3 alternative candidates

EIA report local hearings

DiP local hearings

Parliament DiP voting 1.7.2010: yes
Simo Karsikkoniemi, possibly a new NPP operating site in 2020

Fishermen in winter
www.stuk.fi (also in Swedish and English), e.g.:

- STUK’s YVL Guides
- STUK’s safety assessment concerning Olkiluoto unit 3 construction licence
- STUK’s preliminary safety assessments concerning the possible new plant units OL 4, FV and LO 3 in Finland

OR: Contact stuk@stuk.fi, olli.vilkamo@stuk.fi GSM + 358 400 817981

Thank you for attention!

More information available: