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29-03-04

EXTRABUDGETARY PROGRAMME ON SAFETY ASPECTS OF LONG TERM OPERATION OF WATER MODERATED REACTORS

MINUTES OF THE PROGRAMME'S WORKING GROUP 1 FIRST MEETING

13-15 January 2004
IAEA, Vienna, Austria

INTERNATIONAL ATOMIC ENERGY AGENCY

1. INTRODUCTION

The number of Member States giving high priority to extending the operation of nuclear power plants beyond their initial license is increasing. Decisions on long term operation (LTO) involve the consideration of a number of factors. While many of these decisions concern economic viability, all are grounded in the premise of maintaining plant safety. The IAEA recognized this new industry initiative; therefore, in the 1990's, it developed comprehensive generic guidance on how to manage the safety aspects of physical ageing. It was recognized, however, that internationally agreed-upon, comprehensive guidance was needed to assist regulators and operators in dealing with the unique challenges associated with the LTO issue.

In response, the IAEA initiated this Extrabudgetary Programme (Programme) on 'Safety aspects of long term operation of water moderated reactors' (original title was 'Safety aspects of long term operation of pressurized water reactors'). The Programme's objective is to establish recommendations on the scope and content of activities to ensure safe long term operation of water moderated reactors. The Programme should assist regulators and operators of water moderated reactors, and, in particular WWERs, in ensuring that the required safety level of their plants is maintained during long term operation, should provide generic tools to support the identification of safety criteria and practices at the national level applicable to LTO, and should provide a forum in which MS can freely exchange information..

The Programme activities are guided by the Programme Steering Committee (SC), follow the overall SC Programme Workplan and SC Terms of Reference, [1], and are implemented in 4 Working Groups (WG). The WGs focus on:

- general LTO framework (WG 1);
- mechanical components and materials (WG 2);
- electrical components and I&C (WG 3);
- structures and structural components (WG 4).

Further detailed information on the Programme could be found at: http://www-ns.iaea.org/nusafe/s_projects/salto_int.htm .

The 1st meeting of WG 1 was held at IAEA in Vienna, 13-15 January 2004. The purpose of the 1st meeting of WG 1 was to review and finalize the respective parts of the draft workplan [2], and the draft Standard review process [3] and to initiate the WG 1 activities.

The Agenda for the Meeting is provided in Appendix I. The list of participants is provided in Appendix II.

2. MEETING SUMMARY

The meeting was opened by Radim Havel, the Programme Scientific Secretary, who outlined the meeting objectives and deliverables. Pao-Tsin Kuo, the WG 1 Chairman**,** chaired the meeting and was assisted by Zdenek Kriz, the WG 1 Secretary. He reviewed the agenda with the WG members and set the ground rules to be followed during the meeting. He described the WG 1 objectives, the expected outcomes, and the milestones for each of the Tables 1 – 4. To accomplish these four tasks in an orderly manner, he proposed tentative dates for four future WG meetings. He solicited volunteers for hosting the future meetings. The next meeting is scheduled for August 24 - 26, 2004. Sweden delegate later offered to host the meeting in Stockholm, Sweden for the next meeting. There will be two more meetings in

2005, one in January and the other in August. The last meeting will be in March 2006. The US delegate volunteered to host the January/February, 2005, meeting.

The meeting continued by presentation of national approaches on general framework on long term operation. The summaries of the national presentations are provided next, the complete presentation handouts are provided in Appendix III.

Czech Republic

The Czech Republic presented both regulatory body (SUJB) and utility (CEZ) view on lifetime management and long-term operation. Legislative framework was introduced which in general asks for safety assurance in the frame of whole designed lifetime as well as in any time beyond originally expected.
The Czech legal system basis is formulated by the Atomic Act of 1997 and related regulations in the area of nuclear safety. It constitutes general requirements on LTO of NPPs. More detailed requirements are included in the SUJB regulations, guides and other documents (e.g. SUJB letters, operational licence conditions).
The licensee has implemented the ageing management programme (AMP) from the very beginning of operation. The AMP is a subject of SUJB inspections and review. The AMP has been implemented in the respective areas through internal procedures, which are based on SUJB requirements. Results of research and development programs have been also implemented in the LTO strategy.
The current plan of the Czech Republic is to extend operation of the NPPs for 10 years beyond design lifetime.

Finland

The Finish approach to Nuclear Power Plant licensing does not have a time limit for plant operation. Rather, it is based on short-term operating license extending up to 10 years at a time.
The licensee is expected to conform with all the regulatory requirements (deterministic and probabilistic) at any time and reports any violation.
Plan lifetime extension application is coupled in time with the application for operation license and hence no separate application is required.

Hungary

The Hungarian legislation originally limited the maximal licence period in 30 years. Recently this limitation has been removed and included that the Licensee shall apply for preliminary licence for LTO 5 years before the expiration of the so-called 30 years' „design service life" expires. Upon the legal conditions and the scrutiny of the related IAEA and NRC documents the following approach has been developed to handle the issue:
FSAR: based on Reg. Guide 1-70 and on its Standard Review Plan (NUREG – 0800). FSAR should be a living document, a verification of "as is" design conditions. In regard FSAR is the basic document for issuing and retaining of the operation licence. The FSAR focuses on description of the current configuration of the unit and on safety analyses that are in line with this current configuration.
PSR: Once in teen years, this is the basis for extension of the operation license for next 10 years. PSR should concentrates on ageing issues in wider sense of the expression: ageing of SSCs, personnel, organisation, requirements, procedures, environmental conditions, changes in the state of the art of science and technology, utilisation of operational experience, etc. PSR

should skip the description and the safety analyses of the unit and the SSCs (referring to FSAR if necessary).
Missing design basis: Include the gaps into the list of unresolved safety issues. No a complete "re-design" is needed, but the unresolved safety issues should be resolved "on demand" of current operation license conditions and the license renewal application.
LR: The scope of LR contains only the passive and long lived components (passive: without moving parts or changes in configuration, long lived: no qualified life time restriction shorter than 30 years). LR consists of scoping, screening, integrated plant assessment, FSAR modification, TS modification, environmental impact study. LR does not consists of resolving problems that should be resolved for maintaining of current operating licence conditions.

Russian Federation

PLEX activities are performed in accordance with the requirements of Russian federal norms and rules:

1. Federal Act "About the Use of Atomic Energy"(Article 9);
2. General Regulations on Ensuring Safety on NPP, (OPB-88/97) NP-001-97 (p. 5.1.14);
3. "Main Requirements for Service Life Extension of NPP Power Unit", NP-017-2000;
4. Regulatory document of GAN "Requirements to the content and composition of the documents justifying the safety for the period of NPP extended life", RD-04-31-2001;
5. Methodological and guiding documents of the utility defining the upgrading activities, comprehensive examination, justification of the equipment residual lifetime, QA of LTO.

According to the documents 2, 3, and 5, PLEX activities include:
1. stage – set of activities aimed at assessment of the PLEX technical possibility and economical reasonability

- Comprehensive unit examination
- Unit safety assessment to identify the upgrading scope
- Unit PLEX feasibility study

Decision on PLEX or decommissioning (5 years before the design life expiry)
Development of the program for the unit preparation to operation during extended lifetime
2. stage – set of activities aimed at ensuring of the safe operation during the extended operational life

- Justification of the lifetime extension for the non-replaceable SSC
- Implementation of the NPP unit modernization program
- Safety justification of the NPP unit (In-depth Safety Assessment Report)

The results of the activities are submitted to RF GAN by the utility for independent expertise and licensing of the NPP operation during extended lifetime.

According to the regulatory document 4 operating organization submits the following materials for renewal the license: In-depth Safety Assessment Report, the report on results of complex inspection (15 documents).

Now operational organization obtained ATOP licenses for:

- NV NPP unit 3, Validity of the license - till 31.12.2006
- NV NPP unit 4, Validity of the license - till 31.12.2008
- Kola NPP unit 1, Validity of the license - till 30.06.2008

Slovak Republic

Slovak republic owns 8 units of WWER 440 reactors in two sites, which are in different levels of operation (age), or construction. Jaslovske Bohunice site comprises 2 units of

WWER 440/V230 reactors and 2 units of WWER 440/V213 reactors, all under operation. Units were gradually commissioned during the period of 1978 to 1985. 2 units of WWER 440/V230 reactors have undergone the process of reconstruction and modernization and based on political decision shall be decommissioned in 2006 and 2008.
Mochovce site comprises 2 units of WWER 440/V213 reactors under operation, commissioned in 1998 and 2000 and other two units partially constructed at present under conservation.
A couple of years ago, following the trends in the world, Slovakia started national discussions on the technical expert level regarding the possibility and conditions of the extension of life of existing nuclear power plants beyond the design basis. The present status of this issue is that the Slovak republic and the utility operating the nuclear plants are interested in proceeding of this process at the level of preparation of documentation necessary for admitting the application for plant life extension. Original design plant life of 30 years is planned to be extended by 10 years to the overall period of 40 years of operation. At present processes are gradually running at NPPs operators special expert groups, at Slovak nuclear regulatory authority and at support expert organizations too. The approach to be adopted is considered to be based on the guidance of the IAEA, existing legal basis of Slovakia – regulatory authority guidance and international practice and experience.

Sweden

SKI applies a non-prescriptive approach to regulation. The main law in Sweden regulating nuclear safety is in the Act on Nuclear Activities. The law assigns full responsibility to the licensee for the safety as well as safe handling and final disposal of spent fuel and nuclear waste.
Based on the act SKI has issued an “umbrella” regulation SKIFS 1998:1. It gives basic safety provisions, e.g.: licensee obligations include guidelines for safety and quality system, safety decisions well prepared, adequate personnel, necessary conditions to carry out in a safe manner, experience feedback safety continuously developed.
The licensee has the full and individual responsibility for nuclear safety. SKI supervises how the licensee shoulders their responsibility for safety with strong focus on quality of licensee self-assessment. SKI has the duty to “Initiate safety improvements whenever justified by operating experience, or research and development”.
SKI requires the licensee to conduct an active safety analysis using state of the art analytical tools. Deviations discovered have to be assessed and a program for safety upgrading established.
SKIFS 2000:2 regulates,

- In-service inspection, in-service testing and maintenance
- Systematic evaluation of failures and indications of generic ageing problems, in Swedish plants as well as in other similar plants.
- Reporting of failures and indications of ageing problems.

The license for most nuclear power plants is unlimited in time.
The Swedish NPPs were designed and built late in the 60s to early 80s to somewhat different safety standards and requirements.
SKI general safety regulation will be complemented with requirements for upgrading.

Ukraine

a) Legal basis
The requirements of the Article 14 Law of Ukraine «On Permissive Activity in the Nuclear Power Field» 2000:

- The term of license validity shall be determined in accordance with the envisaged validity term, foreseen by the documents submitted, of relevant stage of service life cycle of nuclear facility.
- During the validity term of license the state regulatory authority of nuclear and radiation safety can introduce changes. One of the grounds to introduce changes into the license is the prolongation the validity term of license.

The requirements of the Article 33 of the Law of Ukraine "On the use of nuclear energy and radiation safety" 1995:
"An operating organisation shall, from time to time and in accordance with nuclear and radiation safety regulations, rules, and standards, re-assess nuclear installation safety and submit the reports thereof to the governmental nuclear and radiation safety regulatory agency."

b) Safety guidelines
The requirements of Par. 3.18 RD 306.1.02./1.034-2000 "General Provisions of safety assurance of NPPs":
"An operating organisation within the terms stated by governmental nuclear and radiation safety regulatory agency but not less than once in 10 years shall re-assess nuclear power units safety and report to government nuclear and radiation safety regulatory agency. By the results of nuclear power unit safety re-assessment the margins and conditions of the future operation are defined. The decision on the prolongation of operational life of NP unit over the period established by the design can be taken only on the basis of the results of a safety re-assessment".

The baselines of LTO are:
- Raising of safety level
- Modernization and reconstruction
- Assessment of remaining life of elements
- Replacement of equipment

USA

The US NRC license renewal process establishes the technical and administrative requirements for renewal of operation power plant licenses. Nuclear power plant licenses were originally issued for 40 years and are allowed to be renewed for an additional 20 years based on the US Atomic Energy Act of 1954 and US NRC license renewal rule (10 CFR Part 54). A 40 years licence term was selected on the basis of economic and anti-trust considerations, but not technical limitations. However, once the license term was selected, design of individual plant structure or component may have been engineered on the basis of an expected 40 years service life.

The US NRC license renewal process proceeds along two tracks: one for review of safety issues (10CFRPart 54) and another for environmental issues (10 CFR Part 51). An applicant must provide the NRC with an evaluation that addresses the technical aspects of plant ageing and describes the ways those effects will be managed. It must also prepare an evaluation of the potential impact on the environment if the plant operates for another 20 years. The NRC reviews the application and verifies the safety evaluations through on-site inspections. This review process for renewal applications provides continued assurance that the level of safety provided by an applicant's current licensing basis is maintained for the period of extended operation. The license renewal review focuses on passive, long-lived structures and

components of the plant that are subject to the effect of ageing. The US license renewal rule requires an applicant, in part, to:

1. perform a scoping review to identify the structures, systems, and components within the scope of license renewal based on criteria delineated in the rule;
2. perform an integrated plant assessment to identify the structures, systems and components that are subject to ageing management, to justify the methodology used, and to demonstrate that the effects of ageing will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation; and
3. demonstrate that time-limited ageing analyses that are based on the current operating term have been evaluated and shown to be valid for the period of extended operation.

The USNRC performs plant-specific reviews of the environmental impacts of license renewal in accordance with the National Environmental Policy Act and the requirements of 10 CFR Part 51. A public meeting is held near the nuclear plant seeking renewal to scope out or identify environmental issues specific to the plant for the license renewal action. The result is an NRC recommendation on whether or not the environmental impacts are so great that they should preclude license renewal.

To facilitate the review of license renewal applications, the US NRC established a streamlined process for reviewing applications consistently and expeditiously. The license renewal process is documented in three NRC documents, namely, the standard review plan for license renewal, Generic Aging Lessons Learned (GALL) report, and Regulatory Guide 1.188 for the standard format and content of renewal applications. These documents provide guidance for future renewal applicants in preparing applications, for the NRC staff in performing reviews, and for the public by informing them of the license renewal process.

Based on the discussion of the presented information, a consensus was reached that it is necessary to establish pre-conditions before a country should commit to LTO for its nuclear power plants. The future tasks will attempt to define the pre-conditions.

Subsequently, the WG 1 Workplan, Appendix of [2], and the Standard review process [3] were reviewed in detail. Consensus was reached regarding required changes and these will be, along with changes from the other WGs, used to prepare final draft of these reports. The final draft reports [2, 3] will be presented to the SC at its next meeting in March for approval.

It was noted that the WG 1 Workplan includes a revised and detailed schedule of the WG 1 activities, Appendix III. It is of particular importance to adhere to the deadlines mentioned in order to complete the Work successfully. Further, the WG 1 future meetings, which will serve co-ordination purposes, are scheduled typically in the middle of the respective Task. To ensure WG 1 meetings are effective and achieve the expected goals, it is necessary, that the respective Task work be initiated well in advance prior to the meeting.

It was agreed, that the national ‘summary’ reports, which will be the outcome of Task 1 (collection of information), should be provided by each WG 1 member in English and consist of approximately 10 to 15 pages. The national reports should also contain a detailed and comprehensive list of references (and/or bibliography).

During the meeting, the table of contents of the final WG 1 report was also discussed. The following proposal was presented by Mr. Mohsen:
1. Background

2. Conditions for application (ref. applicable laws and regulatory guides)
3. Plant design basis events (ref. lists of events etc.)
4. Extension of design basis events
5. Scope of plant life management
6. Plant assessment (including classification, sources of information, methods, tools, etc.)
7. Organization
8. Challenges

After extensive discussion, the majority of the WG 1 members preferred the current planned report format without any changes. However, WG 1 recommends that Mr. Moshen's proposed format be considered for an Agency guideline document as a result of the overall EBP effort should the Agency plan to issue one. The working group reports will be the source documents for the Agency's guideline document.

3. ACTION ITEMS

1. Finalize the meeting Minutes (IAEA-EBP-LTO-04). Action: P-T. Kuo, Z. Kriz, R. Havel + all; 15 February 2004.
2. Finalize the WG 1 Workplan and Standard review process (incl. input to glossary) (IAEA-EBP-LTO-02 and 03). Action: P-T. Kuo, Z. Kriz, R. Havel + all; 15 February 2004.
3. Submit final drafts of IAEA-EBP-LTO-02, -03 and –04 to the SC for review and approval. Action: R. Havel; 5 March 2004.
4. Explore possibility of hosting the next WG 1 meeting. Action: all; 31 January 2004.

4. REFERENCES

[1] Minutes of the Programme's 1st Steering Committee Meeting, IAEA-EBP-LTO-01, Vienna, 2003 (internal EBP report).

[2] Minutes of the Programme's Planning Meeting, IAEA-EBP-LTO-02, Vienna, 2004 (internal EBP report).

[3] Standard review processIAEA-EBP-LTO-03 Vienna, 2004 (internal EBP report).

