

# 4th Review Meeting of the Convention on Nuclear Safety

**Finland**

**Country Group VI**

**April 18, 2008**

**Head of Delegation**

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# Presentation Outline

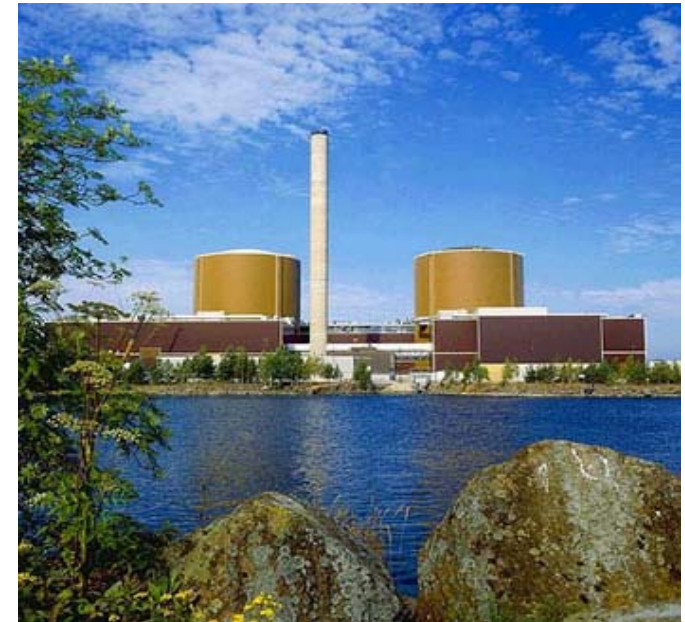
- Selected highlights
  - recent nuclear activities in Finland
  - regulation of nuclear facilities
- Updates to national report to 4th Review Meeting
- Follow-up from 3rd Review Meeting
- Planned measures to improve safety - achievements
- Planned measures to improve safety - challenges
- Questions raised from peer review of National Report
- Licensees' presentations
- Conclusions

# Nuclear power plants in Finland



## **Olkiluoto NPP (TVO)**

- 2 operating units - ABB BWRs
- New EPR under construction
- EIA ongoing for a new unit



## **Loviisa NPP (Fortum)**

- 2 operating units - VVERs
- EIA ongoing for a new unit

## **Fennovoima Ltd**

- EIA ongoing for 1 or 2 new units on four sites

# Three licensing steps of nuclear facilities

1. Decision in Principle (DiP) – “political”
  - DiP opens the way for a new nuclear facility: no more licensing uncertainties or delays should be expected if the licensee and the vendor manage the project properly
2. Construction License (CL) – “technical”
  - main design features are assessed and fixed at this stage: no regulatory uncertainties if the licensee and the vendor follow the principles and specifications fixed in the CL documentation
3. Operating License (OL) – “technical”
  - OL is granted after the regulator has verified implementation of construction according to plans, which were approved during the safety assessment for the CL
  - OL is given for a limited time and has to be renewed after that, pending on results of PSR

# Main parties involved in licensing and regulation of nuclear facilities in Finland

All licenses for nuclear facilities are issued by the Government

- Ministry of Employment and the Economy (TEM) provides administrative support for processing license applications

STUK is the nuclear regulatory body and has following duties:

- preparation of national nuclear safety regulations
- safety evaluation (necessary prerequisite for issuing a license)
- inspections needed to verify the safety state of the facility and the compliance with license conditions over the plant lifetime
- inspections on nuclear waste management and nuclear material safeguards
- giving binding orders to the licensees as needed to ensure nuclear safety (based on expert judgment made at STUK)

# Relicensing of Loviisa 1 and 2

- Loviisa 1 and 2 relicensed 2007
  - new licenses valid up to 2027 and 2030, respectively
  - license conditions include conducting two PSR's, in 2015 and 2023.
- The lifetime of both units will be 50 years; e.g. safety and strength analysis were updated to correspond the continued operation
- Key issues in future:
  - renewal of I&C systems,
  - follow-up of RPV material embrittlement,
  - effective lifetime management,
  - maintaining competence and high level of safety culture,
  - operating experience feedback, and
  - use of risk-informed methods to further develop the plant safety.

# Loviisa OSART 2007

- IAEA OSART Team visited Loviisa 1 and 2, 3-21 March 2007
  - Good practices (10)
  - Recommendations (9)
  - Suggestions (15)
- Licensee action plan to respond to recommendations/suggestions
- Follow-up OSART planned for July 2008.

# PSR of Olkiluoto 1&2 - on-going activity of 2008

- Based on a condition of 1998 operating license, a PSR is being prepared by TVO - to be submitted before the end of 2008
- STUK will review the PSR and conclude whether the plant can be expected to remain safe until the current license expires at the end of 2018 (next PSR to be conducted for licence renewal).
- PSR's detailed contents presented in STUK's guide YVL 1.1 (2006) - summary in the Finnish national report.
- IAEA NS-G-2.10 (2003) safety factors were given full attention when preparing YVL 1.1.
- the results of this PSR will be reported in the next CNS report 2010.



# Status of PRA reviews in Finland, 2007

PSA	Plant	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06 <sup>4)</sup>	07
Internal, full power	LO	X					X		X	X		X	X <sup>2)</sup>	X <sup>2)</sup>					X	X
	OL	X					X					X								
Fires, full power	LO				X <sup>1)</sup>					X										X
	OL				X		X				X									
Flood, full power	LO						X				X			X					X	X
	OL			X			X			X							X			
Seismic (not originally required by STUK)	LO				X															X
	OL								X											
Weather, full power	LO						X			X	X		X						X	X
	OL							X <sup>1)</sup>		X	X				X			X <sup>2)</sup>		
Internal, shutdown & low power	LO									X									X	X
	OL				X					X									X	X
Fires, shutdown & low power	LO														X					
	OL										X									X
Floods, shutdown & low power	LO														X				X	X
	OL																			
Weather, shutdown & low power	LO																X		X	X
	OL																			
Seismic, shutdown & low power	LO																			
	OL																			
LEVEL 2, internal & flooding (LO), Weather (LO)	LO									X	X <sup>3)</sup>				X				X <sup>5)</sup>	X
	OL									X						X				

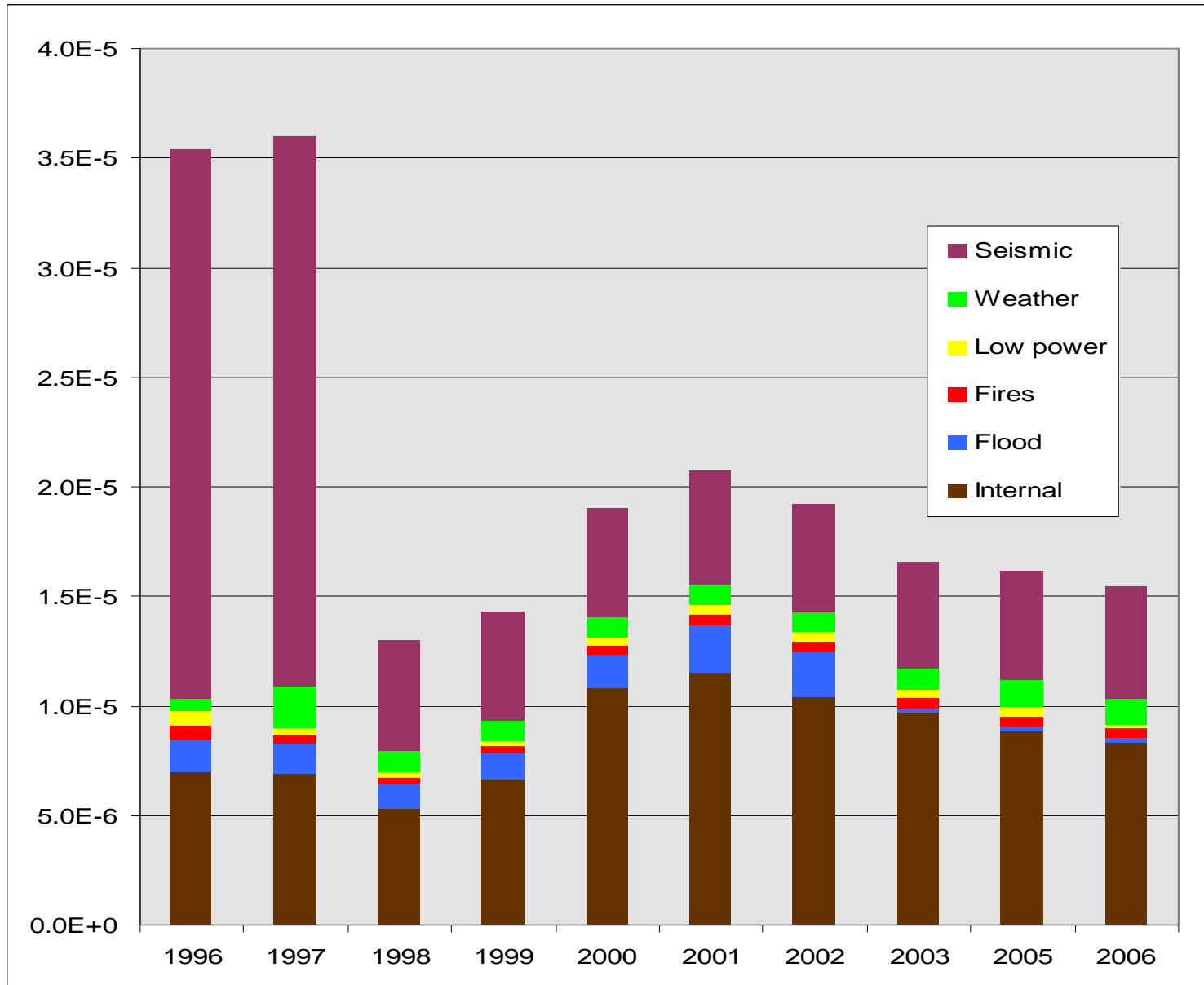
**LO** = Loviisa NPP , **OL** = Olkiluoto NPP