APPENDIX I.
PROVISIONAL AGENDA

Tuesday, 13 January 2004		
09:00	Opening, Meeting objective	R.Havel
09:15	EBP SALTOPWR WG 1-Workplan, SRP	P-T Kuo, Z.Kriz
10:30	*Coffee break*	
11:00	National presentations	
11:00	Czech Republic	M.Svab/M.Holan
11:45	Finland	B.Mohsen
12:30	*Lunch break*	
14:00	Hungary	G.Petofi
14:45	Russian Federation	V.Sulkanishvili/P.Medvedev
15:30	*Coffee break*	
16:00	Slovak Republic	M.Lukac
16:45	Sweden	S.Forsberg
17:30	Adjourn	
19:00	*'Heurigen'*	
Wednesday, 14 January 2004		
09:00	Ukraine	S.Bozhko/M.Zaritskiy
9:45	USA	P-T Kuo
10:30	*Coffee break*	
11:00	Discussion on national approaches	Z.Kriz lead
12:30	*Lunch break*	
14:00	WG 1 Workplan	P-T Kuo, Z.Kriz
17:30	Adjourn	
Thursday, 15 January 2004		
09:00	WG 1 Standard review process	P-T Kuo, Z.Kriz
12:30	*Lunch break*	
14:00	Final discussion	P-T Kuo, Z.Kriz
15:30	Adjourn	

APPENDIX II.
LIST OF PARTICIPANTS

CZECH REPUBLIC

Mr. Zdenek Kříž — ***Secretary***
SUJB
UJV a.s.
25068 Rez
Czech Republic
Tel.: +420 266 17 3424
Cell: +420 602 62 1040
Fax: +420 266 1734 68
E-mail: krz@ujv.cz

Mr. Miroslav Holan
Temelin NPP, CEZ
Czech Republic
Tel.: +420 385782217
Cell: +420 602288325
Fax: +420 385782794
E-mail: Holanm1.ete@mail.cez.cz

Mr. Miroslav Šváb
State Office for Nuclear Safety
Senovážné nám.9
110 00 Praha 1
Czech Republic
Tel.:+420 2 21624 310
Cell: +420 602110253
Fax: +420 2 21624 413
E-mail: mailto:miroslav.svab@sujb.cz

FINLAND

Mr. Bahey Mohsen
Fortum Nuclear Services Ltd.
Finland
Tel.: +385 104532430
Cell: +385 504532430
Fax: +385 104532525
E-mail: Bahey.Mohsen@fortum.com

HUNGARY

Mr. Gábor Petofi
Hungarian Atomic Energy Authority
H-1036, Budapest
Fényes A.u.4
Hungary
Tel.:+36-14364908
Fax:+36-14364909
E-mail: mailto:petofi@haea.gov.hu

LITHUANIA

Ms. Jelizaveta Korikova *Interpreter*
Ignalina Nuclear Power Plant
Visaginas 4761
Lithuania
Tel.: +370 386 24427
Fax: +
E-mail: Korikova@mail.iae.lt

RUSSIAN FEDERATION

Mr. Nikolai Fil
OKB Gidropress
Ordzhonikidze street 21
142103 Podolsk
Moscow
Russian Federation
Tel.: +7 0967540479
Fax: +7 0967542733
E-mail: fil@grpress.podolsk.ru

Mr. Pavel Medvedev
Rosenergoatom
Russian Federation
Tel.: +7 095 710 40 47
Fax: +7 095 376 15 42
E-mail: pg.medvedev@rosenergoatom.ru

Mr. Nikolay Sulkhanishvili
GOSATOMNADZOR,
Taganskaya ul., 34
Moscow 10947
Russian Federation
Tel.: +70959116428
Fax: +70959124710
E-mail: sni@gan.ru

SLOVAK REPUBLIC

Mr. Miroslav Lukac
VÚJE, Trnava, a.s.
Okruzna 5,
Trnava 91864
Slovak Republic
Tel.: +421 33 599 1300
Fax: +421 33 599 1178
E-mail: lukac@vuje.sk

SWEDEN

Mr. Staffan Forsberg
Swedish Nuclear Power Inspectorate (SKI)
Sweden
Tel.: +46 86988431
Fax: +46 86619086
E-mail: Staffan.Forsberg@ski.se

UKRAINE	**Mr. Sergiy Bozhko** SNRCU Nuclear and Radiation Safety Inspection Department Arsenalna street, 9/11 Kiev 01011 Ukraine Tel.: +380 44 559 40 09 Fax: +380 44 558 78 39 E-mail: bozhko@inspect.snrcu.gov.ua	
	Mr. Mykola Zaritskiy NAEK "Energoatom" Vetrova, 3 Kyiv-01032 Ukraine Tel.: +380 44 201 09 20 Fax: +380 44 294 48 92 E-mail: zaritsky@home.org.ua	
USA	**Mr. Pao-Tsin Kuo** USNRC License Renewal & Environmental Impacts Program, Office of Nuclear Reactor Regulation, Mail Stop 0 11F1, Washington, D.C. 20555 USA Tel.: + 1 301 415 1183 Fax: + 1 301 415 2002 E-mail: PTK@nrc.gov	***Chairman***
EUROPEAN COMMISSION	**Mr. Michel Bieth** EC, Directorate General JRC Westerduinweg 3 P.O. Box 2 1755 ZG Petten The Netherlands Tel.: +31 224 565157 Fax: +31 224 565 637 E-mail: michel.Bieth@cec.eu.int	
IAEA	**Mr. Radim Havel** **Ms. Vesselina Ranguelova**	**NSNI-ESS** **NSNI-SAS**

APPENDIX III.
PRESENTATIONS' HANDOUTS

IAEA EBP
on
SAFETY ASPECTS OF LONG TERM OPERATION OF PRESSURIZED WATER REACTORS

1st Meeting of Working Group 1

IAEA, Vienna, 13-15 January 2004

Radim Havel

EBP BACKGROUND

- Scoping meeting – March 2003 (RF, SWE, USA)
- 1st SC meeting – May 2003 (BUL, CR, FI, H, RF, SR, SP, SWE, UKR, USA, EC) + (F, UK); IAEA-EBP-LTO-01; EBP overall Workplan incl. Objective, exp. outcome, and approach (SC+4WGs)
- Planning meeting – August 2003 (WG chairs + secs + SC chair); IAEA-EBP-LTO-02; WG 1-4 draft Workplans, initiated SRP development
- EBP: May 2003 – November 2006; RB 2007 onwards

EBP OBJECTIVE

- IAEA-EBP-LTO-01
- Assist PWR operators and regulators:
  - to ensure the required safety level is maintained during long term operation
  - to provide generic tools to support the identification of safety criteria and practices applicable to long term operation at national level
- Develop an internationally agreed common framework to support safe long term operation including related processes and practices

WGs OBJECTIVE

- 4 areas:
  - General LTO framework,
  - Mechanical components and materials,
  - Electrical components and I&C,
  - Structures and structural components
- Tasks:
  - Compile/collect info (national summary reports)
  - Review and compare info
  - Reconcile info
  - Formulate final reports
- Standard review process (uniformity and compatibility, PSR index)
- Homework assignments (meetings…co-ordination)

1st WG 1 MEETING OBJECTIVE

- Finalize Workplan incl. schedule (mtgs., outcomes, etc.)
- Finalize SRP (WG 1 part)
- Initiate collection of information, etc.
- Homework assignments (whole EBP)
- Deadlines
  - next SC meeting: 16-18 March 2004
  - final WG 1 drafts (Workplan+SRP): 1 March 2004

IAEA LTO PROGRAMME

SÚJB Approach to the Long Term Operation of PWRs

Miroslav Šváb

January 13 – 15, 2004

CONTENT

- ➔Country‘s NPP Age Profile
- ➔Regulatory System
- ➔Regulatory Requirements for NPP Ageing Management
- ➔General Regulatory Review Practices Related to Ageing Management
- ➔Conclusions

Country‘s NPP Age Profile

- Four units of WWER 440/213 at Dukovany (1985 - 1988)
- Two units of WWER 1000/320 at Temelin
- Design lifetime of WWER 440/213 units was determined as 30 years (Technical Design – USSR); lifetime stated by manufacturers in passports of equipment is mainly 30 years, RPV 40 years

Country‘s NPP Age Profile (cont.)

➔ Temelin NPP construction started in 1986

➔ Number of improvements of original Soviet design (e.g.Instrumentation and Control System)

➔ **Majority of equipment in both NPPs were manufactured in Czech factories** (e.g. RPVs, SGs, pipes)

Regulatory System

- State Office for Nuclear Safety (SUJB) is the independent body established by the Government to supervise the fulfillment of Czech legislation requirements in the field of nuclear safety and radiation protection.
- Lifetime management of nuclear installations are covered by the statement of the „ Atomic Act „ as follows :

Regulatory System (cont.)

The Office

- **executes the state supervision over nuclear safety, nuclear items, physical protection, radiation protection and emergency preparedness in premises of nuclear installation or ionizing radiation source workplaces and inspects adherence to a fulfillment of obligations as per this Law,**

- **approves documentation, programs, lists, limits, conditions, physical protection approach, emergency rules and, subject to a discussion of interfaces to external emergency plans with a relevant District Council, internal emergency plans and their modifications,**

Regulatory System (cont.)

The Office

- ➔ **determines conditions, requirements, limits, limiting values and values for exemption from the jurisdiction of this Law,**
- ➔ **makes decisions ensuring handling of nuclear items or radioactive waste, in case their owner or an generator proceeds out of accord with this Law and does not eliminate arisen conditions.**

Regulatory System (cont.)

- Instruments, applied to enforce the legislative requirements set down the SÚJB authority to require the inspected person to remedy the situation, to perform technical inspections, revisions or the functional ability tests, to withdraw the special professional competence authorisation issued and to impose penalties for violating obligations established in the Atomic Act.

- Besides siting, construction and operation a SÚJB licence is prerequisite also for activities such as individual stages of nuclear installation commissioning, restart of a nuclear reactor to criticality following a fuel reload, for reconstruction or other changes affecting nuclear safety, the SÚJB issues authorisations for activities performed by licensee.

Regulatory Requirements for NPPs Ageing Management (cont.)

- **Operational permission is given on the base of Atomic Act by SUJB. Atomic Act states general conditions and requirements that operator has to fulfill before the request for operation license or renewing of the license is submitted to SUJB.**

- **Ageing management is considered by the SÚJB as a constituent part of NPP´s Quality Assurance system.**

- **The Atomic Act does not contain the term *Design Lifetime*. Instead of that requires proofs that the high level of nuclear safety will be ensured for the time of the license duration.**

Regulatory Requirements for NPPs Ageing Management (cont.)

- **Basically the Long Term Operation Concept was accepted and applied for all Czech NPP's. The term Design Lifetime has only an informative value. The Atomic Act states that operator has full responsibility for nuclear safety assurance during the whole time of operation. The Decree 214/97, following the Atomic Act, defines that for SSC important to nuclear safety the operator is responsible for their ageing surveillance using state of art tools.**

Regulatory Requirements for NPPs Ageing Management (cont.)

Relevant regulations for NPP ageing management

- ***Act. 18/1997 Coll. on Peaceful Utilisation of Nuclear Energy and Ionizing Radiation***
- ***SUJB Regulation - 195/1999 Coll. on Requirements on Nuclear Installations for Assurance of Nuclear Safety***
- ***SUJB Regulation - 106/1998 Coll. on Providing Nuclear Safety and Radiation Protection of Nuclear Installations at Their Commissioning and Operation***
- ***SUJB Regulation - 214/1997 Coll. on Quality Assurance in Activities Related to the Utilisation of Nuclear Energy***

Regulatory Requirements for NPPs Ageing Management (cont.)

Special SUJB Requirements

- *Instructions and Recommendations for Qualification of WWER 440/213 Nuclear Power Plants Equipment Important to Safety (SUJB guide - 1998)*
- *Requirements and guidelines for VERLIFE Procedure.*
- *Conditions of SUJB decisions*

Regulatory Requirements for NPPs Ageing Management (cont.)

SUJB stated basic conditions for lifetime extension:

- ➔ **all System, Structures and Components important to safety have to be qualified for normal operational conditions and conditions during and after the accident through all operational lifetime,**
- ➔ **using a state of art tools, the results of ageing monitoring of System, Structures and Components important to safety have to be submitted,**
- ➔ **all previous conditions of SUJB related to ageing must be solved,**
- ➔ **all indicated deviations from recommended nuclear safety standards of higher importance must be solved.**

General Regulatory Review Practices Related to Ageing Management

- SÚJB assesses the level of nuclear safety also in the course of the so-called ”licensing” procedure to issue licenses for activities identified in the Atomic Act. Moreover, for NPP Dukovany SÚJB also assesses its level of nuclear safety assurance and the safety margins for individual SSCs within the following activities:

- assessment of the ***periodically submitted Operational Safety Report*** (requirements for its submittal are specified in the respective SÚJB decisions),
- evaluation of ***SSC qualification program***,
- evaluation of the ***in-service inspections program***,
- evaluation of the program for the ***enhancement of nuclear installations safety,***
- evaluation of ***feedback from the operational experience*** ***and implementation of the latest scientific knowledge and technology***.

General Regulatory Review Practices Related to Ageing Management

- As a part of periodical assessment of the Operational Safety Analysis Report Modifications and generally in 10 years period issued SAR containing the Periodic Safety Review results, the Main Components Lifetime Monitoring Program results are assessed.
- In the lifetime management process, it is the most important to identify, which degradation mechanisms damages the corresponding area of the material in decisive way, to create a mathematical description of the material damage process and subsequently the evaluation of material damage trends and thus the determination of the residual lifetime.

General Regulatory Review Practices Related to Ageing Management (cont.)

Examples of regulatory review practices relating to ageing.

Dukovany NPP Equipment Qualification Programs are completed in subprograms :

- ➔ **Plant Design Basis**
- ➔ **Operational Conditions of SSC**
- ➔ **Equipment Environmental Qualification Program**
- ➔ **Modification Program**
- ➔ **Aging Program**
- ➔ **Operational Inspections and Maintenance Evaluation Program**
- ➔ **Safety Performance Evaluation Program**
- ➔ **other Plant Experience Application Programs**

(in both NPPs the equipment qualification procedures are assessed by SUJB)

General Regulatory Review Practices Related to Ageing Management (cont.)

Dukovany NPP diagnostic software DIALIFE

➔the calculation of the equipment residual lifetime using verified calculation programs based on information from the technological information systems (diagnostics, chemistry, special measurements, SCORPIO in-core measurement system, non-destructive testing results, and material properties database)

Conclusions

- The application of basic measures of the ageing management and plant life management on both Nuclear Power Plants are assessed by licensee and compared with the Design Basis of components in main fields as are:
- lifetime assessment and safety margin specification,
- solution of deviations, based on relevant international standards and operational experience,
- fulfilment of the SÚJB (Regulatory Body) requirements,
- modification and modernisation programmes.

In actual situation there are no safety indications for apprehensions that the operators goals for longer time operation, based on economical calculations will not be fulfilled.

ČEZ

IAEA EBP SALTO PWR

1 st Meeting of Working Groupe 1

M. Holan

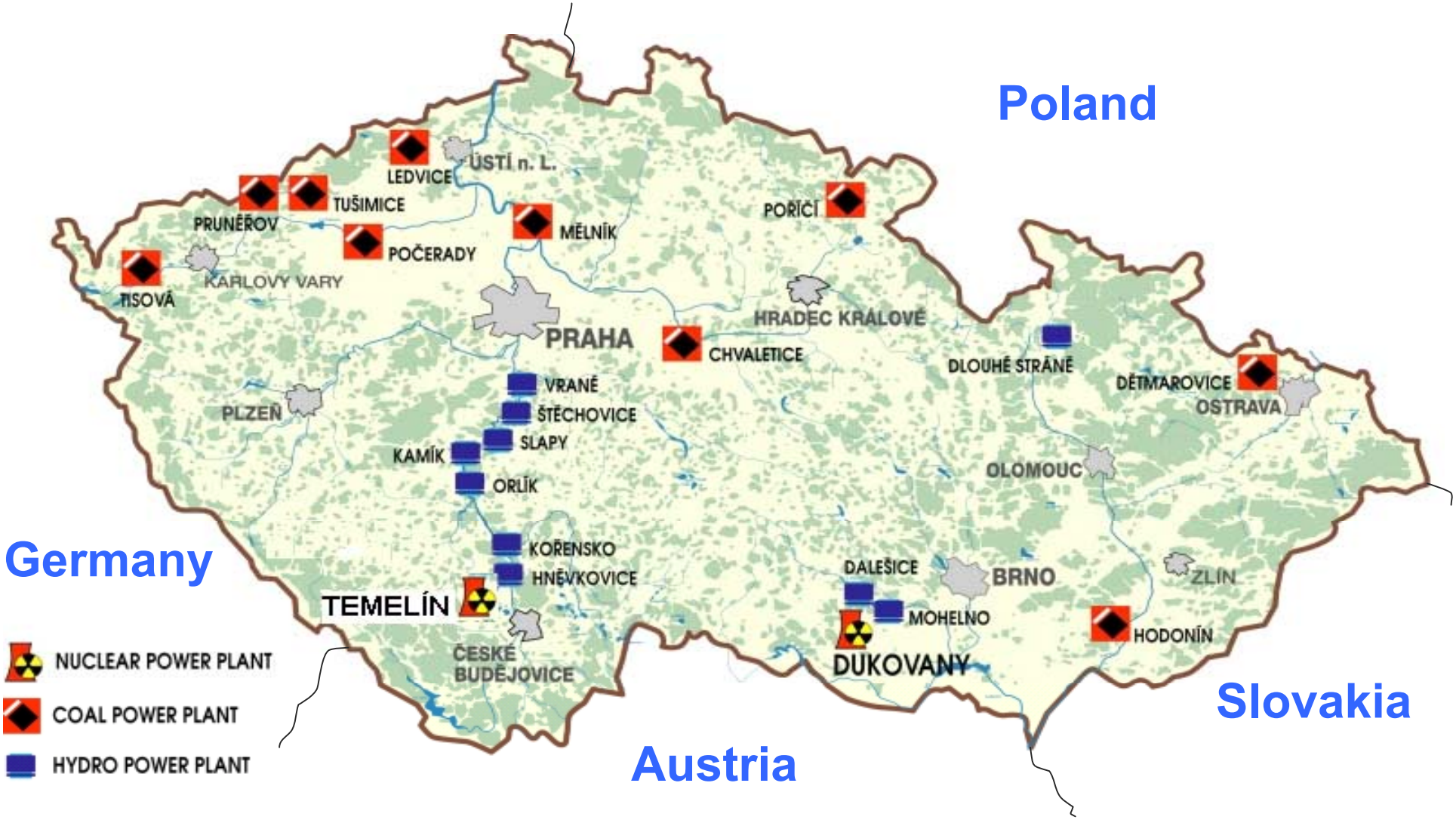
Vienna 13.-15.1.2004

IAEA EBP SALTO PWR - WG 1

CONTENTS

- ČEZ Nuclear Power Plants
- Operational status of CEZ NPPs & Strategic Goals
- Legislative framework and primary AM approach
- International cooperation
- PLEX program preparation

IAEA EBP SALTO PWR - WG 1



IAEA EBP SALTO PWR - WG 1

Operational status of CEZ NPPs & Strategic Goals

- **Dukovany NPP**
  - 4x VVER 440 MW Units in operation since 1985/8
  - Original design life time 30 years (technical passport)
  - Current Strategic Goal – operation till 2025
- **Temelin NPP**
  - 2x VVER 1000 MW Units in operation since 2002/3
  - Original design life time 30 years
  - Current Strategic Goal – operation till 2045

IAEA EBP SALTO PWR - WG 1

Legislative framework

- **ČR Atomic act No 18/1997 Coll. and related Regulations**
  - for SSCs safety related a surveillance program must be in place incl. RPV witness program…….
- **SONS Letter – Statement to Dukovany NPP life extension (1996)**
  - Comprehensive safety assessment incl. SSCs ageing part of PSR
  - Living Safety Assessment Report (LSAR) required
  - International good practice and standards to follow (IAEA, EU,….)
  - ..
- **SONS RG - Qualification of VVER 440 SSCs important to safety (1998)**

IAEA EBP SALTO PWR - WG 1

ČEZ Ageing Management approach

- ČEZ decided EDU to etxend life by 10 years (1996)
- New Plant Life Management (PLIM) program introduced
  - Several plant rules and procedures used
  - Many analytical supporting documents used (ageing phenomena studies, evaluation methodologies….)
  - PSR performed per 10 years and LSAR maintained
  - PLIM needs included into plant modernization program (Morava…)
  - PLIM linked with Surveillance, Maintenance, OEF, ISI programs
  - PLIM upgraded based upon international development and cooperation

ČEZ Ageing Management approach

- **International standards used**
  - IAEA SG Periodic Safety Review NPPs (NS-G-2.10)
  - 10CFR54/1992 NPPS "Licensing restoration requirements.."
  - IAEA Tech.Report No 338/1992 (Methodology for Management of Ageing of NPP Component important to safety)
  - IAEA TECDOC- 670/1992 (Pilot studies on Management of Ageing of NPP Components….)
  - IAEA Safety Practice(1992)- Establishment and Review of NPP Ageing management programs
  - IAEA Safety Report No 15/1999 - Implementation Review of NPP Ageing management programmes

ČEZ Ageing Management approach

- **International standards used** cont
  - EPRI TPR-78-788/1979 " Planning study for PLEX…"
  - EPRI TR-100844, project 2927-07/1992
  - NUREG – 1144 rev.2/1990 „ NPPs Ageing Research program of US NRC…." (NPAR)
  - NUREG/CP - O100/1988 – Int. symposium on ageing results
  - NUMARC – NUPLEX /1992 – „ program of PLEX WG…."
  - …….

IAEA EBP SALTO PWR - WG 1

International cooperation

- International conferences – since 1991 each 2 years
- Bilateral cooperation with VVER- 440 users
- EURATOM Fifth Framework Programme (PLEM Cluster)
  - VERSAFE (Concerted Utility Review of VVER-440 Safety Research Needs)- to create a network of VVER 440 operators aiming at definition of the further research needs of SAM and PLIM…

☞ PLIM Handbook…

Dokument Adobe Acrobat

IAEA EBP SALTO PWR - WG 1

FP - 5	Integrity of equipment and structures	On-line monitoring and maintenance	Organization and management of safety
Irradiation embrittlement	RETROSPEC-FRAME PISA-FEUNMAR (MTR)	GRETE – SPIQNAR REDOS	
Corrosion Thermalhydraulics	CASTOC-PRIS - INTERWELD FLORMIXR - WAHALOADS	LIRES	
Safety margins Welds	ADIMEW-VOCALIST SMILE-THERFAT	ENPOWER	
Risk, PSA, virtual reality		VRIMOR – NURBIM	SPI
Concrete ageing	MAECENAS - CONMOD		
Digital Instrumentation			BESECBS – CEMSIS
EU/CEEC-Harmonisation of practices,VVER safety	ATHENA		VERSAFE – VERLIFE IMPAMVVER
Knowledge management	JSRI		LEARNSAFE

Cluster PLEM

IAEA EBP SALTO PWR - WG 1

ČEZ PLEX / LTO program preparation

- **NPPs life extension by 10 years and even longer feasible**

  RPV ageing min. 40 years calculated, after 17 campaigns main SSC {SG, MCP, Pressurizer…} ageing exhausted by about 15%

- **PLEX/LTO program defined (PP 043 rev.0)**

Phase I.	Technical-economic feasibility study	2005
Phase II.	Operational Program (OP) after 2015	2008
Phase III.	OP execution start	2013
Phase IV.	Licensing for extended operation	

- **Near next steps planned**

  MIT programs No 3 and 4 agreed

  Introductory seminar scheduled for March 2004 (NRI Řež, Škoda, IAM...)