1) Limited version, 2) Partial updating, 3) Internal floods updating, 4) Submission to STUK during 2006, 5) Weather events

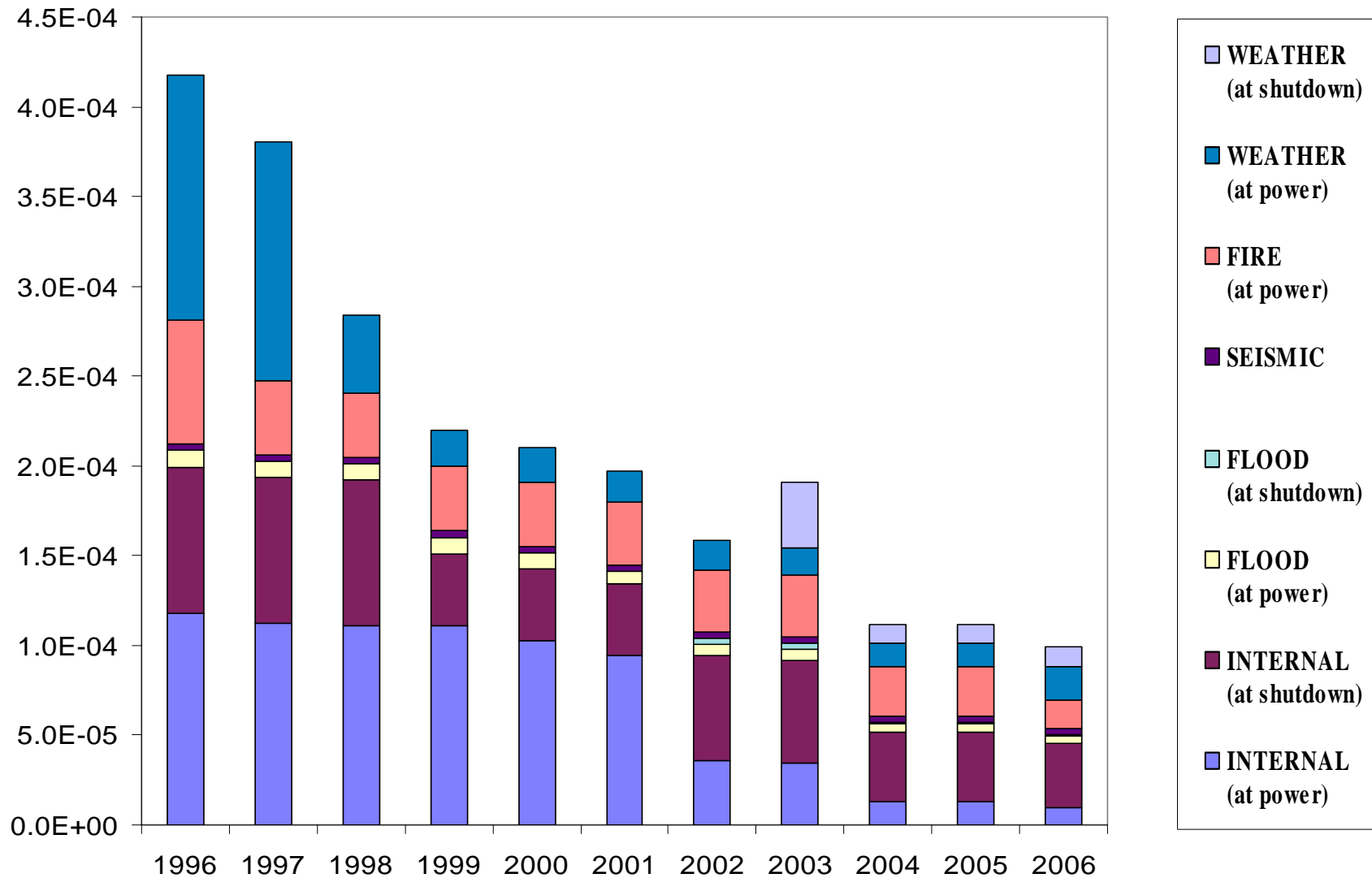
**1997-1998** License Renewals for Loviisa NPP and Olkiluoto NPP; **2006-2007** License Renewal for Loviisa NPP

In addition, a large number of system analysis updateings have been submitted almost yearly.

# Olkiluoto NPP CDF History

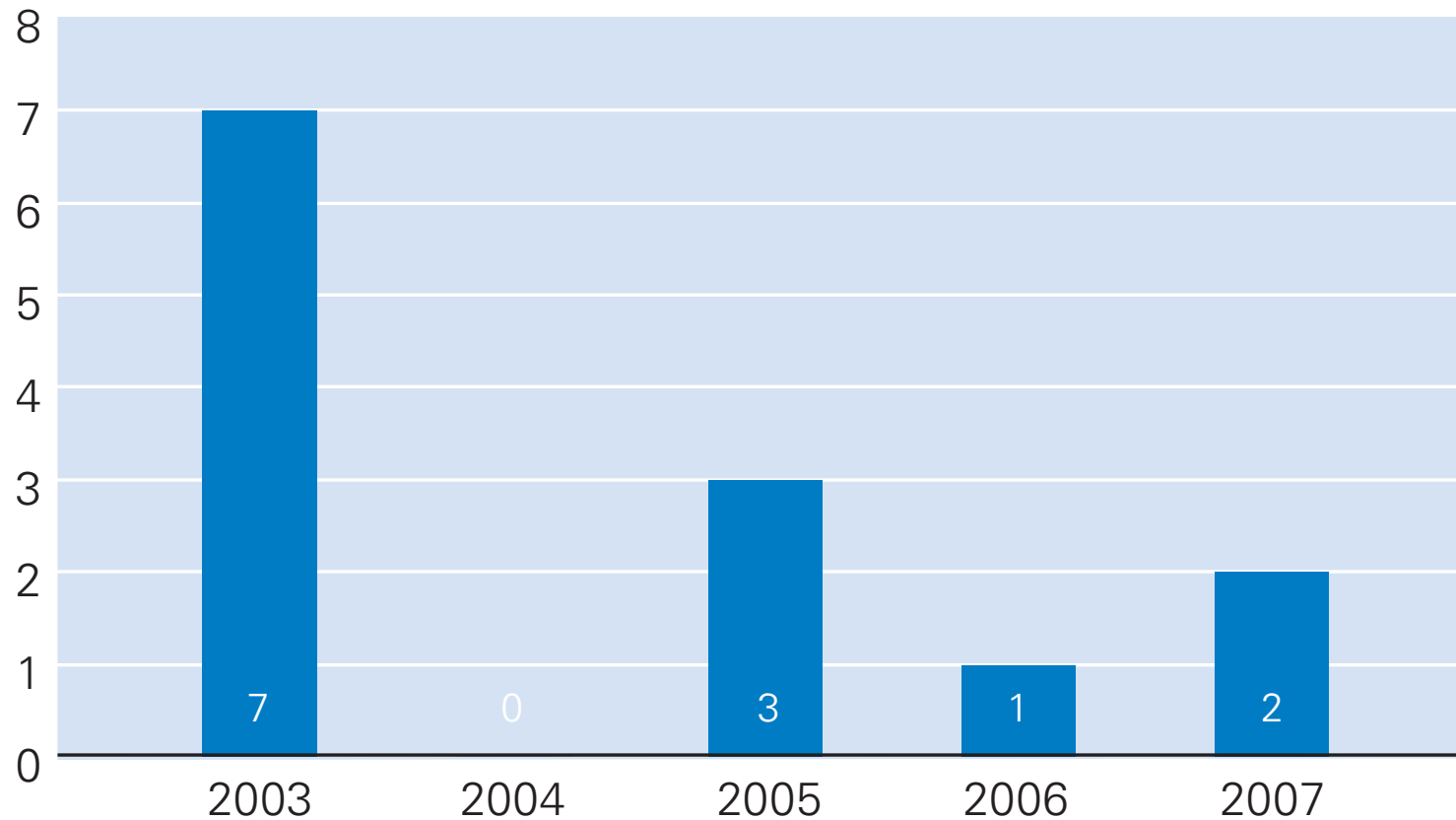


# Loviisa NPP CDF History



## Number of events at INES Level 1 at the four Finnish plant units.

No INES Level 2 events after 1992, never INES Level 3 or higher

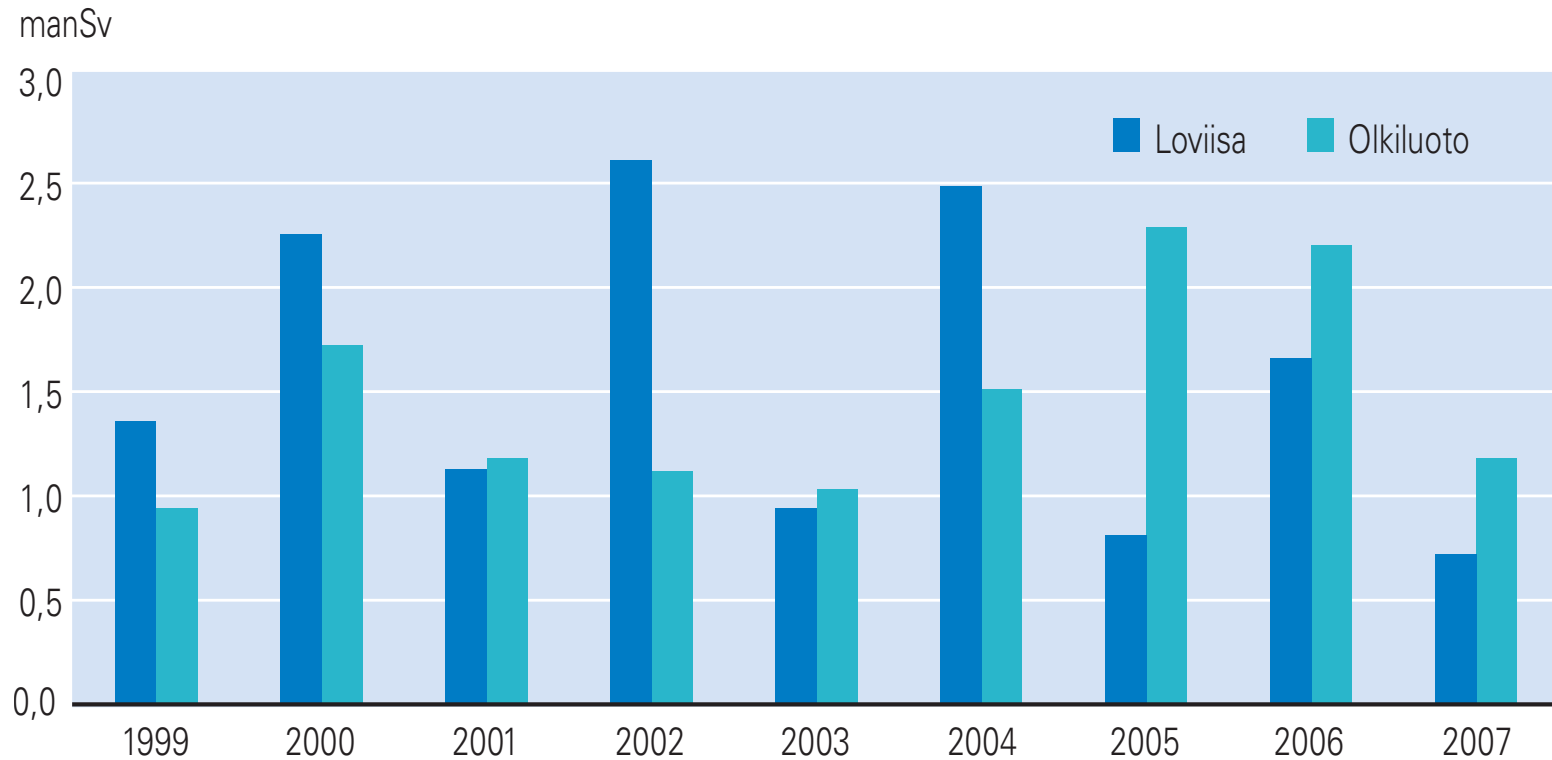


# INES 1 rated events from 2005 - until today

- year 2005
  - OL: error in relay protection setting, potentially effecting on power supply between the units
  - OL: power failure during outage due to electrical isolation error during system modification
  - OL: testing of fire suppression systems not made according to plant Technical Specifications.
- year 2006
  - LO: internal contamination spread occurred during annual outage
- year 2007
  - OL: reactor scram revealed deficiencies in the operation of the system
  - OL: use of nonqualified fuses in electrical systems were detected.

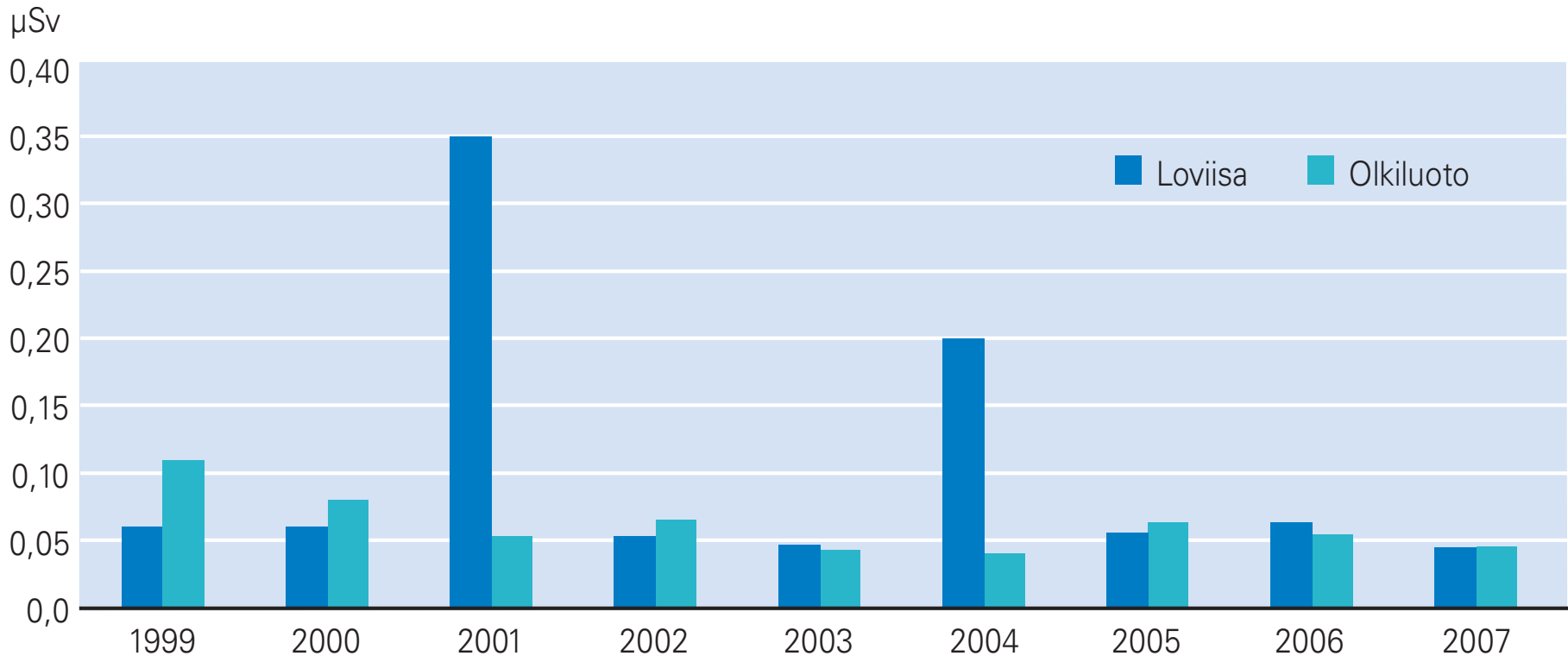
# Collective occupational doses at Finnish NPPs

Regulatory targets (two years' average): Loviisa 1,22 manSv, Olkiluoto 2,10 manSv



# Calculated annual dose estimates of most exposed individuals in the vicinity of the Finnish NPPs

Regulatory limit: 100 microSv - note: 2001 and 2004 peaks followed through controlled releases of low activity level evaporation liquid waste



# OL3 NPP construction - project status

- Project is delayed for more than 2 years - direct causes
  - lack of detailed design at construction start, slow progress since then
    - civil engineering
    - systems design
  - delays and generally slow progress in civil works at site
    - installation of the steel rebars and concreting works progressing more slowly than planned
    - deviation from plans in base slab concreting – need to improve work processes
    - welding errors during installation of the inner containment steel liner – repairs done
- Challenges in the manufacturing of the main components
  - qualification of the new manufacturing technologies has taken longer than expected
  - re-manufacturing of some major components was needed (pressuriser forgings, reactor vessel internals, main coolant pipes, main circulation pump casings and shafts, hp-turbine shaft, generator stator, ...)
- Commercial operation estimated to start mid 2011 (original schedule spring 2009)

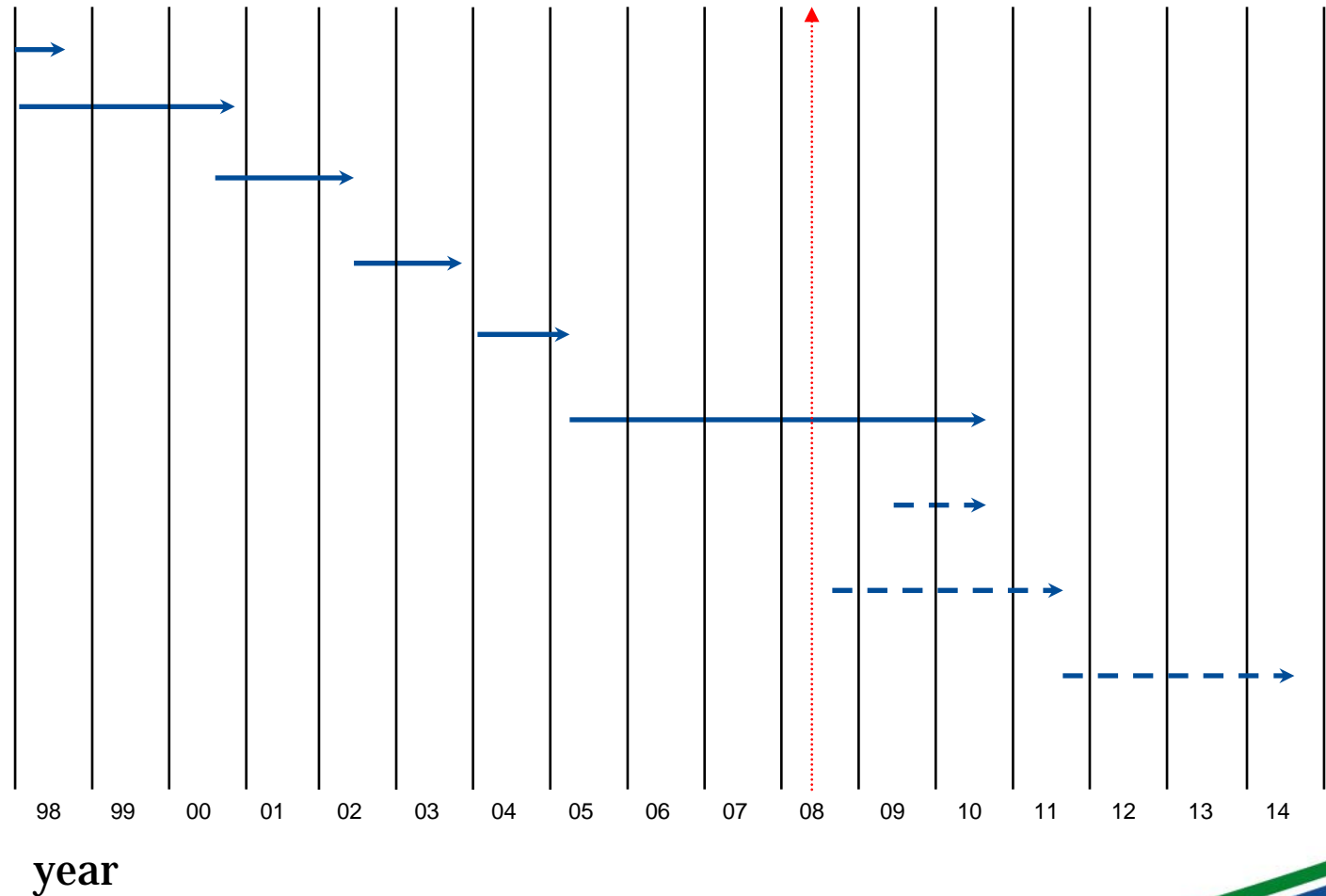


# OL3 NPP construction - project status

- Construction at site
  - Civil works of Nuclear Island are on the critical path
  - Turbine Island has progressed well, installations ongoing and will be ready in 2009
  - Manpower at site about 2900
- Manufacturing of main components ongoing
  - shipping of primary circuit components to site starts during second half of 2008