Thank you for attention

Thank you for attention

LOVIISA NPP
Management strategy

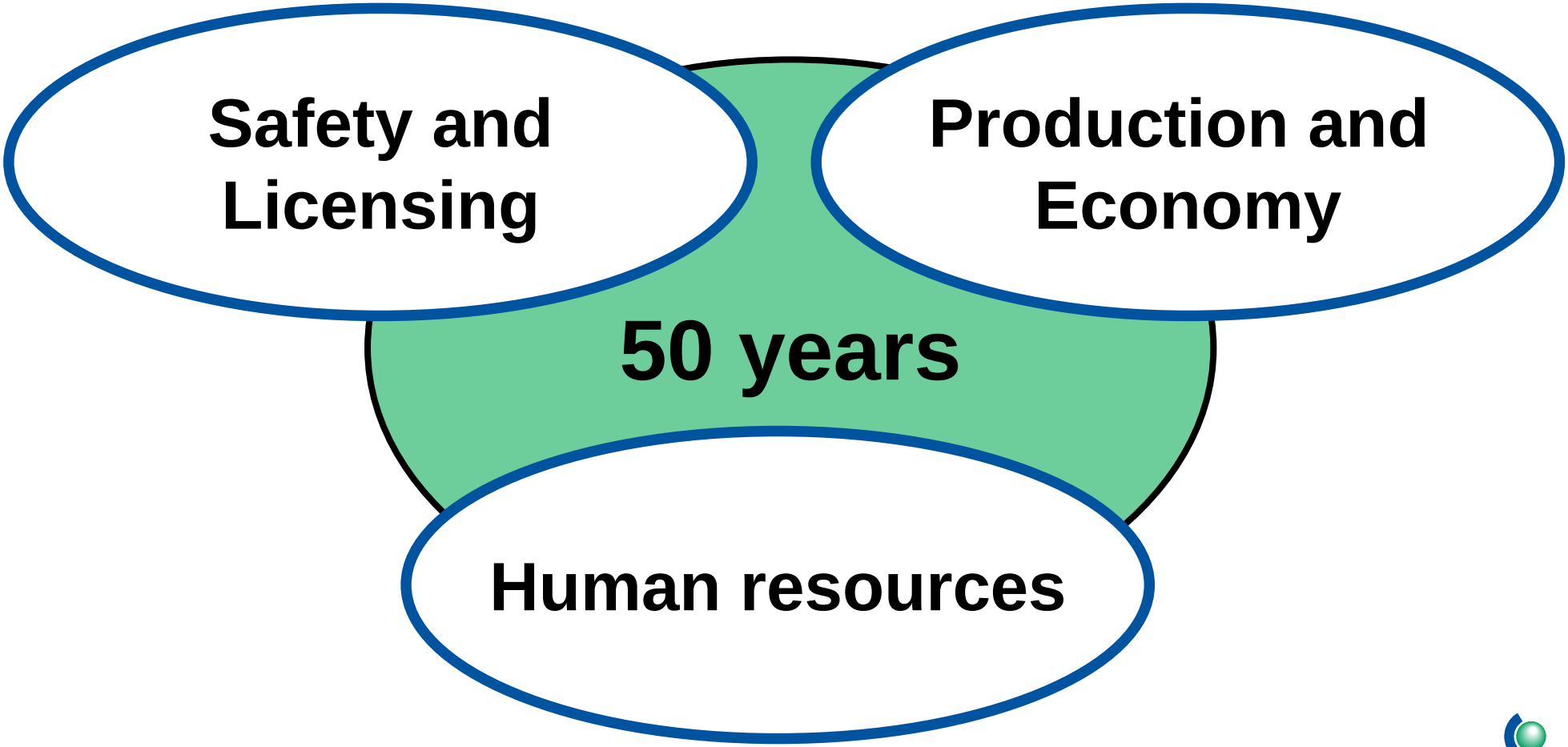
MAIN GOAL:

Commercial operation for

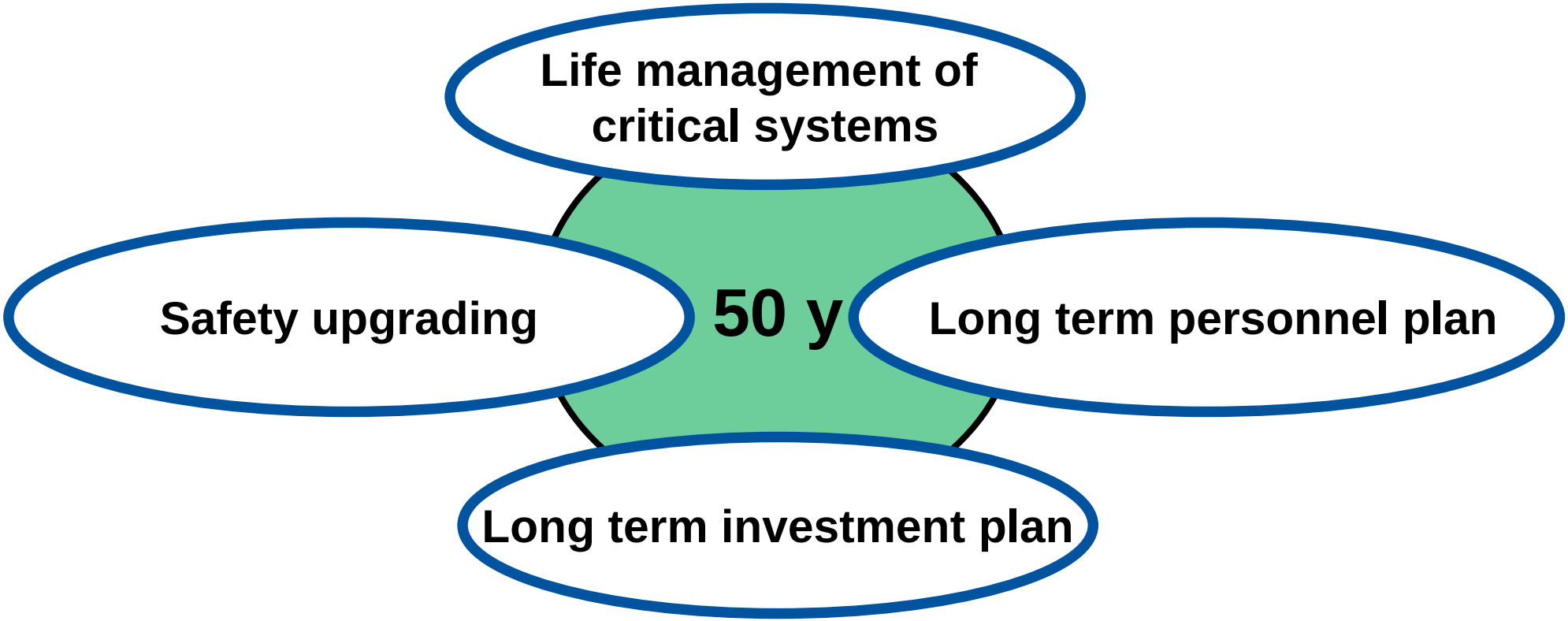
years

Fortum

Strategic Key Issues



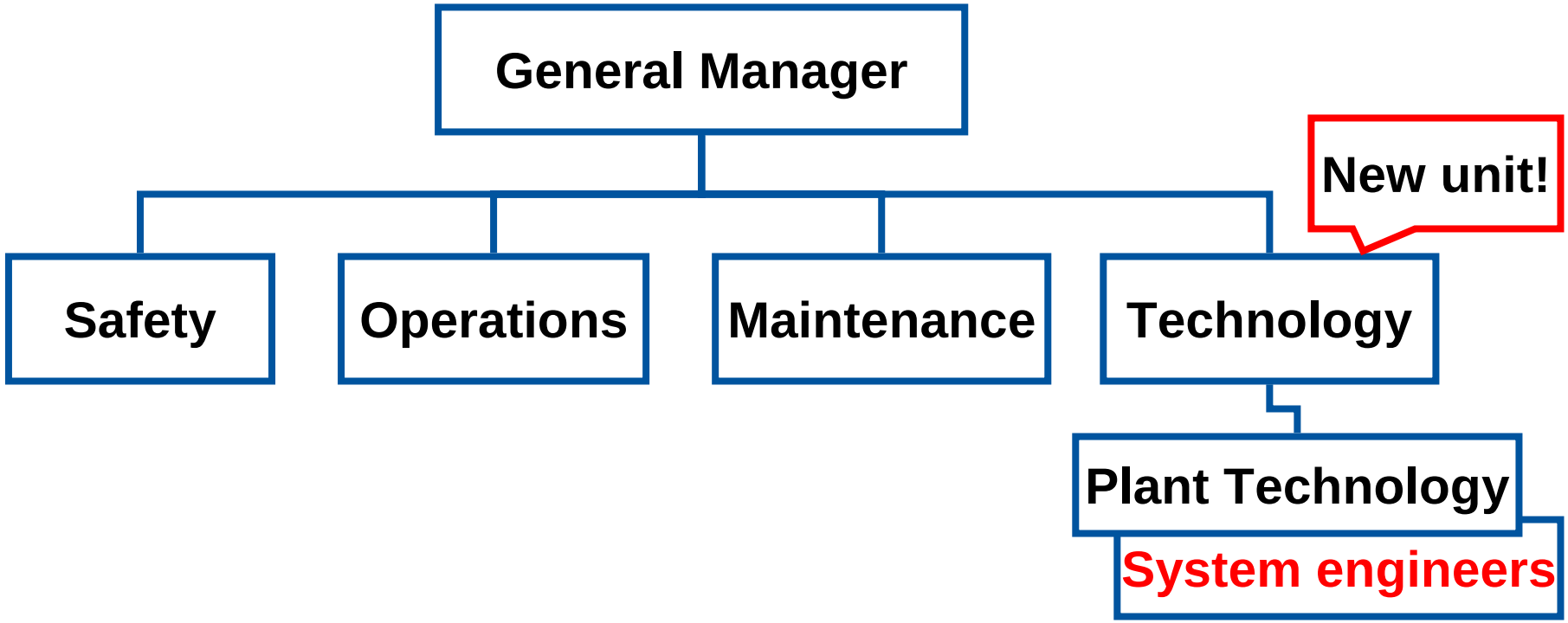
Strategic long term ”tools”



Fortum

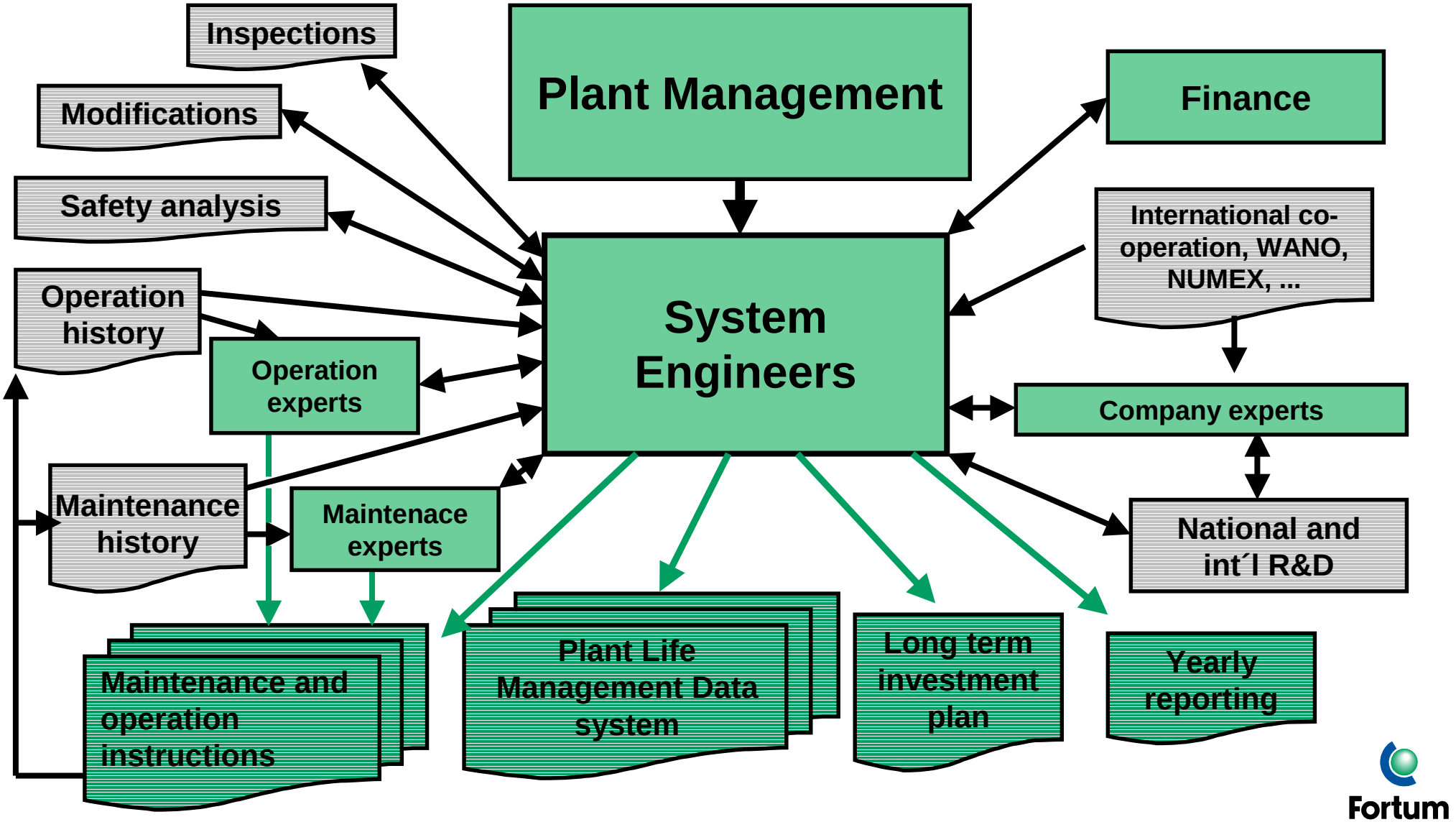
Life management of critical systems

New plant organisation since 1.1.2002



Fortum

Operational environment of System engineers



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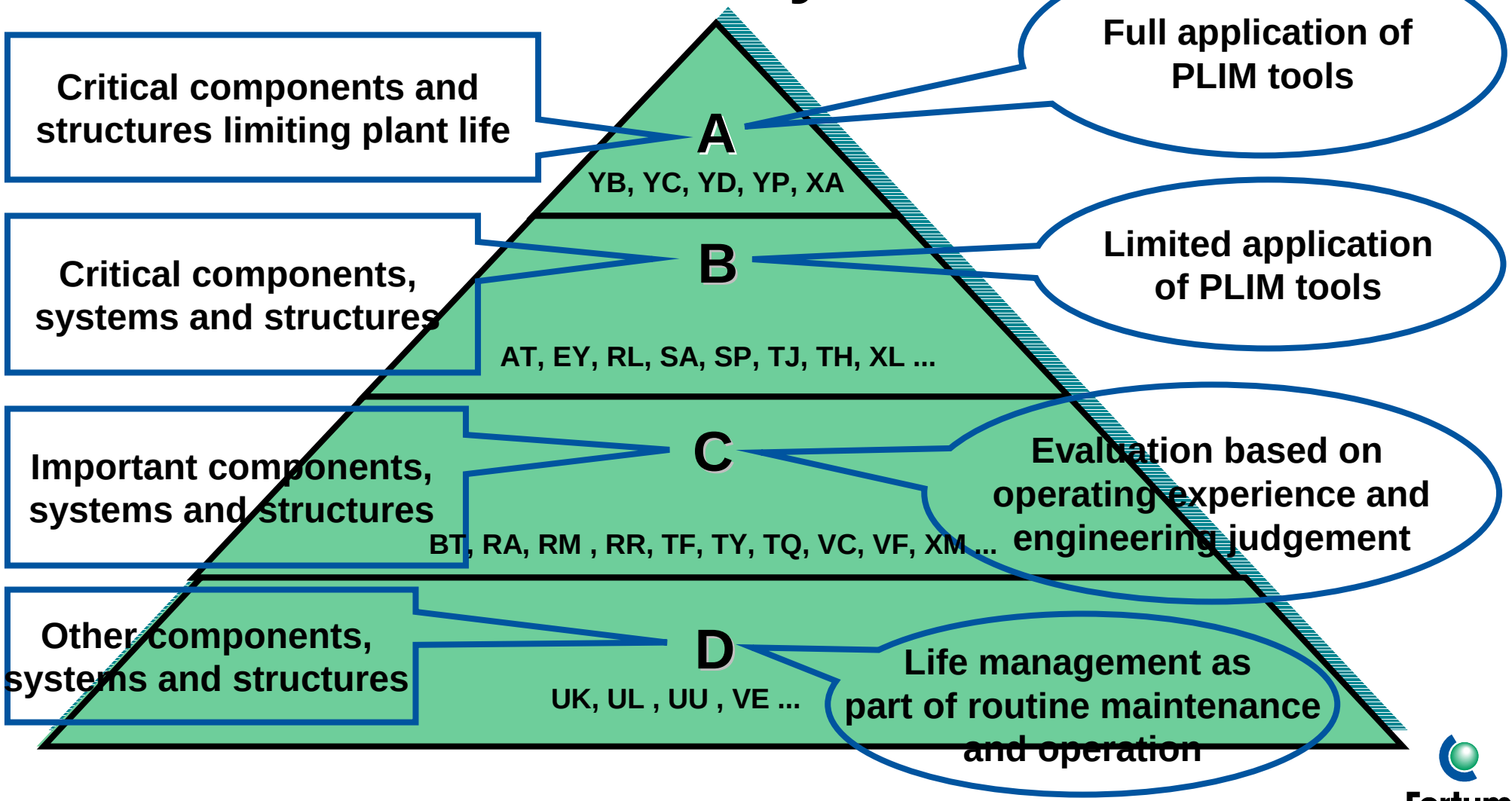
Definition and classification of critical systems



Fortum

Upgrading and modifications since 1990

Main condenser renewals 1989 - 1990
Coating of the HP-turbine casings 1990 - 1994

Replacement of HP- pre-heaters 1991- 1994
LOCA actuator replacements 1988 - 1991

Main gate valve repairs 1992 - 1996
New SG blowdown system 1992 - 1994

PRISE modifications 1996:
Additional emergency water tank
Additional pressurizer spray
New pressurizer safety valves
Automated isolation of steam generators
N16 detection in main steam lines

Severe accident management 2000-2003
Renewal of LP ECC pumps 2000-2002

SG primary collector modifications 1998 - 2004

Large secondary side piping renewals 1994 - 2000
Moisture separators for HP-LP steam lines 1992 - 2000
New SG FW manifolds 1994 - 2002

New secondary water chemistry,
New sump strainers 1994

Power upgrading 109% (turbines, generators, transformers) 1996 - 2002.
A new backup diesel driven sprinkler system 1996