# OL3 NPP construction - schedule

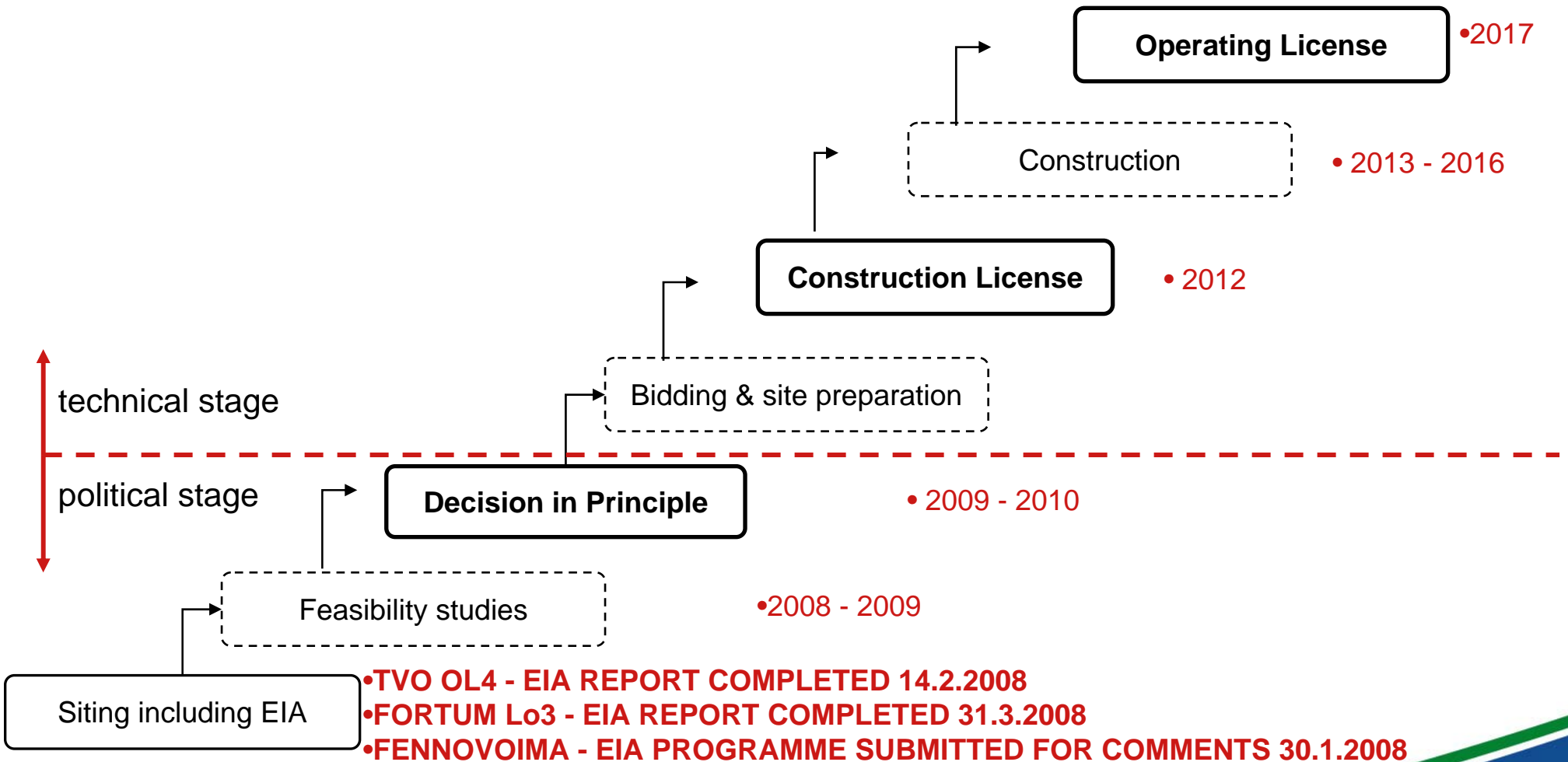
- EIA
- Feasibility studies
- **Decision in principle**
- Preparatory phase
- **Construction License**
- Construction
- **Operating License**
- Commissioning
- Commercial Operation



# Prospects of new NPPs in Finland

- Finland is meeting some 15 % of its needs with imported electrical power, and some old plants burning coal will be decommissioned after some years
- Finnish industry wants to ensure low price energy for the future
- Discussion on climate change has rapidly turned the general attitudes towards broad acceptance of nuclear energy
  
- It is generally expected that the Government will issue in late 2009 or early 2010 for one or more new plants a license that is needed to start tendering process and preparations for construction (“Decision in Principle”)

# Licensing stages and preliminary schedule



# Feasibility studies and discussions with STUK

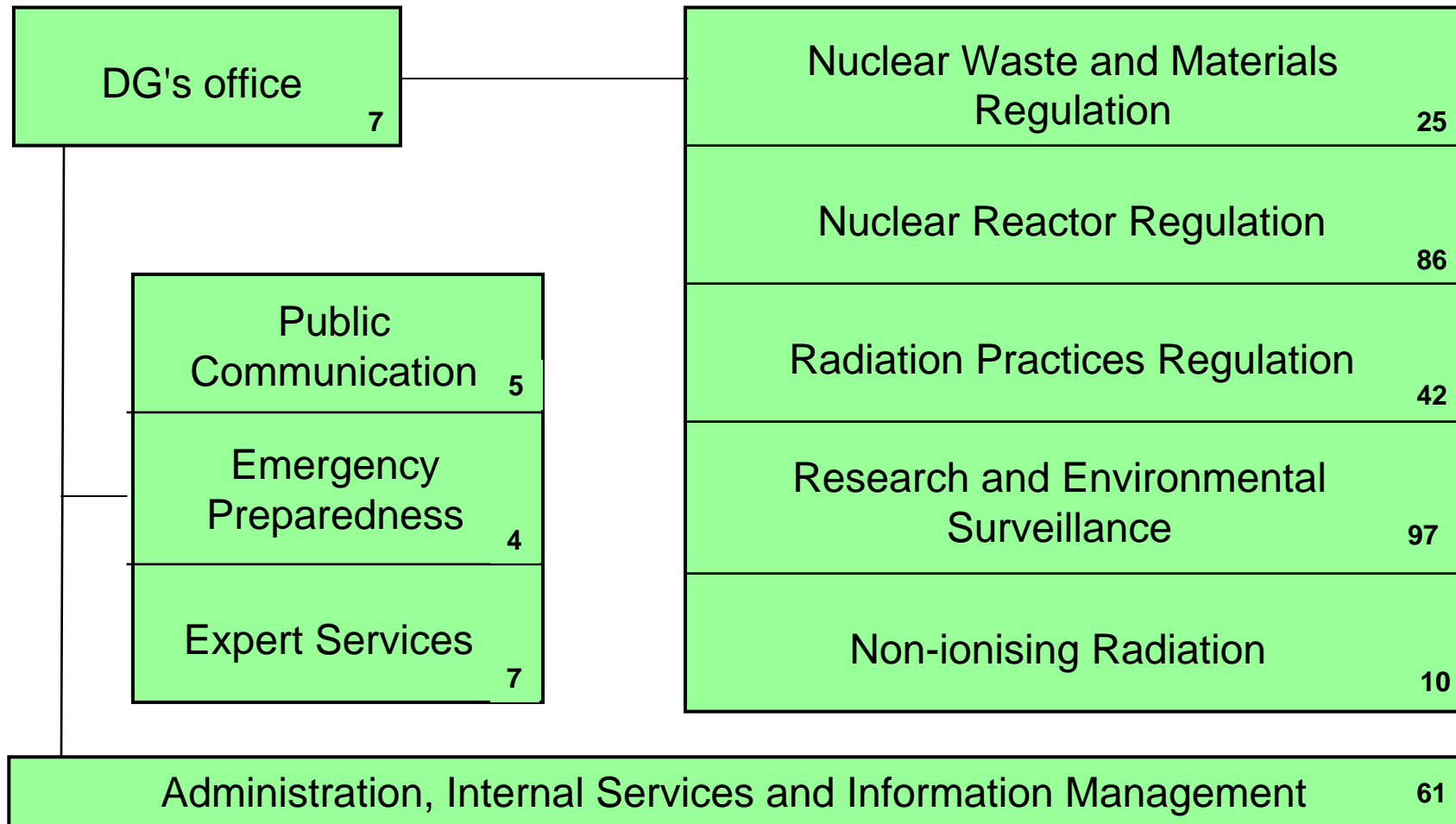
Feasibility studies for new NPPs are currently ongoing or to start soon

- STUK has since June 2007 evaluated at request of TVO (for OL4) three designs of 1400 -1600 MWe class; these compete with EPR
- Fennovoima (for FV-1) has requested to start discussions in May 2008 on two designs of 1000 MW class (twin units) and two designs of 1600 MW class
- Fortum (for O-3) has request discussions to start but has not yet specified the plant types

Each requests implies paying regulator the actual work costs.

# Organisation of STUK

Figures indicate staff number (344) at the end of 2007.



# STUK's strategic plan for 2007 - 2011

- **STUK's mission: Protecting people, society, environment, and future generations from harmful effects of radiation**
- Strategic plan is done using the Balanced Score Card approach which is also the basis for making Annual Plans
- The strategy
  - provides management policies for ensuring the success
  - sets priorities and expected outcomes
- Implementation of strategy
  - an action programme provides practical measures for each core process
  - annual action plans

## Effectiveness

- our impact on maintenance and improvement of radiation and nuclear safety is effective and risk informed
- our safety regulations are in line with good international practice
- our research work is of high quality and focused on key issues of radiation protection
- our public communication builds up confidence



## Resources and financing

- our staff resources are correctly optimized and targeted
- our financial situation, work conditions and tools are in a good shape



**Success factors**  
derived from  
mission and vision



## Processes and structures

- our work processes are consistent, cost effective and well defined
- availability, quality, and timeliness of our services meet the legitimate expectations of our customers and partners



## Development and ability to work

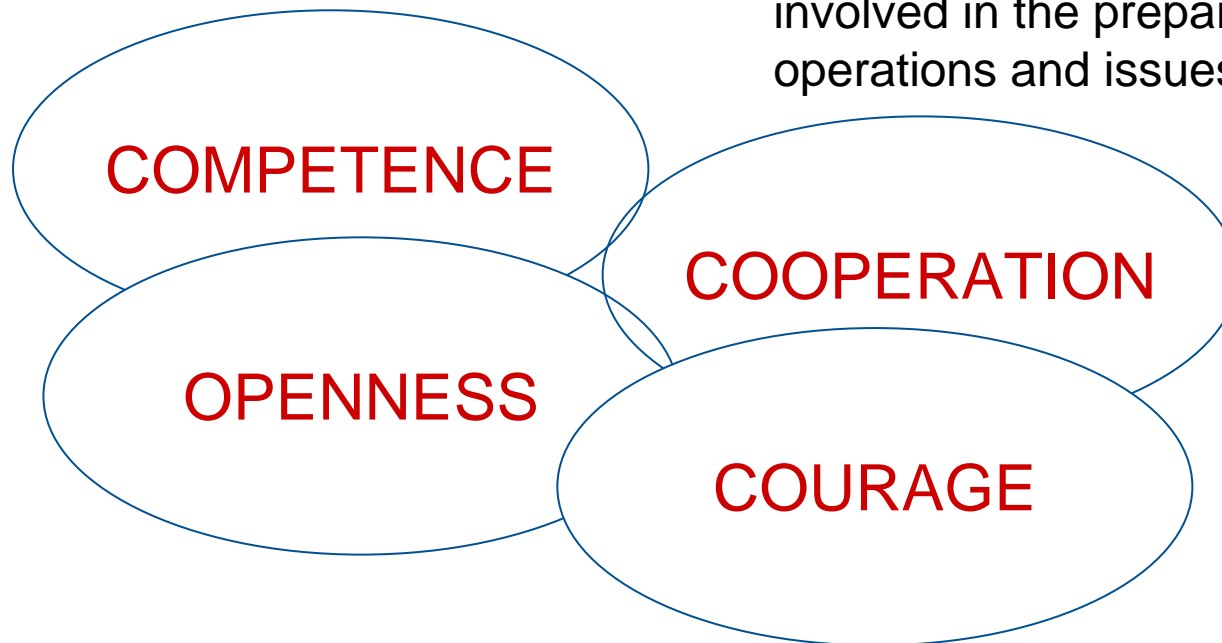
- quality and effectiveness of our work are improving continuously
- our staff is feeling well and is motivated to conduct their work
- our staff is professionally competent and has high work ethic
- good internal cooperation and leadership ensure full utilization of competence



# STUK strategy for 2007-2011 - the values

Actions, statements, and decisions are based on professional knowledge and factual information.

Cooperation within STUK is based on good co-worker relations, teamwork and mutual respect. Stakeholders are involved in the preparation of new operations and issues.



Operations are open and honest, both with stakeholders and general public as well as internally.

Observed problems and personal views are brought up boldly. Responsibility for own decisions is assumed. Mistakes are acknowledged and corrected.

# Assessment and measurement

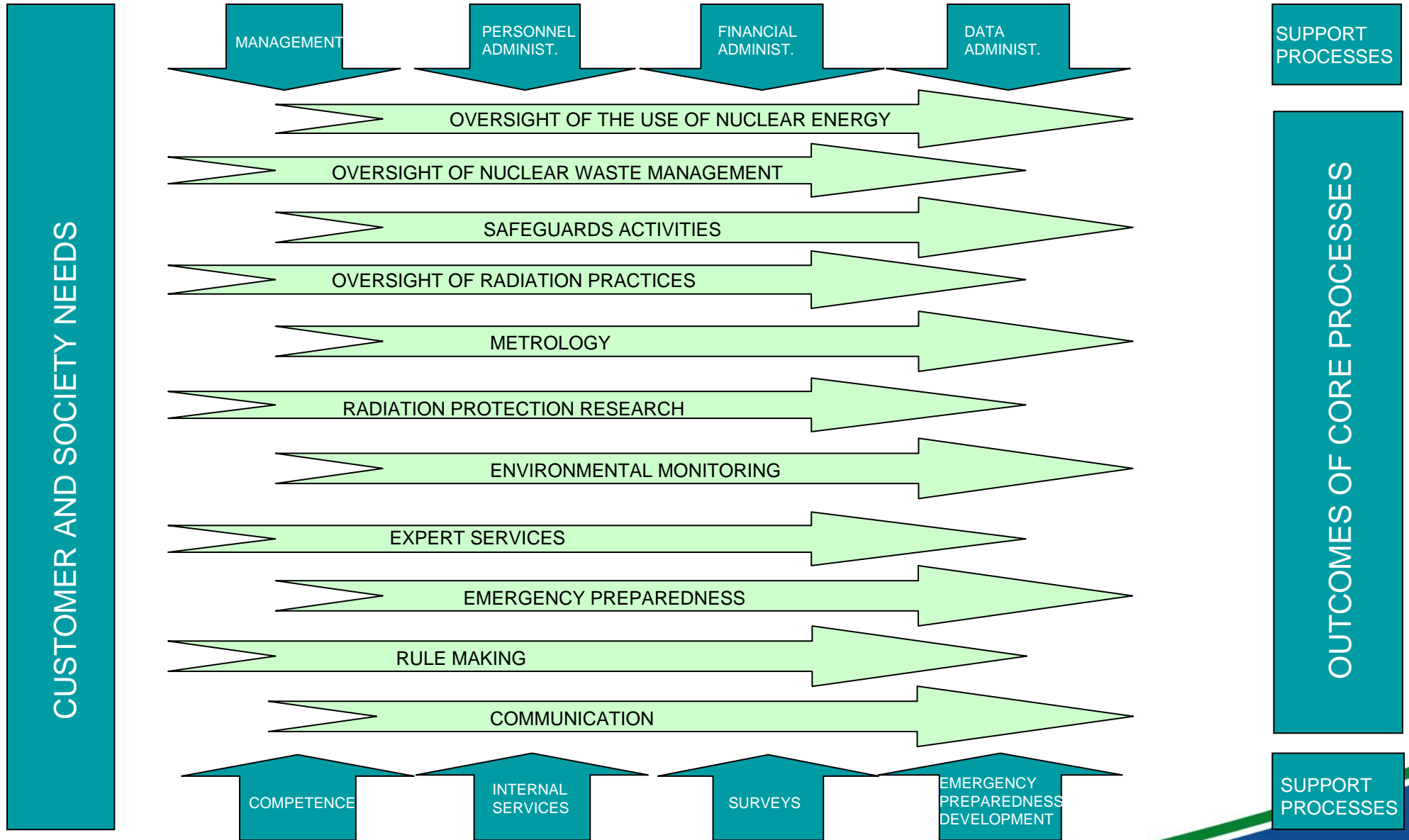
## Internal assessment

- systematic follow-up of achievements against the agreed annual targets
- cross-audits conducted by staff members according to annual audit programme
- self-assessment carried out in internal workshops
- annual upper management reviews
- staff surveys every two years (on staff engagement, motivation, satisfaction, etc.), and
- annual Report to the Ministry on work results and developments, including assessment against agreed targets and other performance indicators.

External assessments are conducted by international and national peers, including the following:

- regulatory activities were evaluated by an IAEA's IRRT mission in year 2000 and a follow-up in 2003
- one or two topical audits every year by external experts who are working on similar issues.