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003

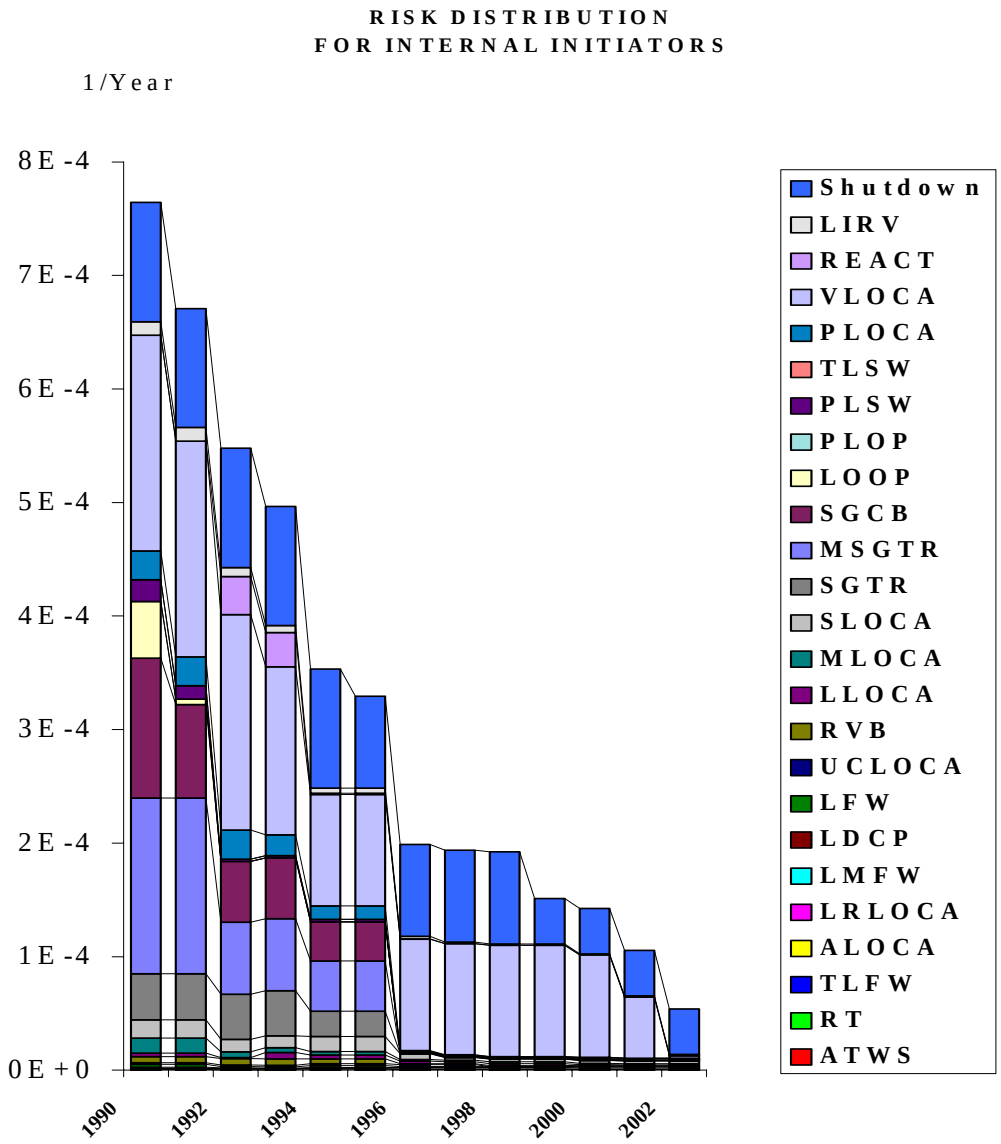
Improved boron dilution control 1992-1998

Outage safety valves, RPV annealing 1996

RCP seal water improvements, New fire alarm system 1999 - 2001

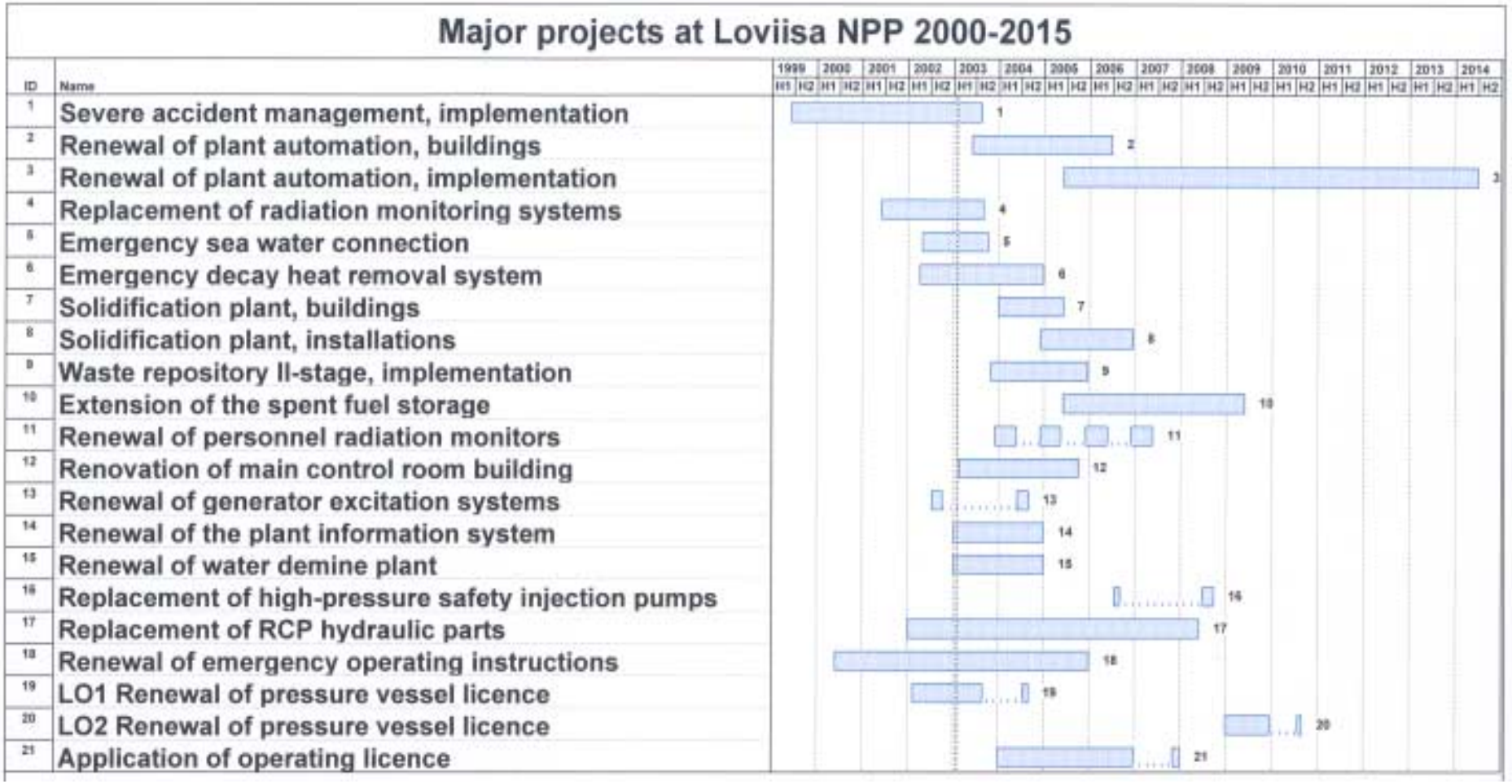
Fortum

Safety upgrading, CDF development



Fortum

Long term investment planning



Fortum

Major challenges for near future

- Reliable and competitive production
- Extensive life mgnt programs for critical systems
- Balanced investment plan for 50 years operation
- Implementation of major projects in normal outages
- Personnel generation exchange
- Preparedness for operating license application

Fortum

PLIM, guideline

Purpose

help define methods to manage plant aging in conformance with requirements outlined in plant strategy and quality assurance

Scope

interface between PLIM and operation, maintenance, inspection, etc...

Fortum

PLIM, guideline

Organisation

leader	overall responsibility
division leaders	implementation and long term strategy
system engineers	planning, implementation and data bank

Fortum

PLIM, guideline

Implementation

- **Classification of plant equipment and systems**

  A limit plant life
  B availability and economy
  C less impact than B
  D others

Fortum

PLIM, guideline

- **Information sources**

  plant records, maintenance, meetings, other power plants and state of the art, etc....

- **planning**

  depends on class;

Fortum

PLIM, guideline

class A equipment split into divisions, conditions assessed and improvements defined using the best expertise

class B similar to A, but less detail

class C evaluation based on collected data, no extensive analyses

Fortum

PLIM, guideline

- **Management**

  means available to system engineers within the organisation are:

  routine check of documents and participation in meetings of operation, maintenance, back fitting, etc...

- **Reporting**

  periodical reports

- **Development**

  follow up meetings (2/year) and reviews

Fortum

Regulatory Tasks and LTO in HUNGARY

Gábor PETŐFI
Hungarian Atomic Energy Authority
Nuclear Safety Directorate

IAEA Extrabudgetary Program
On Safety Aspects in Long Term Operation
Of Presswurized Water Reactors
1st Meeting of Working Group 1
January 13-15, Vienna, IAEA

Decleared regulatory strategy

- Primary responsibility lies with licensee
- HAEA NSD deals with safety significant activites (routine transferred to licensee)
- Importance of international co-operation
- Nuclear Safety R&D program and TSO system
- Regulatory assessment connected to licensing and inspection

Decleared regulatory strategy

- Non-prescriptive, goal- and process-oriented regulation
- Co-operation with several co-authorities
- Tools to monitor safety
  - inspection (routine, rective, comprehensive)
  - witnessing (tests, audits)
  - scrunity of documents
  - independent analysis
  - evaluation of safety performance

Licensing vs. Inspection

- License/permission is given and its conditions are inspected
  - strong assesmnet during licensing
  - simple inspection

- Less licensing but comprehensive inspection
  - needs more experience
  - strong enforcement
  - licensing just for large projects

Regulatory tasks

- Control
  - Requirements (what), recommendations (how)
- Licensing
  - PSR, FSAR (DB, upgrading, actualisation)
  - Modifications (equo, activity)

Regulatory tasks

- Inspection
  - routine, reactive, comprehensive
  - residents, data base, performance evaluation, enformcement initiation
- R&D, Emergency Prep., Training
- Strategic matters
  - international, co-authorities
  - legal interface

Future

- Keeping cont. self-assesment
- Implementation of outer sources
- Changing legal background
- Risk informed regulatory approach

Hungarian Regulatory Approach to Long Term Operation

1. Current situation
2. Preparatory activities
3. Lessons learned
4. Further tasks

Hungarian Regulatory Approach to Long Term Operation

1. Current situation
2. Preparatory activities
3. Lessons learned
4. Further tasks

Current situation

- Paks NPP Unit 1
  - comissioned 1982
  - “design life” 30 years: 2012
- earlier Hungarian legislation
  - design life: limit of operation licence
  - this restriction has been cancelled, but an application 5 years before the expiration date is to be submitted

License Renewal Process

- application
- preliminary license
- fulfilment of the preliminary license conditions and prescriptions
- final license renewal (at the expiration of the current license).

Final Safety Analysis Report

- Originally elaborated according to Soviet practice of the 70s'.
- most of detailed strength, thermal, hydraulic, physic and other safety analyses were not provided for Hungarian site
- elaborated and approved by the Soviet Regulatory Body when licensing prototype (Novo- Voronezh unit 3).
- Part of missing analysis performed (Agnes)

Final Safety Analysis Report

- No basis of the defined 30 years design lifetime
- But in certain manufacturers' documentation there is a warranty of reliable operation for 30 years.
- According to Atomic Act the FSAR has to be elaborated on the basis of the Reg. Guide 1-70.
  - Detailed instructions on Standard Review Plan (NUREG – 0800) contents and aspects of analyses and descriptions.
  - Can not be fulfilled using the available documentation. This information should be completed.

Periodic Safety Review

- once in ten years
- basis for license extension for next 10 years
- currently for unit 1 it is valid until 2008
- i.e: Licensee shall submit an application for the License Renewal (if it wants to do so) in 2007 and the next PSR in 2008.

Hungarian Regulatory Approach to Long Term Operation

1. Current situation
2. Preparatory activities
3. Lessons learned
4. Further tasks

Relevant documents

- IAEA TECDOC series on ageing of SSCs
- US legal documents (10 CFR 50 and 54), NRC guidances and compliance documents.
- Finding: NRC Reg. Guide and the IAEA Guide (**50 – SG – O12 (DS 307)**) were elaborated independently
  - Periodic Safety Review in USA not considered
  - IAEA Guide doesn't rely on an updated FSAR
  - Difference in scope of related SSCs, in details of description of the tasks of both Licensees' and Regulator's etc.

Using American approach

- HAEA decided to use American approach for the license renewal for two reasons:
  - Real experience – US NRC really made license renewals
  - Detailed open information about regulatory requirements, guidelines and licensees' applications for license renewal as well.

Main features of the approach

- scope of LR: passive and long lived components
- licence renewal application consists of
  - scoping, screening, integrated plant assessment, FSAR modification, TS modification (if necessary), and environmental impact study,
- licence renewal does not consist of
  - resolving problems that should be resolved for maintaining of current operating licence conditions
- for the application of the approach
  - we shall adopt the conditions of the operation licence according to 10 CFR 50 regulation

Comparison with Hungarian opportunities

- **Listing of equipment, which needs ageing management**
- **Identification of scope and structure of ageing analyses**
- **Ageing analysis of selected equipment (provided by TSO VEIKI).**
- **Preparation of guides on ageing management in accordance with Hungarian regulations' structure**
  - Design
  - Operation
  - Quality assurance
  - Regulatory procedures

Hungarian Regulatory Approach to Long Term Operation

1. Current situation
2. Preparatory activities
3. Lessons learned
4. Further tasks

Role of FSAR and PSR

- FSAR is a living document for a verification of design conditions (maintaining)
  - the basic document for giving and retaining of the operation licence.
  - focuses on description of the current configuration and on safety analyses
- PSR concentrate on ageing issues (overview)
  - ageing of SSCs, people, organisation, requirements, procedures etc
  - complex overview of SSCs' technical conditions, their ageing management programs, environmental conditions, changes in the state of the art of science and technology, utilisation of operational experience, etc.

Missing DB

- include the gaps to the list of unresolved safety issues
- do not require a complete “re-design”, but will be resolved within
  - current operation license conditions
  - license renewal