# Core and support processes of STUK



### **Rule making**

Legislation  
Regulatory guides  
Int. statements

### **Decision making and enforcement**

Document handling  
Contracted services  
Enforcement

### **Inspection programs**

Periodic inspection program (KTO)  
Inspection program for construction (RTO)  
Inspections required in YVL- guides

### **Oversight of new power plant projects and plant modifications**

Conceptual design of the plant  
Conceptual design of the systems  
Systems design  
Components and structures design  
Manufacturing and construction  
Validation and suitability  
Inspections of components and structures  
Commissioning  
Modifications

### **Safety assessment and analysis**

Deterministic safety analysis  
Probabilistic safety analysis (PSA)  
Safety performance indicators; analysis and feedback

### **Oversight of operations**

Compliance with Tech Specs  
Incidents  
Oversight of outage management  
Maintenance and ageing management  
Fire protection  
Radiation protection  
Emergency preparedness  
Physical security

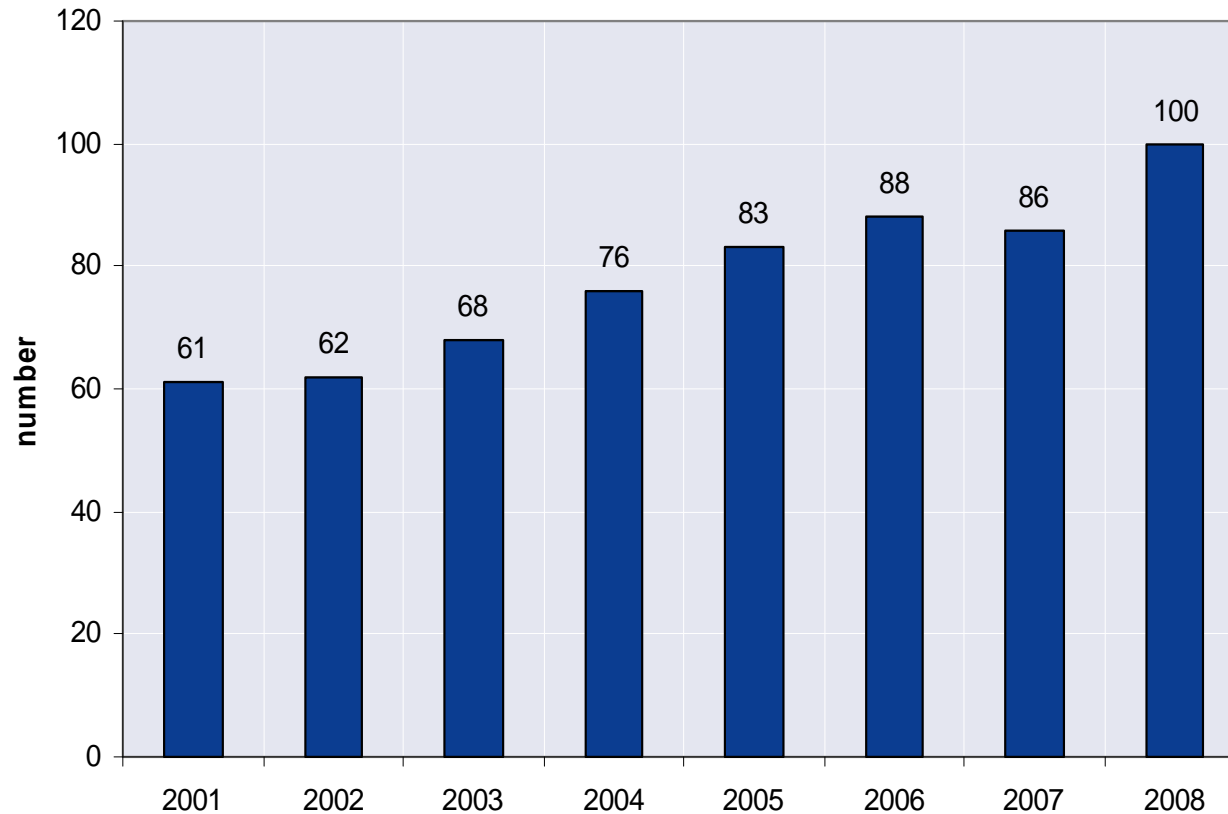
### **Oversight of management in regulated organizations**

Safety management  
Management systems and QMS  
Training and qualification of staff  
Use of operational experience  
Event investigation  
Nuclear liability  
Testing and inspection organisations  
Manufacturers of nuclear pressure equipment

### **Safety assessment**

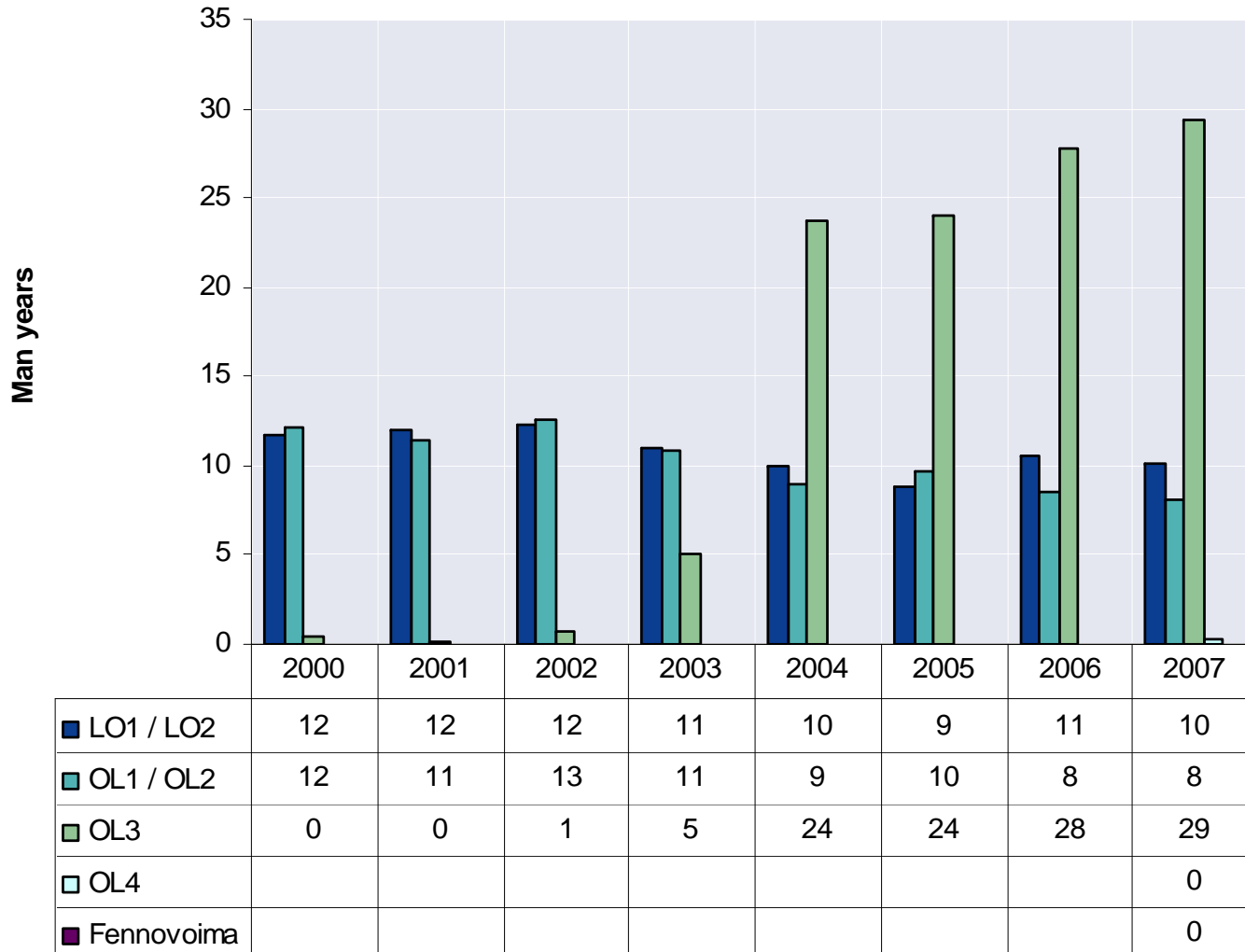
Statement for decision-in-principle, construction and operating licenses, periodic safety review  
Annual assessment of the safety of NPPs  
Safety assessment required in CNS