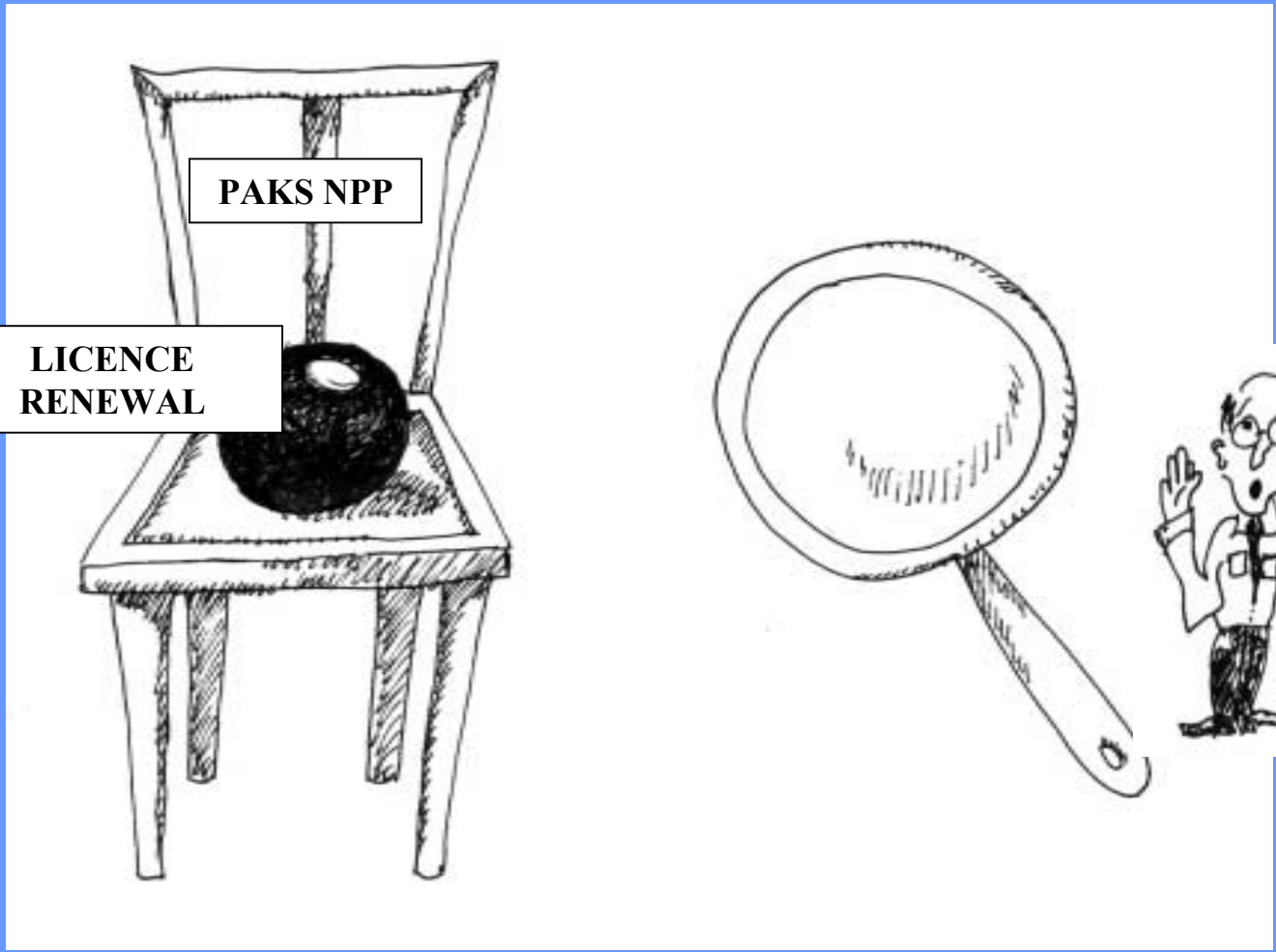
Major areas to be addressed

IF LICENSE RENEWAL IS A CHAIR,

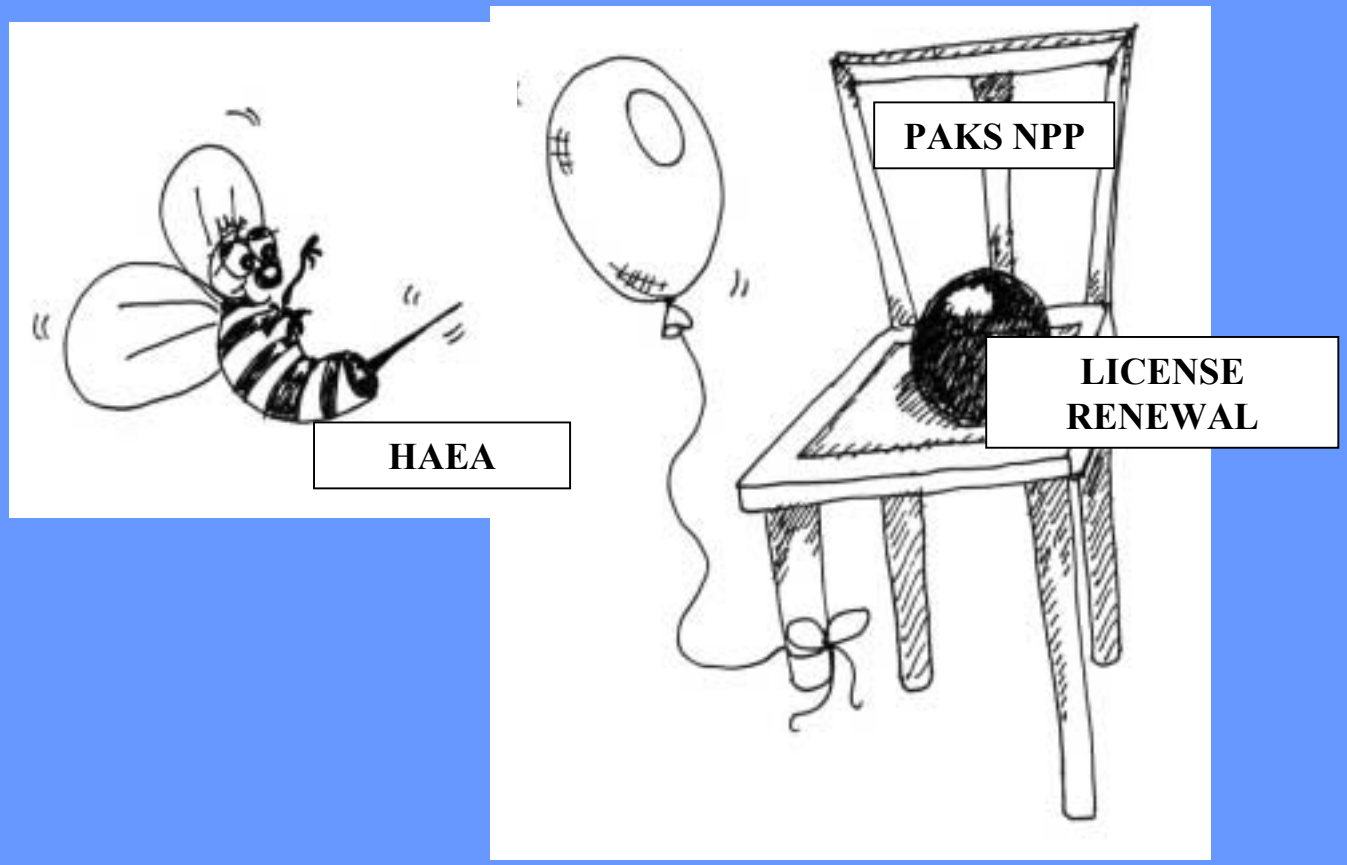
IT HAS FOUR LEGS

but these legs are necessary *also* for the current license conditions

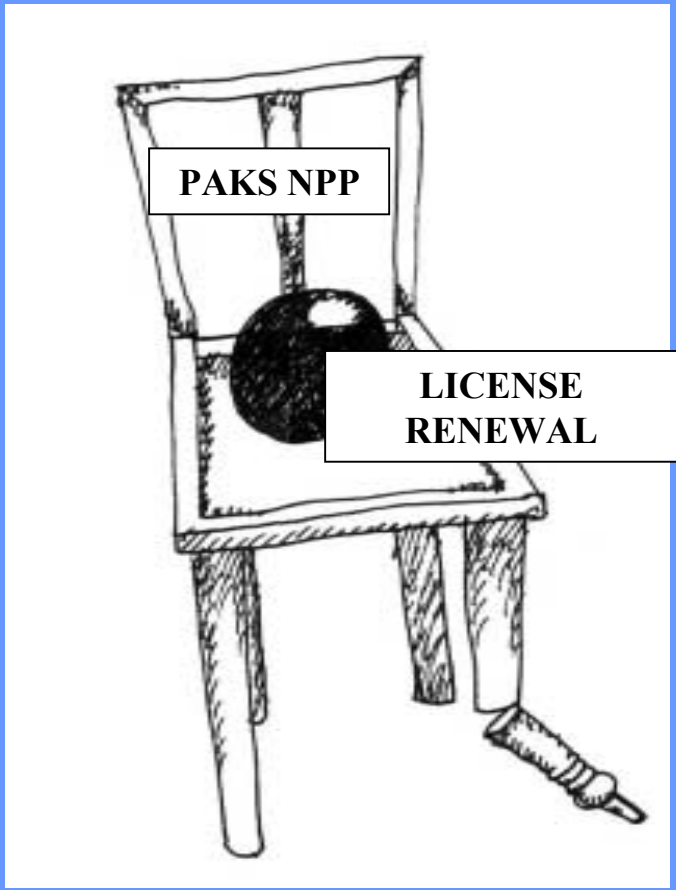
THE CHAIR OF LICENSE RENEWAL



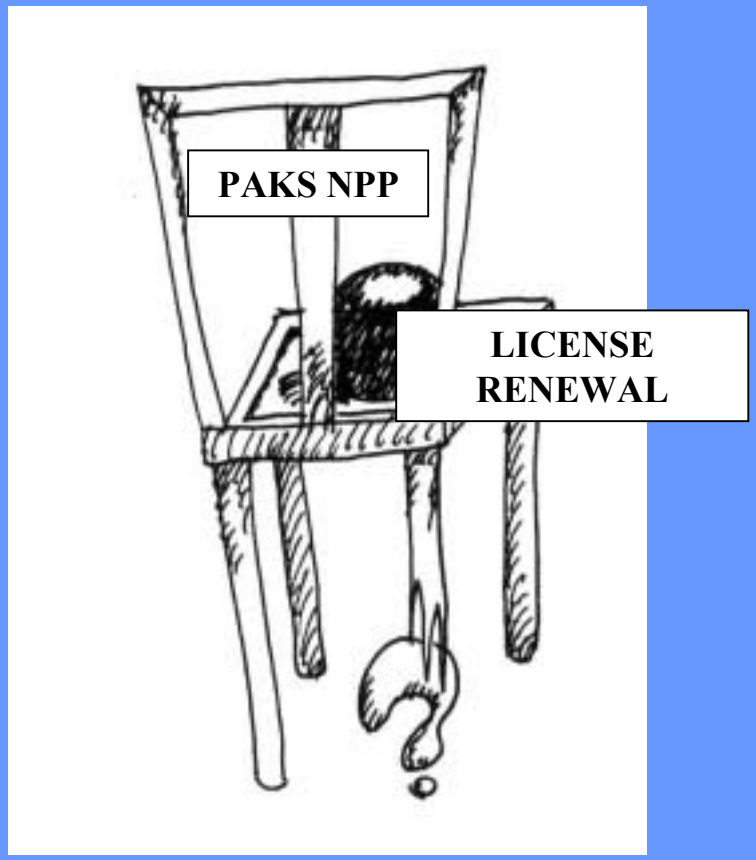
1. LEG: EQUIPMENT QUALIFICATION



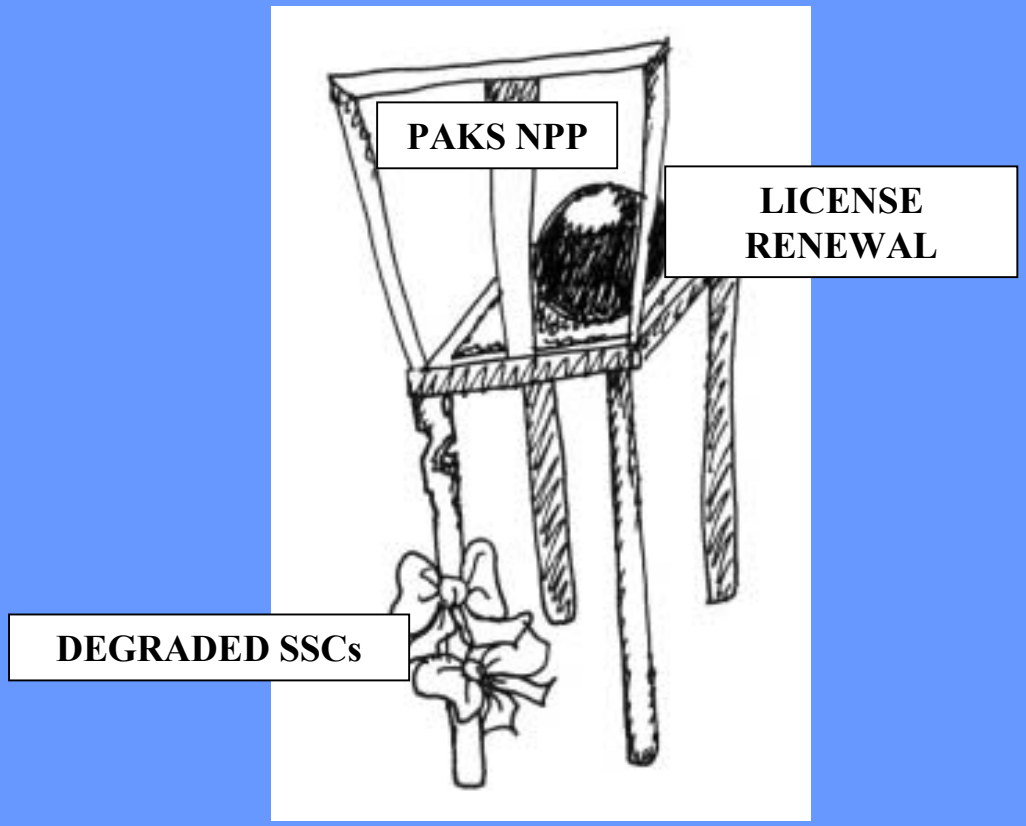
2. LEG: MAINTENACE OF SAFETY RELATED EQUIPMENT



3. LEG: THE DESIGN BASIS



4. LEG: THE AGEING MANAGEMENT PROGRAM



IF ONE OF THE LEGS FAILS...

Achievements

- Guides have been developed and agreed on ageing management (4) and EQ (3) (reflecting the Hungarian regulations):
  - during design of NPP and equipment
  - during operation of NPP
  - QA
  - regulatory processes
- Draft guides (2) for Licence Renewal application elaborated

Achievements

- Agreement on starting the implementation of Maintenance Rule (2 draft guides)
- New role and content of PSR and FSAR (included in QA manual) defined and related regulations have been reviewed.
- The legal basis to all these efforts will be provided by modification of related Governmental Decree and the Nuclear Safety Regulations.

Hungarian Regulatory Approach to Long Term Operation

1. Current situation
2. Preparatory activities
3. Lessons learned
4. Further tasks

3 groups of further tasks

- preparation of the license renewal application
- for the last five years of operation under design lifetime
- to be performed in the renewed license period.

International Atomic Energy Agency

Regulatory approaches to LTO in Russia

N. Sulkhanishvili
(Gosatomnadzor of Russia)
P. Medvedev
(Rosenergoatom)

Meeting of the Working Group 1 on General Long Term Operation Framework.
Vienna, Austria, 13-15 January, 2004.

Table of Contents

Main Terms and Definitions.

ATOP	–	Additional Term of Operation
EBP	–	Extrabudgetary Programme
LTO	–	Long Term Operation
PLEX	–	Plant Life Extension
PDSL	–	Plant Design Service Life

2. Regulatory approaches to LTO.

- Federal Act "About the Use of Atomic Energy" (Article 9);
- General Regulations on Ensuring Safety on NPP, (OPB-88/97) NP-001-97 (p. 5.1.14);
- “Main Requirements for Service Life Extension of NPP Power Unit”, NP-017-2000;
- Regulatory document of GAN "Requirements to the content and composition of the documents justifying the safety for the period of NPP extended life“, RD-04-31-2001;
- Methodological and guiding documents of the utility defining the upgrading activities, comprehensive examination, justification of the equipment residual lifetime, QA of LTO.

2. Regulatory approaches to LTO (cont.).

Federal Act "About the Use of Atomic Energy" (Article 9) allow for the possibility of power unit life extension.

2. Regulatory approaches to LTO (cont.).

General Regulations on Ensuring Safety on NPP, (OPB-88/97) NP-001-97 (p. 5.1.14):

5.1.14. Based on estimation of the residual service life of equipment and other safety validation studies the operating organization may raise a question about extension of the NPP unit service life. In this case a new license on NPP unit operation shall be obtained from Gosatomnadzor of Russia.

2.1. Main requirements to NPP unit preparation for ATOP.

In this chapter we will discuss the general regulations of the document:

“Main Requirements for Service Life Extension of NPP Power Unit”, NP-017-2000.

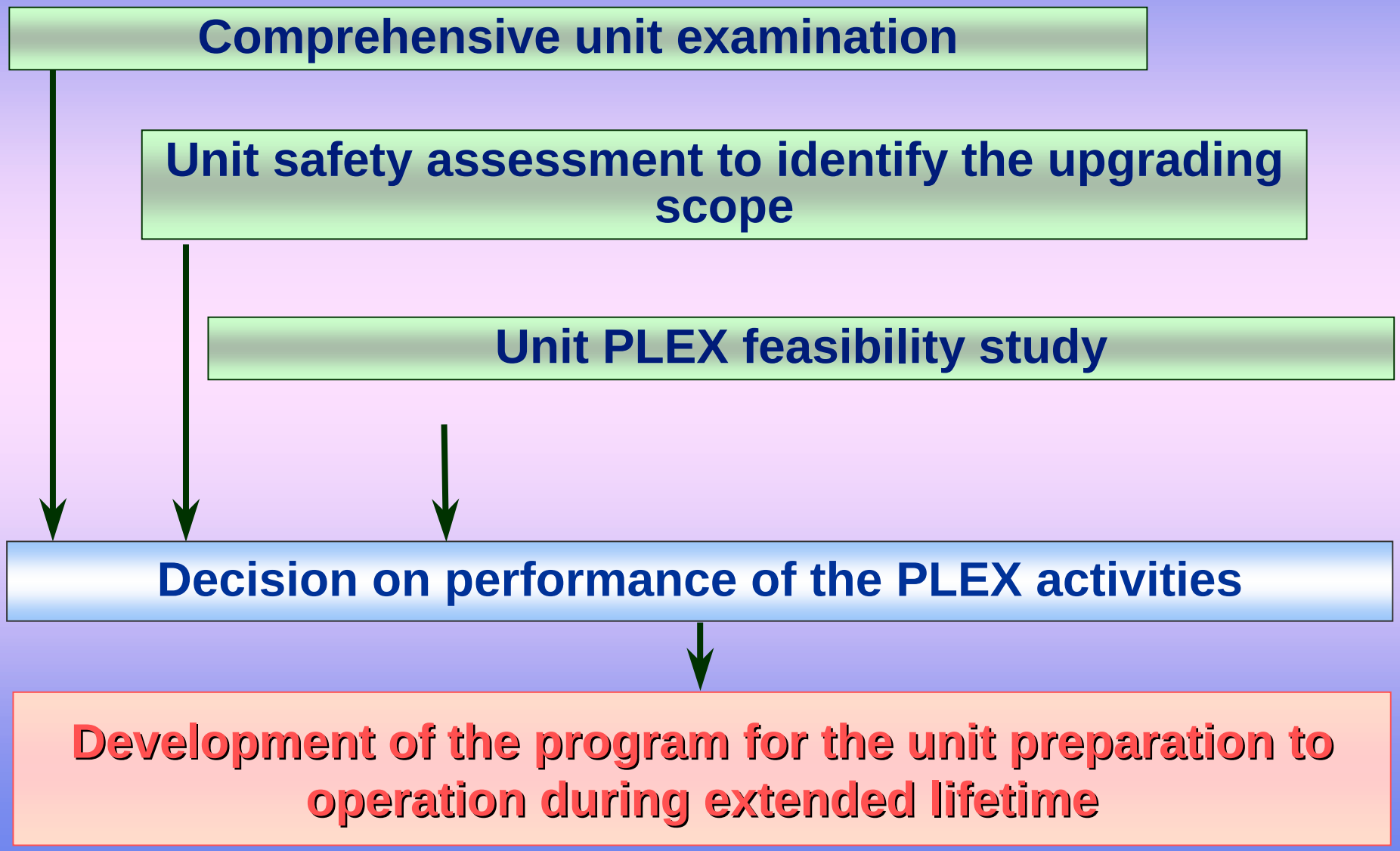
Stages of the NPP units preparation to **PLEX**

- 1 stage – set of activities aimed at assessment of the PLEX technical possibility and economical reasonability

Decision on PLEX or decommissioning
(5 years before the design life expiry)

- 2 stage – set of activities aimed at ensuring of the safe operation during the extended operational life

The first stage of the PLEX activities



The second stage of the PLEX activities

(implementation of the program for the unit preparation to operation during extended lifetime)

Justification of the lifetime extension for the irreplaceable elements

Implementation of the NPP unit modernization program

Safety justification of the NPP unit

The results of the activities are submitted to RF GAN by the utility for independent expertise and licensing of the NPP operation during extended lifetime

2.1. Main requirements ... (cont.)

Duration of plant operation beyond PDSL should be established in view of technical and economic aspects, including:

- **Opportunity to provide and to maintain safety during plant long term operation;**
- **Presence of a necessary residual resource of non-replaceable equipment;**

2.1. Main requirements ... (cont.)

- **Presence of an opportunity of temporary storage of additional amount of spent fuel or an opportunity to remove it from NPP site;**
- **Opportunity to maintain safety at the handling of radioactive waste during ATOP;**
- **Opportunity to maintain safety during plant decommissioning.**

2.1. Main requirements ... (cont.)

Operating organization should carry out the following basic measures for a PLEX:

- **To execute complex inspection under the authorized program;**
- **To develop the program of preparation of the NPP unit for PLEX;**
- **To execute preparation of the NPP unit for operation during ATOP;**
- **To carry out necessary tests.**

2.1. Main requirements ... (cont.)

The purposes of <u>complex inspection</u> are:

- **<u>An assessment of real condition</u> of NPP unit;**
- **<u>Definition of residual resource</u> of components for developing the Program of preparation for PLEX.**

Upgrading Programme as a basis to re-licensing .

Main principles of the identification of the NPP unit upgrading scope

1. Deterministic analysis of the design compliance with the valid normative documents (ND) on safety:
   - Identification of the incompliance with the ND requirements
   - Incompliance grouping and formulation of the safety issues
   - Rating of the safety issues in accordance with the significance
   - Development of the activities aimed at elimination (compensation) of the identified issues

Main principles of the identification of the NPP unit upgrading scope (cont)

2. Probabilistic safety analysis:
   - Identification of the input of the most expensive activities in severe core damage frequency decrease
   - Upgrading recommendations to decrease the severe core damage frequency
   - Severe core damage frequency forecast upon the upgrading completion
3. Consideration of IAEA recommendations and international experience

Main upgrading goals for PLEX

Main goals:

- **Decrease of the severe core damage frequency**
- **Elimination (compensation) of the main safety deficiencies**
- **Replacement of the equipment with the expired lifetime**

2.1. Main requirements ... (cont.)

Program of preparation for PLEX should foresee:

- Definition **of a residual resource of non-replaceable components** of NPP unit, buildings and structures, definition and realization of necessary **measures on increase of its residual resource**;
- Performance (if necessary) additional researches by definition **of a residual resource of replaceable components** and realization of measures **on restoration** of a residual resource;
- Development of technical and organizational measures on **exception** and/or **restriction** of **safety deficiencies influence** on safety;

2.1. Main requirements ... (cont.)

Program of preparation ... (cont.):

- Development of the working **design documentation;**
- Development (if necessary) **programs of works**;

- Development (if necessary) **plans-diagrams** of performance of works on preparation for PLEX;
- Development of **Quality Assurance Program** of works on preparation for PLEX;

2.1. Main requirements ... (cont.)

Program of preparation ... (cont.):

- Development **of requirements to acceptance** of the executed works and results of the carried out actions;
- Realization **of tests**;
- **Updating** of current **documents on safety justification** according to an actual condition of the NPP unit **or preparation of new documents on safety justification**.
- **Retraining** of plant **personnel (if necessary).**

2.2 Justification of the NPP unit residual lifetime

LIST OF CRITICAL ELEMENTS

METHODOLOGE OF THE LIFETIME JUSTIFICATION → **WORK PROGRAMS**

- Analysis of the operational history of the elements
- Analysis of the discrepancies from the requirements of the valid normative documents
- Set of metal examination activities
- Strength calculations to justify the residual life

DECISION on possibility and conditions for the further operation of the elements

2.3 Justification of the unit safe operation during expended lifetime

According to recommendations RB G-12-42-97 the in-depth safety assessment report is developed with consideration of all the upgrades implemented at the unit including:

- Deterministic safety assessment
- 1-st level PSA
- Operation experience analysis

Recommendations RB G-12-42-97 meet the international approaches to the safety assessments of the NPPs constructed in accordance with the outdated standards

2.4. Re-licensing processes. The documents necessary for granting of the licence for the period of PLEX.

The documents necessary for granting of the license for the period of PLEX are described in regulatory document of GAN:

"Requirements to the content and composition of the documents justifying the safety for the period of NPP extended life", RD-04-31-2001

In this chapter we will discuss the general regulations of this document.

2.4. The documents necessary ... (cont.).

According to RD-04-31-2001 the structure of the complete set of the documents justifying safety during additional term of operation of NPP unit should include the following materials:

1. **NPP unit safety justification.**
2. **The program of preparation of the NPP unit for PLEX.**
3. **The report on results of complex inspection.**
4. **Technological regulations (technical specifications) of NPP unit safe operation.**
5. **The certificate of NPP unit reactor.**

2.4. The documents necessary ... (cont.).

6. The instruction on liquidation of design basis accidents.

7. The manual on management of beyond design basis accidents.

8. Emergency planning procedures on protection of personnel and population in the event of an accident at the NPP.

9. Quality assurance program of NPP unit operation.

10. The information on selection, training, admission to independent work and maintaining of qualification level of the NPP operational personnel.

2.4. The documents necessary ... (cont.).

11. The instruction on nuclear safety ensuring at storage, transfer and overloading of a nuclear fuel.

12. The instruction on the accounting and the control of a nuclear materials on the unit of a NPP.

13. The information on ensuring of NPP unit physical protection.

14. A copy of act of the interdepartmental commission on the organizing of NPP protection.

15. The information on the organizing of system of the accounting and control of radioactive substances and radioactive waste.

3. Real experience for PLEX in Russia. NV NPP Units-3,4 and Kola-1 Life Extension.

Operating organization developed the program of works for NV NPP units 3-4 and Kola-1 on safety increase and preparation for ATOP.

According to this program the following works were executed:

- Complex inspection of units;
- Modernization of units;
- Residual service life of components was proved;
- The equipment, worked out a resource, was replaced;
- In-Depth Safety Review Reports summing all realized modernization was developed.

3. Real experience …(cont).

As a result of the executed works safety of units was essentially increased:

- **Deviations of categories 3 and 4 (on IAEA classification) from requirements of regulatory norms and rules are completely eliminated;**
- **Expansion of a spectrum of design basis accidents from leaks of the primary piping with Du32 (accepted in the initial design as maximal) up to leaks with Du100 is provided;**
- **Restriction of radiating influence on the personnel, the population and an environment under beyond design basis accidents is provided (with the help of the eddy-jet condenser);**
- **The total probability rate of severe core damage is reduced from size $1.8*10^{-3}$ 1/reactor-year up to $3.44*10^{-5}$ 1/reactor-year (for unit 3), for Kola-1 – $2.92*10^{-5}$ 1/reactor-year.**

4. Conclusions.

1. **Federal Act "About the Use of Atomic Energy" (Article 9) and other Russian federal regulatory documents allow for the possibility of NPP unit service life extension.**
2. **Based on estimation of the residual service life of equipment and other safety validation studies the operating organization may raise a question about extension on the NPP unit service life. In this case a new license on NPP unit operation shall be obtained from GAN. (According to "General Regulations on Ensuring Safety on NPP", OPB-88/97, p. 5.1.14).**

4. Conclusions (cont).

3. New documents, created for regulation of NPP unit preparation for service life extension are:
   - “Main Requirements for Service Life Extension of NPP Power Unit”, NP-017-2000;
   - "Requirements to the content and composition of the documents justifying the safety for the period of NPP extended life“, RD-04-31-2001.
4. Now operational organization obtained ATOP licenses for:
   - NV NPP unit 3, Validity of the license - till 31.12.2006
   - NV NPP unit 4, Validity of the license - till 31.12.2008
   - Kola NPP unit 1, Validity of the license - till 30.06.2008

PREPARATION OF LICENSE RENEWAL IN SLOVAKIA

The role of external support organisation in ageing management programs

EBP SALTO PWR

Vienna IAEA, 13-15.1. 2004

Presented : Miroslav LUKÁČ

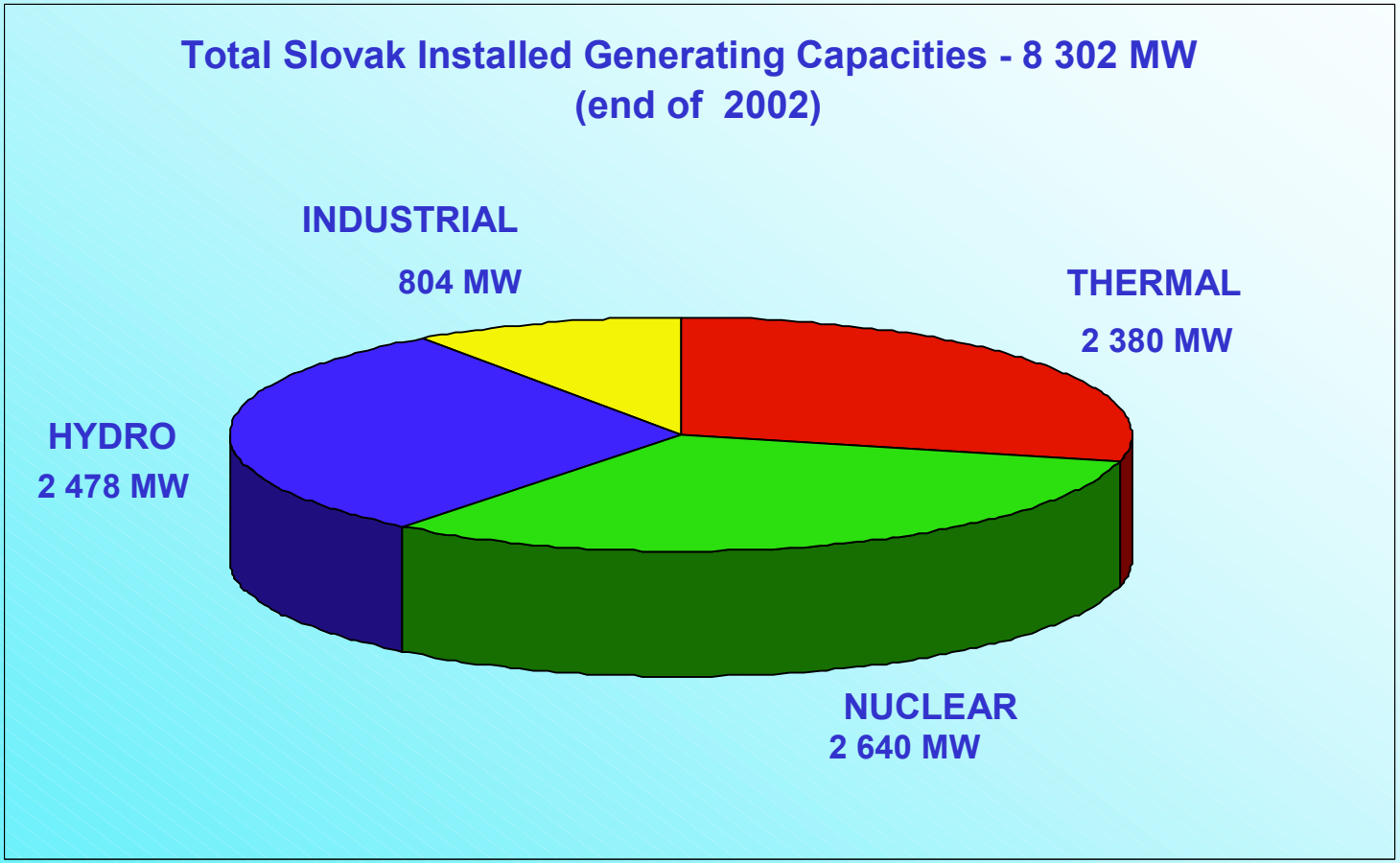
OUTLINE

- NUCLEAR POWER INSTALATION IN SLOVAKIA
- LEGAL BASIS AND SAFETY GUIDELINES
- ROLE OF SUPPORT ORGANISATION
- CURRENT SITUATION IN SLOVAKIA
- REAL PROGRAMS ILLUSTRATIONS
- CONCLUSIONS

Nuclear Power Installation in Slovakia

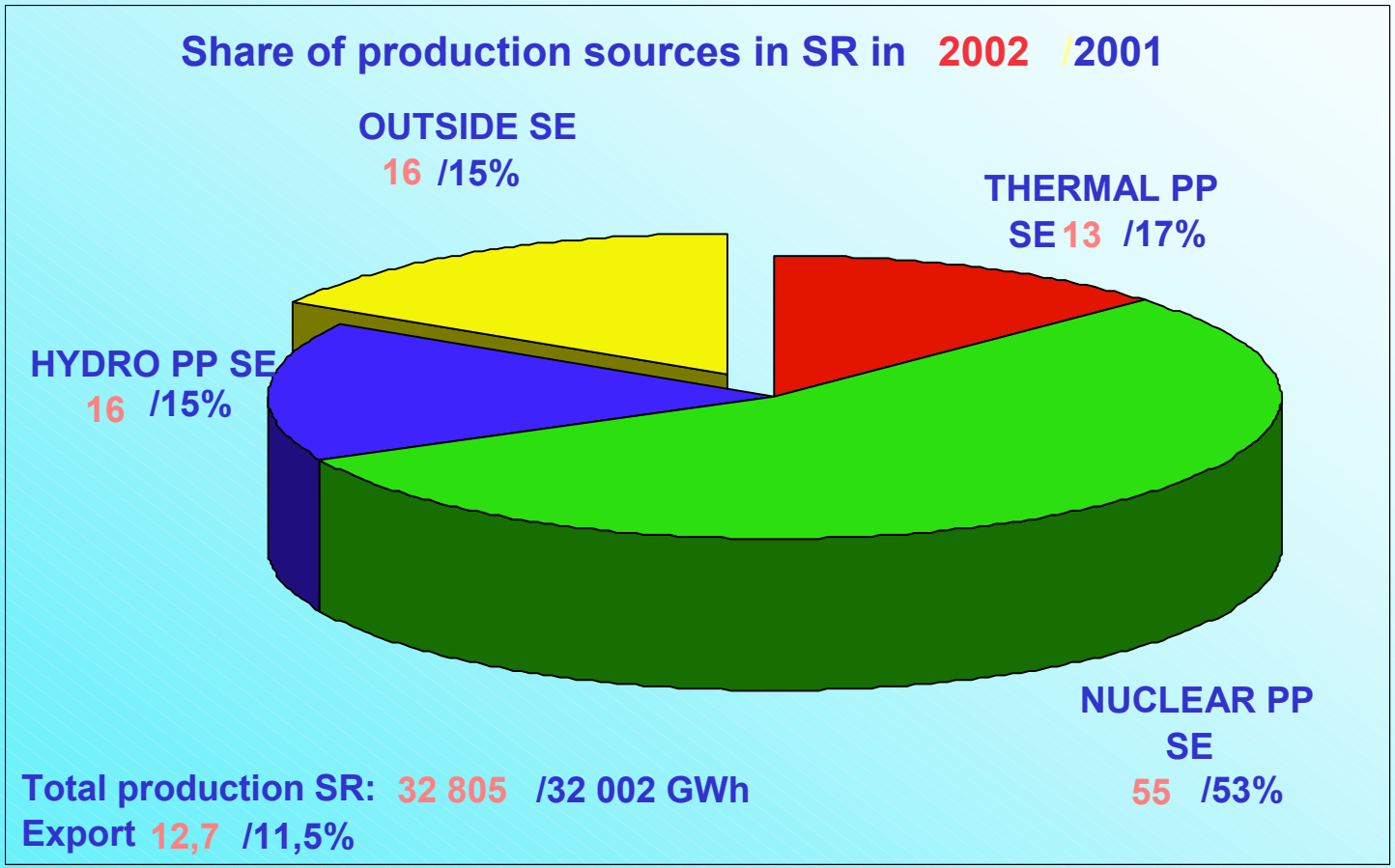
NPP Bohunice - 2 units VVER 440 1978-1985
NPP Mochovce - 2 units VVER 440 1998- 2000

Slovak Installed Capacities in 2002

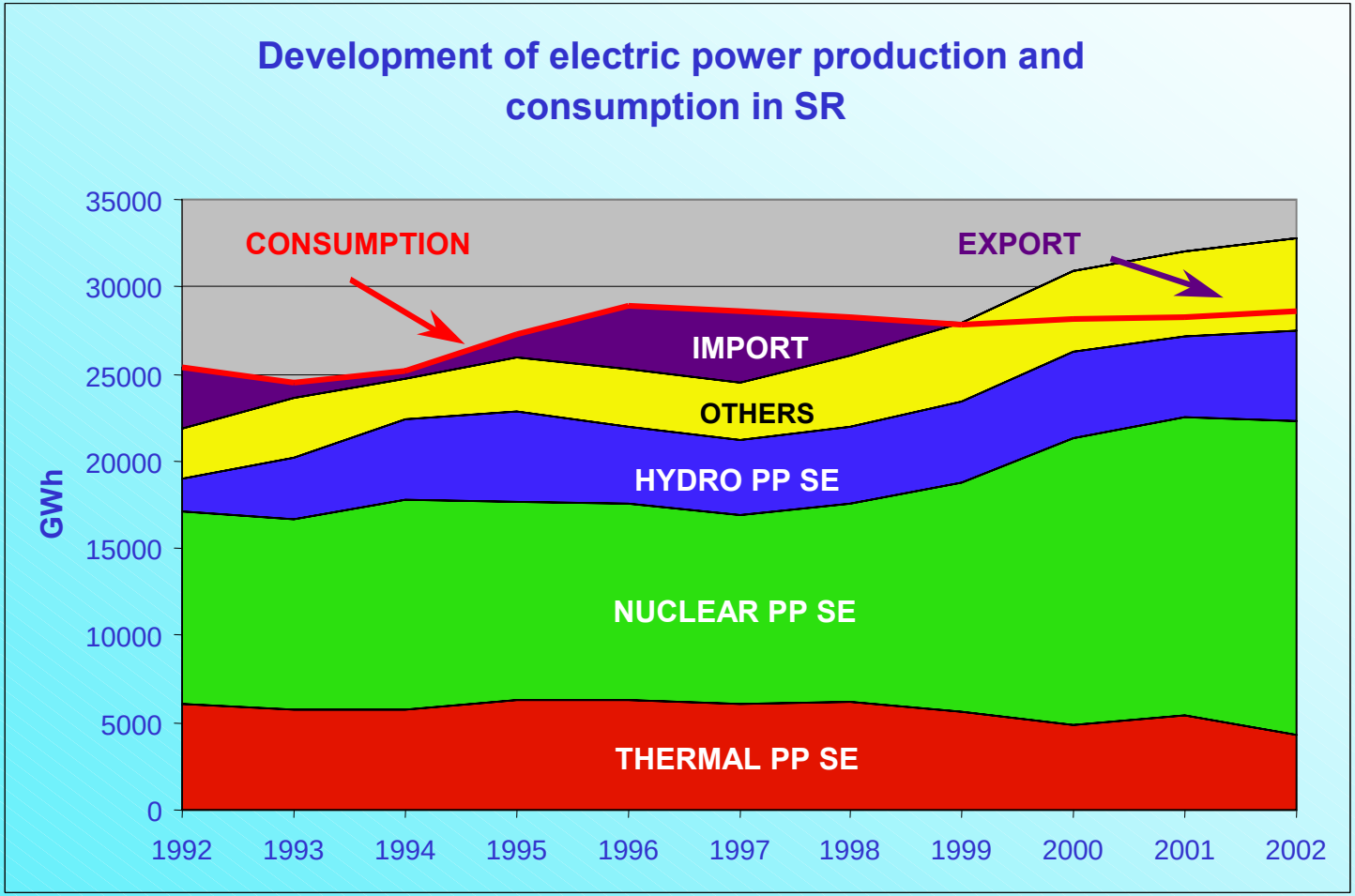


SE share - 83 %

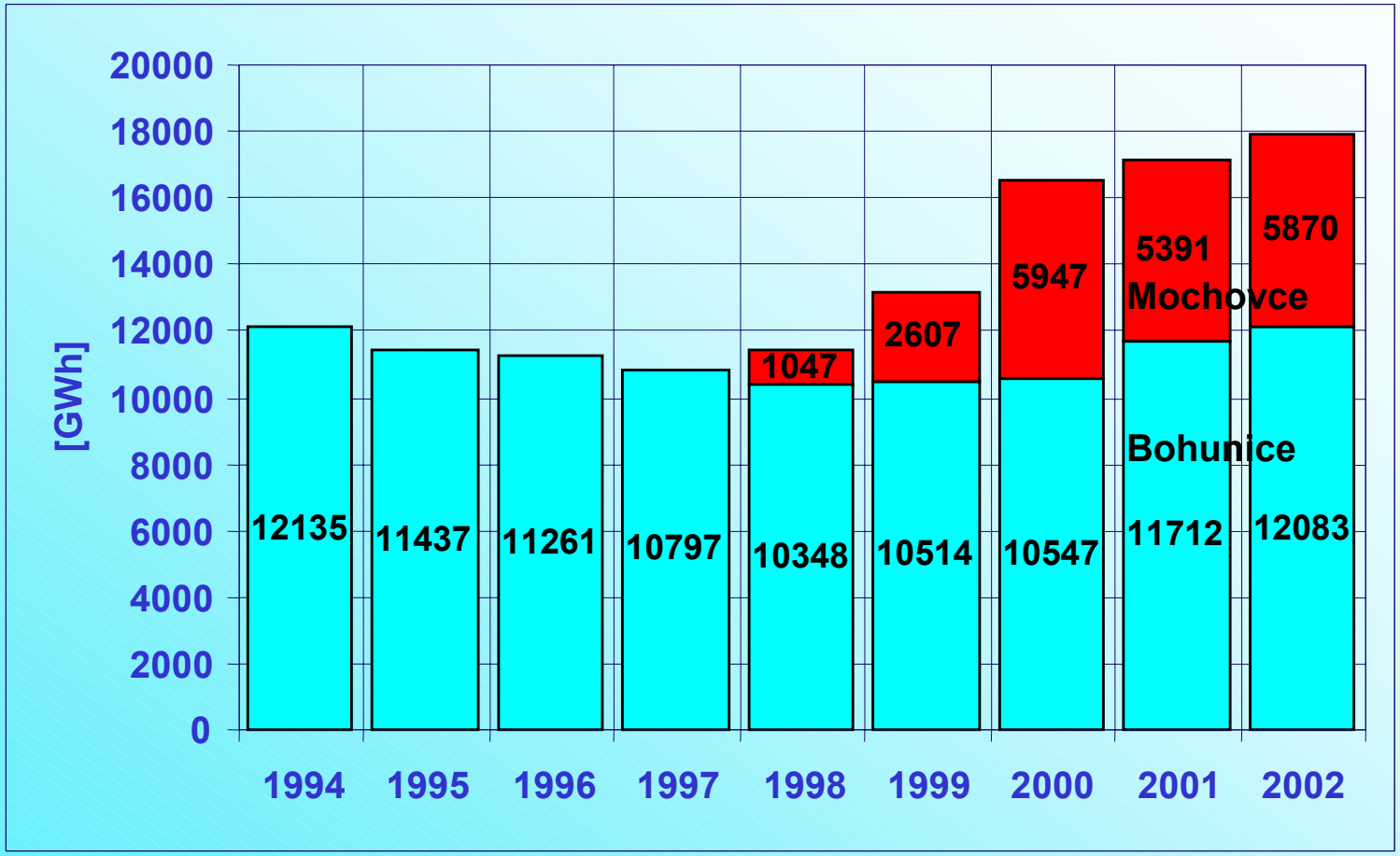
Share of production sources



Development of Generating Structure



Electricity Production at NPPs



LEGAL BASIS
AND SAFETY GUIDELINES

LEGAL BASIS (1)