# Number of personnel at Nuclear Reactor Regulation department

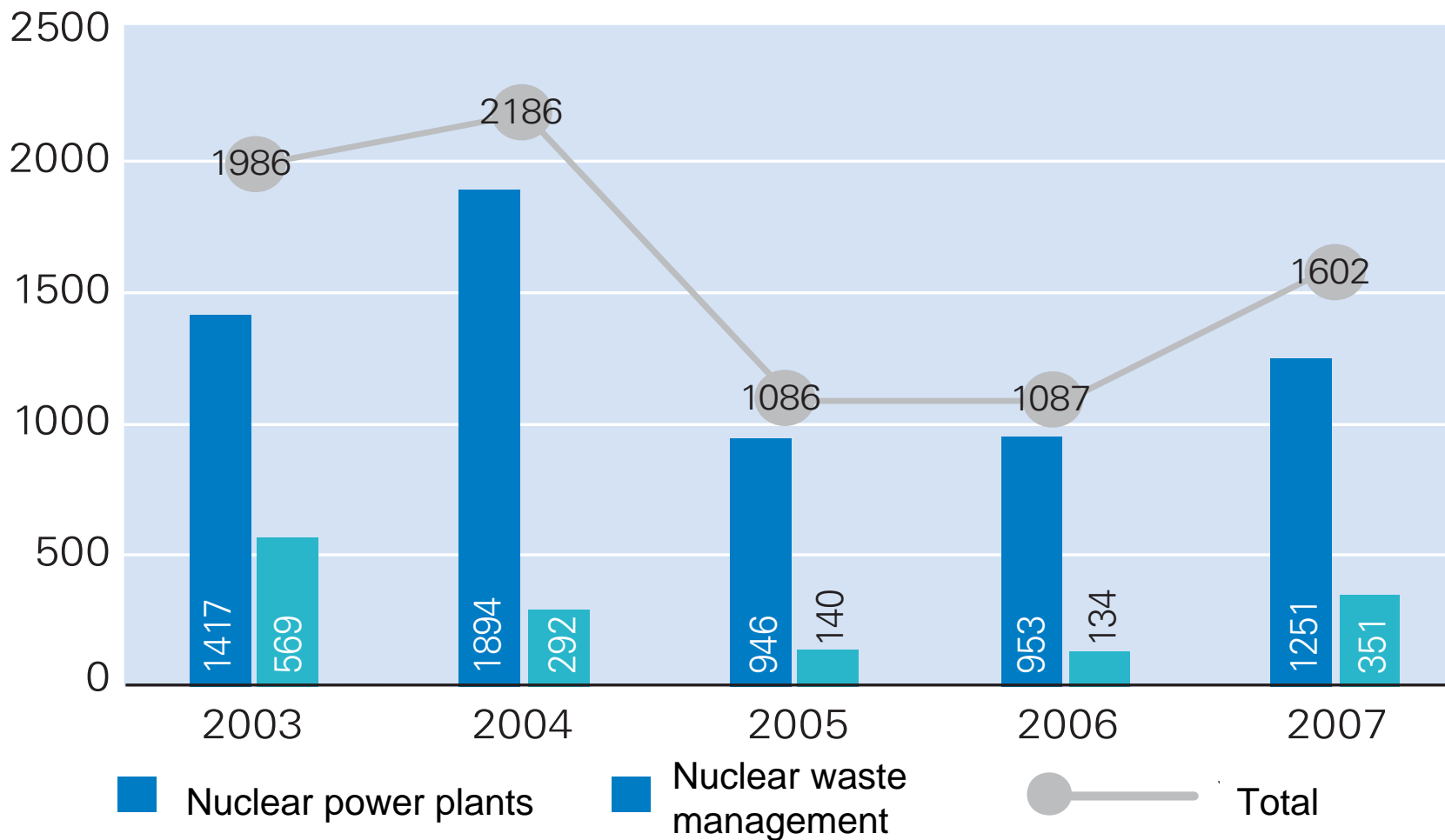


\* 2008 figure is an estimate

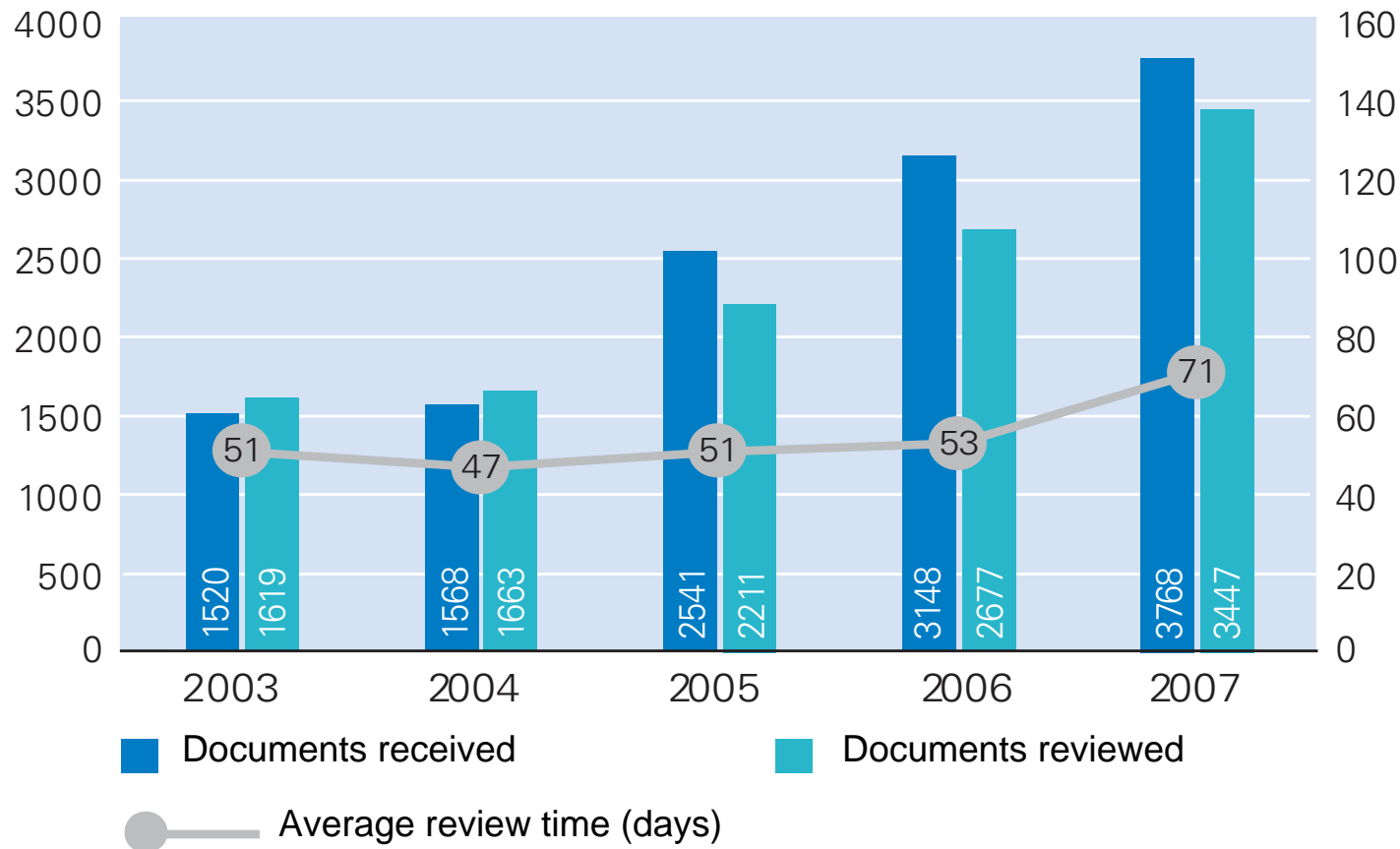
# Regulatory oversight work / plant



# Cost of contracted work to support the nuclear safety oversight (1000 euro) in 2003-2007

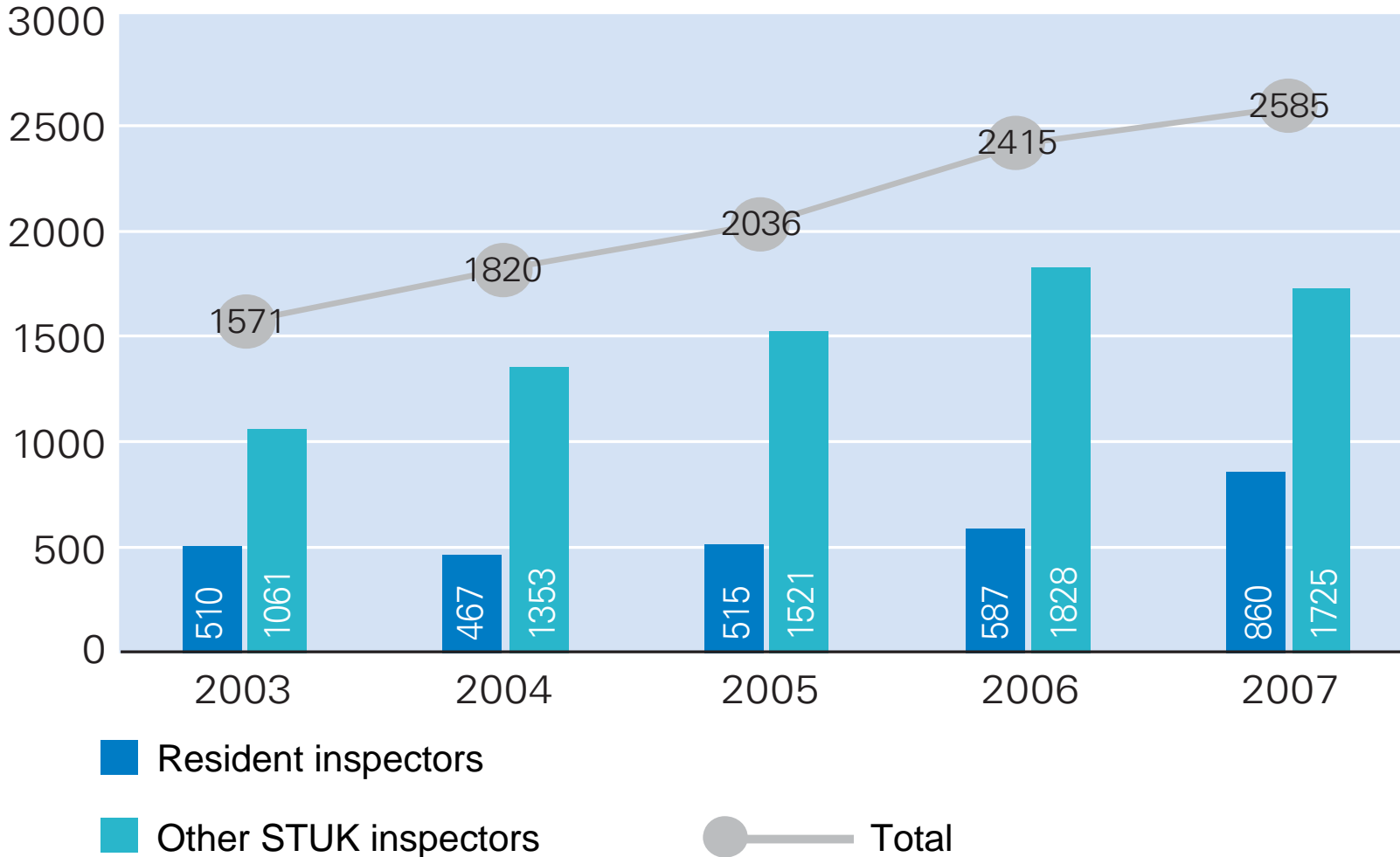


# Numbers of documents received and reviewed as well as average document review time in 2003 -2007





# Number of inspection days onsite and at component manufacturers' premises in 2003 - 2007



# STUK's new Advisory Board

- STUK's Director General invited in January 2008 a new Advisory Board consisting of eminent representatives of the Finnish society.
- Objective: to advice STUK for developing its activities as a regulatory, research and expert organisation in such a way, that it meets the expectations of the Finnish society in a best possible manner.

The composition of the STUK Advisory Board is the following:

- Osmo Soininvaara (Chair, ex-Green Party Chairman and parliament member)
- Matti Apunen (editor-in-chief, newspaper Aamulehti)
- Hannu Kuikka (head of department, Prime Minister's Office)
- Merja Kuusisto (parliament member, Social Democratic Party)
- Mauno Paavola (former CEO of TVO, retired)
- Osmo Tervonen (professor, Oulu University Hospital)
- Tapani Tölli (parliament member, Centre Party)
- Terttu Vartiainen (professor, National Public Health Institute).

# Development of Finnish nuclear regulations

- Modification of the Nuclear Energy Act and Decree and the Decisions of the Government
  - fundamental safety requirements will be transferred to the Act in order to reflect the spirit of revised Constitution (2001)
  - Decisions of the Government will be replaced with Government Decrees
  - no major changes either in the safety requirements or in the licensing process
  - consideration of development of science and technology as well as operating experience
  - revised legislation will be issued soon.
- STUK's regulatory guide system (YVL) restructuring
  - improved consistent structure and terminology
  - improved clarity and user-friendliness
  - early licensee involvement in working groups during preparation
  - updated national legislation, IAEA and WENRA guidance considered
  - project continues until 2011.

# Structure of new STUK-YVL Guide system

## 1 General Safety Requirements

### 1.1 Regulatory oversight of nuclear facilities

### 1.2 Definitions applied in STUK-YVL Guides

## 2 Safety management of nuclear facilities

- 2.1 Management systems
- 2.2 Personnel
- 2.3 Construction activities
- 2.4 Operating activities
- 2.5 Safety assessment
- 2.6 Risk management
- 2.7 Ensuring the integrity of pressure equipment
- 2.8 Management of modifications
- 2.9 Condition monitoring, maintenance and ageing management
- 2.10 Physical protection
- 2.11 Emergency preparedness
- 2.12 Siting of nuclear facilities
- 2.13 Reporting
- 2.14 Operating experience feedback

## 3 Plant and system level design

- 3.1 Safety classification of systems, structures and components
- 3.2 Safety systems
- 3.3 Reactor and nuclear fuel
- 3.4 Primary circuit
- 3.5 Containment
- 3.6 External threats
- 3.8 Fire protection

## 4 Radiation safety of nuclear facilities

- 4.1 Radiation protection of personnel
- 4.2 Environmental releases from NPPs
- 4.3 Measurement of environmental releases
- 4.4 Constructive arrangements for radiation safety in nuclear facilities

## 5 Nuclear materials and nuclear waste

- 5.1 Procurement of nuclear fuel
- 5.2 Safeguards control
- 5.3 Transportation of nuclear materials and nuclear waste
- 5.4 Handling, storage and encapsulation of nuclear fuel
- 5.5 Waste management and decommissioning
- 5.6 Disposal of nuclear waste

## 6 Structures and components of nuclear facilities

- 6.1 Fabrication and operation of nuclear fuel
- 6.2 Mechanical structures and components
- 6.3 Structures of construction engineering
- 6.4 Electrical and automation equipment

# Updates to National Report to 4th Review Meeting

No major updates necessary. Covered in this presentation.

- Changes since issuance of the 4th report are
  - STUK's Management Board was abolished and all management tasks were assigned to Director General of STUK
  - STUK's Director General invited an Advisory Board
  - Ministry of Trade and Industry was merged with the Ministry of Employment and is now Ministry of Employment and the Economy - no effect on licensing process
  - revised Nuclear Act and revised Nuclear Decree will be issued in spring 2008
  - revised Government Decrees (5) that provide mandatory safety rules are being finalized

# Follow-up from 3rd Review Meeting

## Issues addressed to Finland in 3rd Review Meeting

- ageing of regulatory staff
  - addressed, no concerns (see Article 8)
- maintaining competence during extended retirement
  - addressed, no concerns (see Articles 8 and 11)
- developing risk informed regulation
  - several applications in use, including Risk Informed ISI (see Articles 7 and 8 and chapter 3)
- regulatory oversight of construction of the new Olkiluoto plant unit
  - being conducted effectively with increased resources (see Article 7)
- replacement of I&C at Loviisa NPP
  - somewhat delayed, supplier's work has not fully met expectations and more work has been needed than originally planned (see Annex 2)

# Follow-up from 3rd Review Meeting

## Issues addressed to Finland in 3rd Review Meeting (cont.)

- maintaining and enhancing safety culture
  - done and receives continued attention, also during new build (see Article 10)
- completing the NDT qualification programme
  - major part done (see Article 14 and chapter 3)
- ageing management at Finnish NPPs
  - normal routine activity (see Article 14 and chapter 3)
- renewal of operating licenses for Loviisa plant units 1 and 2
  - done (see Article 6)
- Periodic Safety Review (PSR) for Olkiluoto NPP units 1 and 2
  - being worked on in 2008, as planned (see Article 6)

For details, please see the Finnish national report as referenced above.

# Finnish good practices (1)

- Modern nuclear legislation and regulations
  - reflects citizens' constitutional rights (safety, participation in environmental matters, hearing), proven licensing procedure, clear distinction of authority functions.
  - covers all safety related issues, is regularly updated to follow development of science and technology and responds to operational experience.



# Finnish good practices (2)

- Advanced regulatory infrastructure
  - STUK has clear mission, values, vision and strategy
  - QM system defining the quality policy, management principles, processes, functions as well duties and authorities of all employees
  - professional, safety oriented and motivated staff with knowledge on all fields of nuclear technology
  - service oriented attitude towards society, effective communication to public.

# Finnish good practices (3)

- Trustworthy, safety-minded licensees
  - demonstrated alertness in all nuclear and radiation safety issues
  - determined implementation of ageing management programmes
  - pro-active continuous investments for plant safety improvements.

# Planned measures to improve safety - achievements (see chapter 3.1)

- Qualification of non-destructive testing
  - qualification organisation established, several guidelines developed.
  - ENIQ recommendations followed, adapted through Guide YVL 3.8 (2003).
- Ensuring reliability of digital automation
  - practical implementation of guidelines of YVL 5.5 (2002) is maturing
  - next ten years' challenge, plant I&C as well control room modifications foreseen.
- Provision for plant ageing
  - requirements on ageing management as part of PSR included in the YVL 1.1 (2006)
  - also other guidance (YVL 5.2, 5.5, 3.5) improved to cope with aging
  - the licensee ageing management programmes carefully reviewed.

# Planned measures to improve safety - achievements (see chapter 3.1) (cont.)

- Maintaining competence
  - broad cooperation (industry, universities, authorities, licensees) for national training courses
  - national funding for competence building safety research ensured through nuclear legislation, SAFIR -research programme
  - increased attention to human resources allocation and personnel training.
- Risk informed regulation
  - PSA's broad coverage results in comprehensive view of risks
  - effective use of PSA for many applications, i.a.: pre-service testing, in-service testing, analysing of allowed outage times and plant modifications, development of Technical Specifications, justifying exemptions from TechSpecs, training of personnel.

# Planned measures to improve safety - challenges

- responding to the growing needs for competent staff and professional, efficient working methods
- increasing basic education and training in the nuclear energy and safety field
- restructuring, streamlining and updating the safety regulations
- focusing increased attention to lifetime management of I&C technology
- further enhancing the operating experience feedback processes
- responding to increased demand for timely and effective communication to public and the request from foreign colleagues
- maintaining national research programmes on nuclear safety and participation in international programmes
- giving increased attention to information security issues
- setting stronger focus in general on security to prevent illegal actions

# Questions raised from Peer Review of 4th Finnish Report

The answers are available as handout and also at STUK's website ([www.stuk.fi](http://www.stuk.fi))

- number of questions has been increasing: 1999 (63 from 9 countries), 2002 (78 from 14 countries ), 2005 (100 from 20 countries), 2008 (132 from 25 countries)
- distribution according to articles - very even. Most interested countries were Canada, Germany, France
- frequently asked: STUK's independence, EUR requirements, NPP lifetime concept, Loviisa high sea level event 2005.

# Questions raised - some selected answers

Is STUK independent as the regulator?

- financially: according to the legislation, all costs of nuclear regulation can be recollected from licensees or license applicants – this provides a possibility to recruit staff and use consultant services as needed to implement the regulatory strategy
- legally: STUK's tasks and authorities are specified in the legislation; STUK has broad authorities to ensure that nuclear power is produced in a safe manner, and based on its expert judgment to give necessary orders for this purpose; statement on safety is a prerequisite for issuing a license
- functionally: STUK is administrated by a ministry that has no tasks in energy policy or industrial development: Ministry of Social Affairs and Health; Ministry is not involved in substance decision but allocates budget money to STUK and coordinates the nomination of STUK's DG for Government who makes the appointment; DG's appointment is not political but knowledge and experience from work area is required by the statutes; DG is appointed for an unlimited time and he decides on STUK's organization, strategy, use of financial resources, and appointment of new staff
- practically: STUK's management and all professional staff stays strictly away from energy policy debate and comparisons between various energy sources; STUK is dedicated on nuclear safety and its main goal is to keep safety level as high as reasonably achievable, no matter what is the political atmosphere with respect to use of nuclear power; in preparing and making STUK's decisions, thorough understanding of relevant nuclear safety issues and their balanced consideration is underlined; STUK has public trust and it would not be accepted by the public that STUK's safety concern would overlooked by the Government

# Questions raised - some selected answers

What is the role of EUR requirements?

- The call for Olkiluoto 3 plant tender was very much based on EUR requirements (that was the choice by the licensee).
- The Finnish regulations are currently based on our best knowledge on development status of science and technology. These will be regularly revised to take into account operational experience and development of technology. IAEA and WENRA guidance is given full credit when revising the regulations.
- In view of strive for European harmonization, more consideration will be given to EUR requirements when revising Finnish safety regulations in future.



# Questions raised - some selected answers

What is the Finnish lifetime management concept?

- the lifetime of a plant is not manifested in anyway in advance. The plant may continue the operation as long as it fulfils the safety requirements. By effective technical lifetime management the operating age will finally be limited due to economical reasons.

What happened with the high sea level at Loviisa 2005?

- exceptional weather conditions raised the sea level up to +1.73 m above normal. Alarm limit is +1.75 m launching Site Emergency and shutdown, design limit is +2.0 m. No threat to safety, EOPs will be checked again.

# Conclusions 2008

- A significant part of electricity consumed in Finland will be generated with nuclear power also in future
  - new capacity through Olkiluoto 3 will be commissioned in 2011
  - other existing units continue to operate to a far future
  - new facilities will be built.
- Finnish approach to safety is a proper approach to us – and it will be further strengthened
  - safety is based on licensees' high safety culture and effective safety management systems
  - independent safety verification is based on effective regulatory processes, periodical re-licensing including periodic safety reviews
  - the principle of continuous improvement of safety is followed.