ACT No. 130/1998 Coll. on peaceful use of nuclear energy

§ 16 - EXTENSION OF NUCLEAR INSTALLATION LIFETIME

(1) REGULATORY AUTHORITY MAY EXTEND THE VALIDITY OF THE OPERATIONAL LICENCE BASED ON AN ACTUAL CONDITION OF NUCLEAR INSTALLATION AND THE SUPPLEMENTARY SAFETY DOCUMENTATION

LEGAL BASIS (2)

ACT No. 130/1998 Coll. on peaceful use of nuclear energy

- **§ 16 - EXTENSION OF NUCLEAR INSTALLATION LIFETIME**

(2) SUPPLEMENTARY SAFETY DOCUMENTATION SUPPLEMENTS THE SAFETY DOCUMENTATION (REQUIRED PRIOR COMMISSIONING AND OPERATION) AT THE APPLICATION OF OPERATIONAL LICENCE EXTENSION

LEGAL BASIS (3)

REGULATION No. 318/2002 Coll.
ON SAFETY DOCUMENTATION OF NUCLEAR INSTALLATIONS

- **DEFINES CONTENT AND FORMAT OF SAFETY DOCUMENTATION SUBMITTING TO NRA FOR:**
  - **CONSTRUCTION**
  - **COMMISSIONING**
  - **OPERATION**
  - **LIFETIME EXTENSION**

LEGAL BASIS (4)

REGULATION No. 318/2002 Coll.
ON SAFETY DOCUMENTATION OF NUCLEAR INSTALLATIONS

- **§ 27 - SUPPLEMENTARY SAFETY DOCUMENTATION**
  - **OVERALL EVALUATION OF CONDITION OF EQUIPMENT**
  - **EVALUATION OF OPERATION PHASE**
  - **EVALUATION OF AGEING MANAGEMENT PROGRAMME**
  - **MODIFICATIONS OF OP NECESSARY FOR PLEX**
  - **DESIGN MODIFICATIONS REQUIRED FOR PLEX**
  - **SAFETY ASSESSMENT OF PROPOSED MODIFICATIONS**

NRA SAFETY GUIDELINES BNS I.9.2/2001

„AGEING MANAGEMENT OF NPPs“ (1)

- **MAIN AIMS**

  - **TO PROVIDE THE OPERATING AND TECHNICAL SUPPORT ORGANISATIONS WITH METHODOLOGY FOR ELABORATION AND IMPLEMENTATION OF AMP**

  - **TO ELABORATE IN MORE DETAIL PROVISIONS OF GENERALLY OBLIGATORY LEGAL REGULATIONS**

NRA SAFETY GUIDELINES BNS I.9.2/2001

„AGEING MANAGEMENT OF NPPs“ (2)

- **FEATURES**
  - **ELABORATED BASED ON IAEA DOCUMENTS (TECDOC, GUIDELINES, …)**
  - **NONMANDATORY DOCUMENT, HOWEVER IN SPECIFIC CASES THE REGULATORY AUTHORITY MAY REQUIRE THE OPERATOR TO ACT IN ACCORDANCE WITH THE GUIDE**
  - **THE GUIDELINES REQUIREMENTS ARE CONSIDERED AS MINIMAL ONES**
  - **ANALOGUE IT CAN BE USED FOR ALL TYPES OF NI**

NRA SAFETY GUIDELINES BNS I.9.2/2001

„AGEING MANAGEMENT OF NPPs“ (3)

- **MAIN AREAS**
  - **FIELD OF APPLICATION**
  - **CRITERIA FOR SELECTION OF SSCs**
  - **REQUIREMENTS ON AMP ORGANIZATION**
  - **REQUIREMENTS ON DATABASE OF SSCs**
  - **REQUIREMENTS ON DOCUMENTATION**
  - **ASSESSMENT OF AMP IMPLEMENTATION**
  - **RESPONSIBILITIES**

ROLE OF SUPPORT ORGANISATION

AMP REQUIREMENT

- Specific knowledge and experts from the areas of material assessment
- Sufficient know-how
- Approach to the state-of-the-art science and research
- Advanced technologies and laboratory facilities.

Expert organisation:

- Proposes ageing management programmes, develops methodologies for SSC assessment.
- Carries out analyses and evaluations of SSC conditions within the implementation of special programmes based on the requirements of operator.
- Performs expert evaluations and assessment of the causes of degradation or loss of SSC function.
- Introduces new, progressive methods for the assessment of ageing.
- Develops proposals for the elimination, or mitigation of the effects of degradation mechanisms on the conditions and ageing of SSC.

CURRENT SITUATION IN SLOVAKIA

CURRENT SITUATION IN SLOVAKIA (1)

- **AGE PROFILE OF NPPs**

PLANT/TYPE	UNIT	COMMISSION	REMARK
BOHUNICE V-1/WWER 440/230	1	1978	END 2006
	2	1980	END 2008
BOHUNICE V-2/WWER 440/213	3	1984	PLEX
	4	1985	PLEX
MOCHOVCE/WWER 440/213	1	1998	PLEX
	2	1999	PLEX
	3	UNDER CONSERVATION	
	4	UNDER CONSERVATION	

CURRENT SITUATION IN SLOVAKIA (2)

- **IMPLEMENTATION OF AMP (1)**

  - **BOHUNICE V-1 AND V-2 NPP AMPs ARE IMPLEMENTED**

    * **Rpvs SURVEILLANCE PROGRAMMES**
    * **FATIGUE DAMAGE EVALUATION**
    * **CORROSION PROGRAMME OF PRIMARY CIRCUIT COMP.**
    * **CORROSION- EROSION PROGRAMME OF SEC. CIRCUIT**
    * **CONFINEMENT - TIGHTNESS, CLADDING**
    * **CABLES**

CURRENT SITUATION IN SLOVAKIA (3)

- **IMPLEMENTATION OF AMP (2)**

- At Bohunice V-2 NPP within the modernisation and safety upgrading programme and r&d project aimed at development and implementation of integrated AMP is under run, including plant life Extension

- At Mochovce NPP, unit 1 and 2 AMP implemented, Unit 3 and 4 are under conservation

CURRENT SITUATION IN SLOVAKIA (4)

RESEARCH PROGRAM FOR AGEING MANAGEMENT AND LIFE-TIME EVALUATION OF NPP SSCs

THE MAIN GOALS OF PROJECT:

1. To identify the ageing degradation mechanisms of the safety related systems and components.
2. To develop the database system for this purpose.
3. To use the existing monitoring systems for monitoring of all important degradation influences.
4. To develop the ageing management programme.
5. To develop the software products for safety evaluation and technical-economical tools for maintenance of safety related npp components.

Important parameters of project :

The ageing management program and plant life extension is very important for every NPP operator.

- The goals of this project will give the results for technical arguments that ageing processes of safety related components are maintained, and that NPP operator have all tools for evaluation of systems degradation before their malfunction.
- The minimum of planned PLEX is 10 years.
- All planned activities create the complex, being prepared on the base of world experience and information regarding the ageing management.
- The project itself divided into couple of subtasks

Task 01:

The research and analysis of ageing mechanisms

The planned results are:

- The creation of database of safety related systems and components
- To explore the dominant degradation processes and related critical parts.

Task 02:

The ageing management programmes

The planned results are:

- The creation of methodology and tools for evaluation of safety related parts from their end of life point of view.
- The optimisation of input data database for individual components, for setting the trends of spent life-time and for corrective measures to maintain the ageing processes.

Task 03:

The research of improved systems for degradation processes monitoring

The planned results are:

- The state of the art monitoring systems implementation in the diagnostic of ageing processes.

Task 04:

Legislation for ageing management programme

The planned results are:

- To prepare the legislation for ageing management programme with aim for PLEX of NPP units.

Task 05:

Database of ageing management programme

The planned results are:

- Input and output data and criteria specification for existing database improvement used for life-time evaluation of safety related systems.

Task 06:

Evaluation of efficiency conditions for PLEX of NPPs

The planned results are:

- The technical-economical tools preparation for proper management and decisions in the ageing process.

Task 07:

Legislation conditions for licensing process of NPP after planned life-time

The planned results are:

- The development of validated software methods related to ageing management processes implementation for NPP safe operation during standard and emergency regimes (conditions).

CONCLUSIONS

- **EXISTING GENERALLY OBLIGATORY LEGAL REGULATIONS ASSUME A POTENTIAL PLANT LIFE EXTENSION**
- **IMPLEMENTATION OF AGEING MANAGEMENT PROGRAMME IS PRECONDITION FOR NPPs LIFE EXTENSION**
- **NRA SR SAFETY GUIDELINES ON“NUCLEAR POWER PLANT AGEING MANAGEMENT“ PROVIDE METHODOLOGY FOR IMPLEMENTATION AND UTILISATION OF AMP**

APPROACHES TO LONG TERM OPERATION IN UKRAINE

S.Bozhko
State Nuclear Regulatory
Committee of Ukraine

First Meeting of the Working Group 1 on General Long Term Operation Framework
13-15 January 2004, Vienna
Extrabudgetary Program on Safety aspects of long term operation
of pressurized water reactors

CONTENS

- List of Ukrainian NPP
- LEGAL BASIS
- SAFETY GUIDLINES
- CONCLUSION

List of Ukrainian NPPs

Name of NPP	Number of the unit	Electric Output, MWe	Reactor Installation Type	Commissioning Date
Zaporizhzhya NPP	1	1000	V-320	October 1984
	2	1000	V-320	July 1985
	3	1000	V-320	December 1986
	4	1000	V-320	December 1987
	5	1000	V-320	August 1989
	6	1000	V-320	October 1995
South Ukraine NPP	1	1000	V-302	December 1982
	2	1000	V-338	January 1985.
	3	1000	V-320	September 1989
Rivne NPP	1	440	V-213	December 1980
	2	440	V-213	December 1981
	3	1000	V-320	December 1986
	4	1000	V-320	Unit under construction
Khmelnitsky NPP	1	1000	V-320	December 1987
	2	1000	V-320	Unit under construction

LEGAL BASIS

The requirements of the Article 14 Law of Ukraine «On Permissive Activity in the Nuclear Power Field» 2000

- The term of license validity shall be determined in accordance with the envisaged validity term, foreseen by the documents submitted, of relevant stage of service life cycle of nuclear facility.
- During the validity term of license the state regulatory authority of nuclear and radiation safety can introduce changes. One of the grounds to introduce changes into the license is the prolongation the validity term of license.

The requirements of the Article 33 of the Law of Ukraine "On the use of nuclear energy and radiation safety" 1995

- "An operating organisation shall, from time to time and in accordance with nuclear and radiation safety regulations, rules, and standards, re-assess nuclear installation safety and submit the reports thereof to the governmental nuclear and radiation safety regulatory agency."

SAFETY GUIDLINES

The requirements of Par. 3.18 RD 306.1.02./1.034-2000 "General Provisions of safety assurance of NPPs":

- "An operating organisation within the terms stated by governmental nuclear and radiation safety regulatory agency but not less than once in 10 years shall re-assess nuclear power units safety and report to government nuclear and radiation safety regulatory agency. By the results of nuclear power unit safety re-assessment the margins and conditions of the future operation are defined.

  The decision on the prolongation of operational life of NP unit over the period established by the design can be taken only on the basis of the results of a safety re-assessment".

”General requirements on the extension of NPP operation beyond its design lifetime”
(working name)

The mains task of this document is following:

- ***to define the conditions for operation beyond the “original design lifetime”***
- ***to define the basis requirements for Ageing Management Program***
- ***to establish a procedures for the renewal of license***

“Requirements for Safety Re-Assessment of NPP Units in Ukraine”(Periodic Safety Review)

The main task of this document is following:

- **to define the main objectives and the goal of PSR**
- **to establish PSR procedure**
- **to establish methodology of PSR**
- **to determine fields of analysis of PSR**

CONCLUSION

A PSR is part of the regulatory system of Ukraine. It is a key regulatory instrument for maintaining the safety of plant operation in the long term and for addressing requests by licensees for authorization to continue plant operation beyond an established licensed term. The PSR provides reassurance that there continues to be a valid licensing basis, with plant ageing, modifications made to the plant and current national and international safety standards taken into consideration.

National Nuclear Energy Generating Company

The current position on LTO of Ukrainian NPPs

M.Zaritsky,
Chief of Department

To be presented on first Meeting of the Working Group 1 on General Long Term Operation Framework Vienna, IAEA, 13 to 15 January 2004

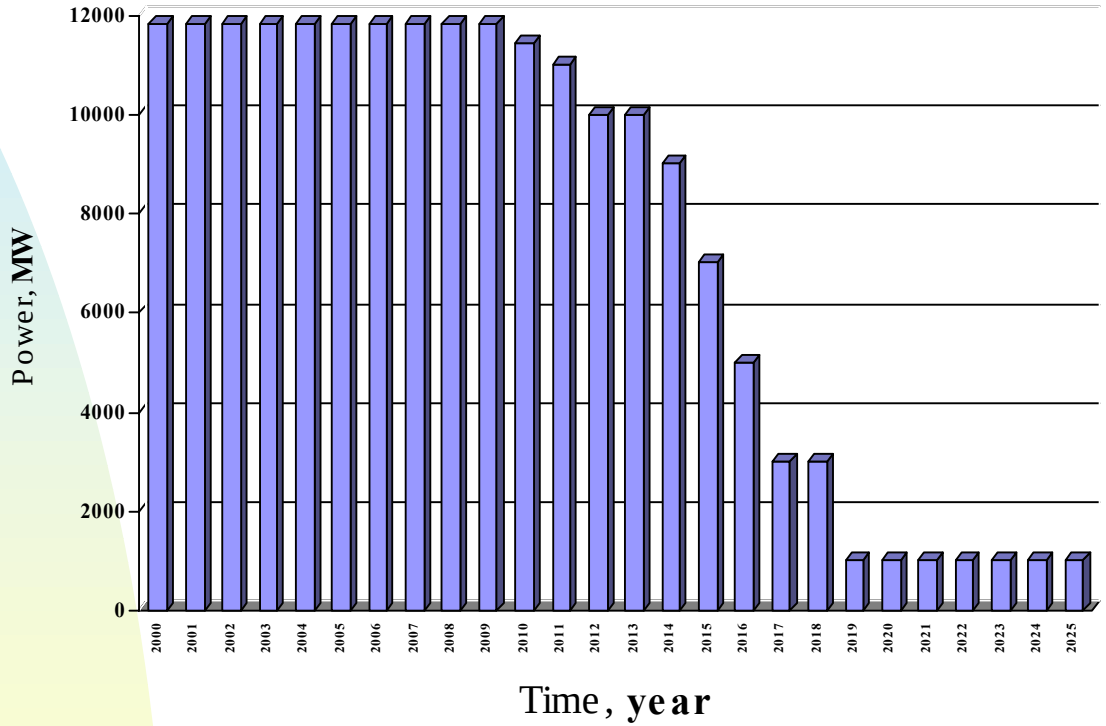
Contents

1. The status of nuclear power of Ukraine
2. The basic documents
3. The baselines and results of activity
4. Conclusions

The status of nuclear power of Ukraine (1)

NPP, unit	Type of reactor facil-ity	Power, MW	Date of commis-sioning	Date of de-commissining according to the project
NPP Rov-1	**WWER-440/B-213**	**416**	**31.12.80**	**2010**
NPP Rov-2	**WWER -440/B-213**	**416**	**30.12.81**	**2011**
NPP SU-1	**WWER -1000/B-302**	**1000**	**22.12.82**	**2012**
NPP Zap-1	**WWER -1000/B-320**	**1000**	**10.10.84**	**2014**
NPP SU-2	**WWER-1000/B-338**	**1000**	**06.01.85**	**2015**
NPP Zap-2	**WWER-1000/B-320**	**1000**	**02.07.85**	**2015**
NPP Zap-3	**WWER-1000/B-320**	**1000**	**10.12.86**	**2016**
NPP Rov-3	**WWER-1000/B-320**	**1000**	**24.12.86**	**2016**
NPP Zap-4	**WWER-1000/B-320**	**1000**	**24.12.87**	**2017**
NPP Hm-1	**WWER-1000/B-320**	**1000**	**31.12.87**	**2017**
NPP Zap-5	**WWER-1000/B-320**	**1000**	**31.08.89**	**2019**
NPP SU-3	**WWER-1000/B-320**	**1000**	**20.09.89**	**2019**
NPP Zap-6	**WWER-1000/B-320**	**1000**	**19.10.95**	**2025**

The status of nuclear power of Ukraine (2)



The status of nuclear power of Ukraine (3)

Long term operation is:

- The most significant tendency of the present-day development of nuclear power (experience of the USA, Russia and other countries)
- The most effective course of putting up funds for the preservation of generating supplies

The importance and the priority of the baseline on LTO is determined in “The Conception of development of National Nuclear Energy Generating Company “Energoatom” for 2003-2008”

The basic documents (1)

- The law of use of atomic energy
- The norms and regulations in nuclear power
  - “General Provisions of safety assurance of NPPs” NP 306.1.02. /1.034-2000
  - “The rules of safe exploitation of equipment and pipelines of NPPs”
  - “The basic positions of LTO of power-generating unit” (in progress)
  - “Requirements to PSR” (in progress)
- The state standards of equipment reliability
- The methodical documents of the reassessment of lifetime of NPP equipment

The basic documents (2)

The principal possibility of LTO of NPP units is permitted by the "General Provisions of safety assurance of NPPs": NP 306.1.02. /1.034-2000":

- ***The decision on the prolongation of operational life of NP unit over the period established by the design can be taken only on the basis of the results of a safety re-assessment".***

The baselines and results of activity (1)

Ensuring of reliable and safe exploitation of units in over planned period is the difficult complex task:

- Modernization and reconstruction
- Raising of safety level
- Assessment of remaining life of elements
- Replacement of equipment

There is a realization of complex of measures in NPP, determined in state and branch programs.

The baselines and results of activity (2)

“The program of modernization and safety raising of NPP units”
(approved by Decree of Cabinet of Ministers of Ukraine)

•Elimination of deviations (discrepancies) in the setting project from requirements of normative documents currently in force in Ukraine;
•Raising of reliability of systems, equipment and elements, that are important for safety;
•Realization of recommendations of IAEA experts on safety raising of NPP and taking into consideration the foreign experience.

As a result of program application, in addition to raising of projected safety; the considerable part of equipment, which has already exhausted its life, will be replaced by much modern.

The baselines and results of activity (3)

“The comprehensive program of organizing and technical measures for the prolongation of operational life of NPP units (for the period of 2003-2010)”

- The structure organizing of management and scientific-technological support for prolongation of operational life of NPP units;
- Development of technical documents providing work according to requirements of regulatory authority;
- Preparation of technical-economical calculations of costs for prolongation of operational life of NP units in period of time till 2025;
- Development and starting of realization of Aging Management Program.

The baselines and results of activity (4)

Deterministic analysis of NPP safety is accomplished with attracting of Ukrainian specialists and foreign experts. The revealed safety problems are divided according to the importance and priorities of their realization.

Probabilistic safety analysis of pilot NPP units is accomplished for the present day; reports are prepared.

The fulfilled probabilistic safety analysis give a possibility to optimize the planning of realization measures for safety raising.

The baselines and results of activity (5)

The document on the organization of special divisions on prolongation of operational life of NPP is developed.
Special divisions with the fixing of certain functions and responsibilities is created on each NPP.

The preliminary technical-economical calculation of costs for prolongation of operational life of NPP is being developed.
(The term of finishing - February 2004).

The schedule of development of methodical documents on assessment of SSC residual life is authorized.
(In total 24 techniques will be developed; 8 are at the development stage).

The baselines and results of activity (6)

"**The comprehensive program of Aging Management"** is being developed. This document is basic organizing-technical document on prolongation of operational life of NPP. On base of document will be prepared and applied AMP in NPP units.
(The term of finishing - 2004).

The special lists of SSC of pilot units for assessments of technical state and residual life are developed.

In the period of planned pilot units stop in 2004 the works on assessment of SSC possibilities of further operation or replacement are started.

The baselines and results of activity (7)

Technical Co-operation (TC) Program IAEA UKR/4/013, "Nuclear Plant Lifetime Management in Ukraine" is realized in Ukraine.

In 2003 the 3 missions of IAEA experts took place.
(2 in Kiev and 1 on RovNPP)

The activity of National Nuclear Energy Generating Company "Energoatom" for prolongation of operational life of NPP is considered and the according recommendations are given.

Three working meetings for issues of AMP introduction on units and methodic of assessment of SSC residual life are planned for 2004.

Conclusions

The decision on the prolongation of operational life of NP unit over the period established by the design can be taken only on the basis of the results of a safety re-assessment".

The baseline activity are:

- Modernization and reconstruction
- Raising of safety level
- Assessment of remaining life of elements
- Replacement of equipment

There is a realization of complex of measures in NPP, determined in state and branch programs.

.

In the period of planned pilot units stop in 2004 the works on assessment of SSC possibilities of further operation or replacement are started.

U. S. License Renewal Process

P. T. Kuo, Program Director
License Renewal and Environmental Impacts
U. S. Nuclear Regulatory Commission

IAEA EBP Working Group 1
January 13-15, 2004

USNRC License Renewal Process

- Background and overview
- License Renewal Rule (Rule)
- Guidance Documents
  - Generic Aging Lessons Learned (GALL) Report
  - Standard Review Plan for License Renewal (SRP-LR)
  - Regulatory Guide 1.188
  - NEI 95-10
  - Interim Staff Guidance
- Summary

What is License Renewal?

- Atomic Energy Act of 1954
  - 40-year license to operate
  - Allows for renewal
- License Renewal Rule allows new license to be issued to operate for up to 20 years beyond the current term
- Application submittal requirements
  - Not earlier than 20 years before expiration of current license
  - Not later than 5 years before expiration of current license for timely renewal provisions

Significant Commission Determinations

- Existing regulatory process is adequate for ensuring safety of operating plants
- Current licensing basis (CLB) is adequate and carries forward into the period of extended operation
- Issues relevant to the current operation of plants will be addressed by the regulatory process, which will carry forward into the period of extended operation.

License Renewal Regulations

- Safety Review of Renewal Application
  - Safety Evaluation
  - Hearing Opportunity
  - Advisory Committee on Reactor Safeguards (ACRS) review
  - Inspection Verification
  - Commission approval
- Environmental Impacts of Renewal Application
  - National Environmental Policy Act (NEPA)

Principles of License Renewal

- The regulatory process is adequate to ensure that the licensing bases of all currently operating plants provide and maintain an acceptable level of safety, with the possible exception of the detrimental effects of aging.
- Plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

Scope of the License Renewal Rule

- Safety-related systems, structures and components relied upon to:
  - Maintain integrity of the reactor coolant pressure boundary
  - Ensure capability to shut down and maintain a safe shutdown condition
  - Prevent or mitigate offsite exposures comparable to 10 CFR part 100 offsite dose analyses for siting
- Nonsafety-related systems, structures and components whose failure could prevent safety-related function as outlined above

Scope of the License Renewal Rule

- Systems, structures and components relied upon for compliance with regulations:
  - Fire protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Pressurized thermal shock (10 CFR 50.61)
  - Anticipated transients without SCRAM (10 CFR 50.62)
  - Station blackout (10 CFR 50.63)

Integrated Plant Assessment (IPA)

- Identify and list structures and components subject to an aging management review (AMR)
- Describe/justify methods to identify structures and components subject to an AMR from those systems, structures, and components within the scope of the rule
- Demonstrate effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation

Time-limited Aging Analyses (TLAAs)

- Definition
  - Involve systems, structures and components within the scope of the rule (not limited to passive and long-lived),
  - Consider the effects of aging,
  - Involve time-limited assumptions defined in the current operating term,
  - Determined by licensee to be relevant in safety determination,
  - Involve conclusions related to performance of intended functions, and
  - Contained or incorporated by reference in CLB

TLAAs (continued)

- Applicants are required to provide a list of TLAAs in the LRA
- The TLAAs demonstrate that
  - Analyses remain valid for the period of extended operation,
  - Analyses have been projected to the end of the period of extended operation, or
  - Effects of aging on the intended functions will be managed during the period of extended operation

Other Requirements of the License Renewal Rule

- Final Safety Analysis Report (FSAR) Supplement
  - Summary description of the programs and activities for managing the effects of aging and evaluation of TLAAs
- Technical Specification Changes
  - Changes and their justification necessary for managing the effects of aging during the period of extended operation

Environmental Report Supplements

- Environmental Rule amended in 1996
- Included the results of a License Renewal Generic Environmental Impact Statement (GEIS)
- Resolved 69 of 92 environmental impacts identified for license renewal
- 23 environmental impacts to be addressed on a plant-specific basis

Standards for Issuance of Renewed License

- Actions have been or will be taken to
  - Manage the effects of aging during the period of extended operation on the functionality of structures and components
  - Evaluate TLAAs that required review
- Reasonable assurance that activities authorized by the renewed license will continue to be conducted in accordance with the CLB

GALL Report

- Catalog of generic aging management evaluations
  - Builds on previous aging studies
  - Reviews aging effects
  - Identifies relevant aging programs
  - Evaluates program attributes to manage aging effects
- Evaluation Conclusion
  - Program is adequate and no further evaluation is needed, or
  - Program should be augmented or new program considered

GALL Report (continued)

Table of Contents

- Chapter I Application of ASME Code
- Chapter II Containment Structures
- Chapter III Structures and Component Supports
- Chapter IV Reactor Vessel, Internals, and Reactor Coolant System
- Chapter V Engineered Safety Features
- Chapter VI Electrical Components
- Chapter VII Auxiliary Systems
- Chapter VIII Steam and Power Conversion System
- Chapter IX Not Used
- Chapter X Time-Limited Aging Analyses
- Chapter XI Aging Management Programs
- Appendix Quality Assurance for Aging Management Programs

Standard Review Plan (SRP-LR)

- Guidance is consistent with NUREG-0800 Format
- Includes guidance for the following review sections
  - Areas of Review
  - Acceptance Criteria
  - Review Procedures
  - Evaluation Findings
  - Implementation
  - References

SRP-LR (continued)

- Provides staff guidance in reviewing license renewal applications
- References GALL report for generic aging evaluations
- Focuses on areas where programs should be augmented
- Incorporates lessons learned from initial license renewal reviews

Program Attributes (SRP-LR, Section A.1)

- Scope of program
- Preventive actions
- Parameters monitored or inspected
- Detection of aging effects
- Monitoring and trending

Program Attributes (continued)

- Acceptance criteria
- Corrective actions
- Confirmation process
- Administrative controls
- Operating experience

Regulatory Guide 1.118 & NEI 95-10

- RG 1.188 endorses NEI 95-10, Revision 3, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule”
- NEI 95-10 provides guidance to applicants in preparing their license renewal applications
  - Standard format of license renewal application
  - Active/passive component determination table (Appendix B to 95-10)
  - Consistency with other license renewal guidance documents

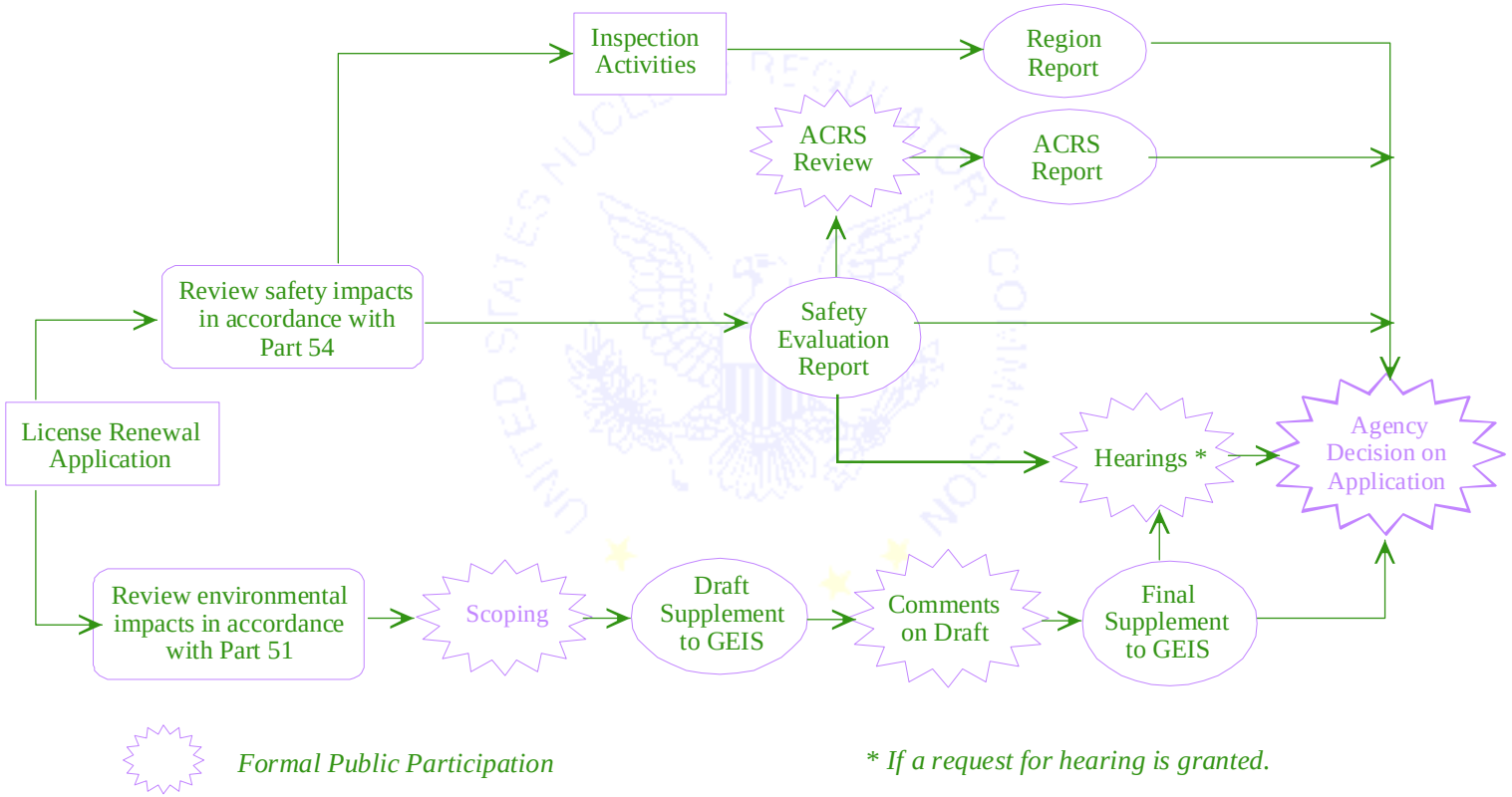
Interim Staff Guidance (ISG)

- Provides guidance on generic, technical issues that emerge between revisions of the license renewal guidance documents
- Contain guidance that current or future applicants need to address
- May have to be addressed by licensees with renewed license
- Currently:
  - 5 ISGs approved
  - 15 (roughly) ISGs in review
- Approved ISGs are available on the NRC web site

ISG Process

- Provides a structured approach to developing interim staff guidance
- Allows for stakeholder input
- Addresses implementation for future and current applicants
- Addresses FSAR update for newly identified information for plants with renewed licenses

License Renewal Review Process



License Renewal Review Process Logistics

- Review Schedule:
  - 30 months with hearing
  - 22 months without hearing
  - 585 days to complete the safety evaluation report and environmental impact statement

Summary

- License renewal is a proven option for meeting power demands while maintaining public health and safety
- Stable and predictable
- Allows for public scrutiny and participation
- Meets agency goals of
  - Maintaining public health and safety
  - Enhancing public confidence
  - Increasing effectiveness and efficiency
  - Reducing unnecessary regulatory burden

IAEA EBP on Safety Aspects of Long Term Operation of Pressurized Water Reactors,

First Meeting of WG 1, Vienna 13 – 15 January 2004.

Radelina Tranteeva, Kozloduy NPP

KOZLODUY NPP

Status. Modernization Programs and Evaluation of Rest Life Time

KNPP Units 3 & 4

KNPP operates four WWER-440 reactors, commissioned 1974 – 1982, and two WWER-1000 reactors commissioned 1987 - 1991. On a decision of the Government of Bulgaria Units 1 and 2 were shutdown on 31.12.2002 and brought into Status "E" in conformity of the Technical Specifications. The power station used to produce up to December 2002 more than 45% of the country's electricity**.**

Unit	Reactor type	Start of operation	Current fuel cycle	Expected end of 30th fuel cycle
Unit 1	WWER-440/V 230	Oct. 1974	Shut down in 2002 /23	-
Unit 2	WWER-440/V 230	Nov.1975	Shut down in 2002/24	-
Unit 3	WWER-440/V 230*	Dec. 1980	19	2015
Unit 4	WWER-440/V 230*	Jun. 1982	18	2016
Unit 5	WWER-1000/V 320	Nov.1987	10	2024
Unit 6	WWER-1000/V 320	May 1991	9	2025

Although Units 3&4 have been traditionally referred to as WWER-440/B-230 model, in their original design there are number of important differences from a standard B-230 model, which makes them closer to B-213 design. Those include a cladded pressure vessel, a functional capability of the safety systems, (3 X 100%, high pressure-low pressure injection), emergency control room, etc.

UNITS 3 AND 4 - IMPROVED DESIGN

Safety systems equal to V-213

- **Three safety systems channels (HPIP, LPIP, SP, EFWP, two SWP, DG, ESFAS)**
- **Simultaneous start of all pumps in one safety channel in case of ECCS actuation signal**

The safety improvement activities at KNPP started in 1991 with the implementation of the three stage "**Short term program for safety upgrading"(STP)** realized in close cooperation with IAEA, RISKAUDIT, BNSA, GIDROPRESS and Western reactor organizations. The realization of the **STP** between 1991 and 1997 resulted in implementation of more than **800** upgrading measures, which decreased the number of deviations in both the original design and operational safety from the requirements of current standards. In the process of in-depth safety analysis for defining current level of safety a set of specific measures was defined and unified in the **"Complex modernization program"(CMP) for units 1-4 – PRG'97**.

The version **PRG'97/A** of the CMP was created in 1999 and focused on providing adequate reliability of barriers under accident conditions corresponding to all initiative events, on implementation of additional measures to improve reliability of the plant structures, systems and components, and on providing hardware and software for severe accident management to enhance the overall plant safety level.

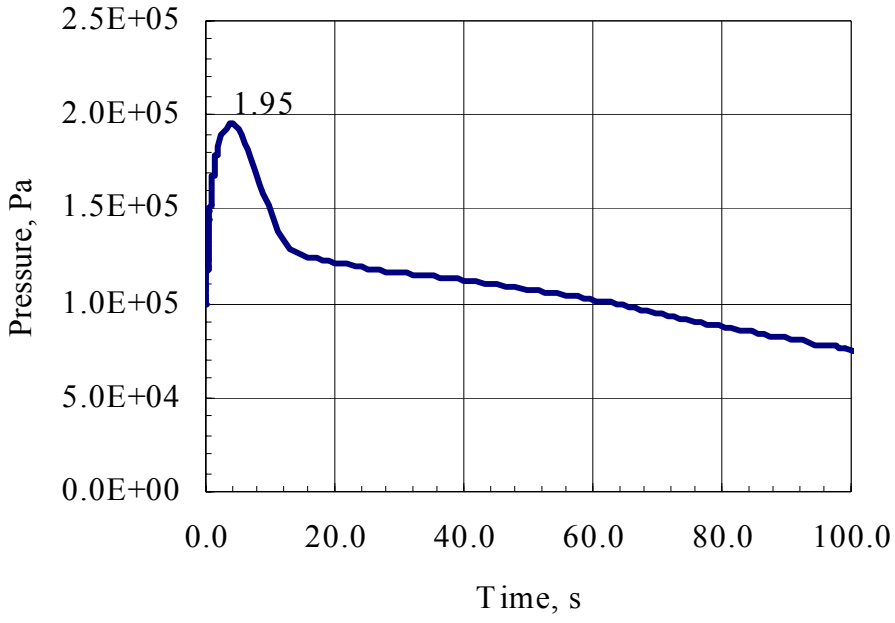
Considering the inherent safety features of WWER 440 plants and taking advantage of both the specific original design features of KNPP 3&4 and the considerable improvements implemented in the past, in September 2000 KNPP launched the Project PR-B-209M as the last version of the CMP that was aimed at upgrading the original design basis according to international safety practice. This project has been successfully completed.

KNPP 3&4 modernization programs:

Three Stage Short Term Program 1991-1997 – 800 improvements
Complex Modernization Program (CMP) 1997-2002 – 500 improvements
Final goal of the CMP – Upgraded Design Basis – reached in 2002

KNPP let continuously peer review its safety improvement activities by competent experts of national and international organizations to update the proposed measures. This was well reflected in the various stages of both the **STP** and the **CMP**. Owing to this fact, **the spectrum of upgrading measures covers the whole range of safety concerns for pressurized water reactors required by the current safety standards and international safety practice**.

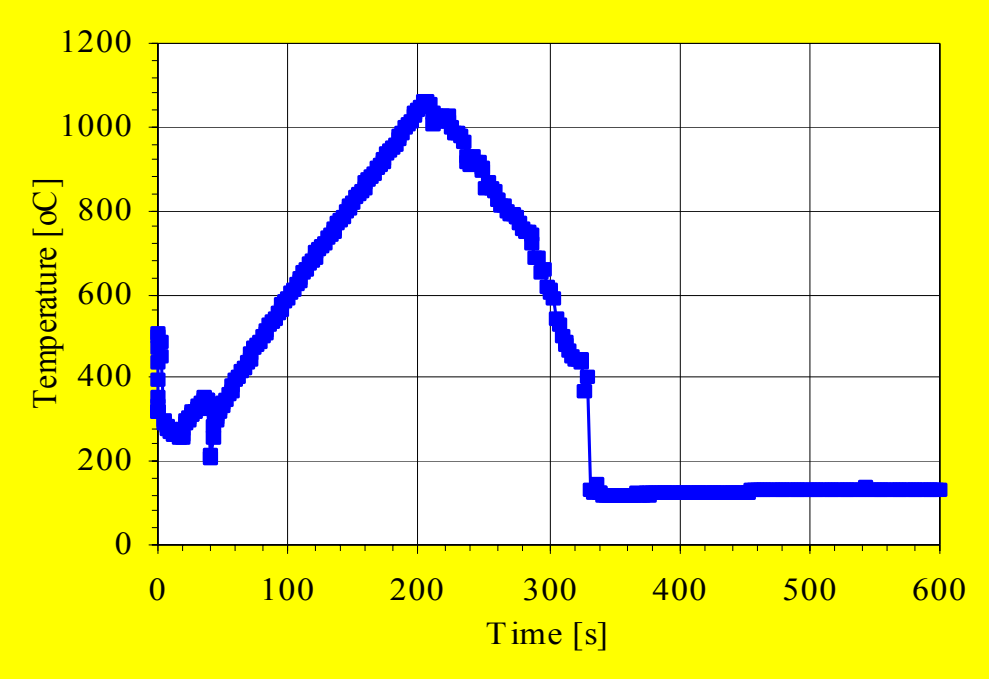
Strengthening the confinement was one of the most important tasks. The installation of the Jet Vortex Condenser assures structural integrity after all RCS breaks including 500 mm break. Confinement leak tightness was significantly improved and radiological requirements are fulfilled for all postulated events.



Pressure in KNPP 3&4 confinement after LB LOCA does not exceed the design limit of 200 kPa

The confinement is under process to be provided with two systems protecting its integrity even in the case of a severe accident – a System of Hydrogen Recombiners, to prevent the explosion hazard and Filter Venting System to prevent uncontrolled leakeges.

Plant safety systems are proved to be able to cope with a 500 mm pipe break. Years of experience has shown that the reactor shutdown does not provoke sequential loss of off-site power. This has been taken into account in safety
analyses, which proved that the maximum cladding temperature after accident does not exceed the limit 1200 C .



Temperature of fuel cladding after LB LOCA remains below the limit of 1200 °C

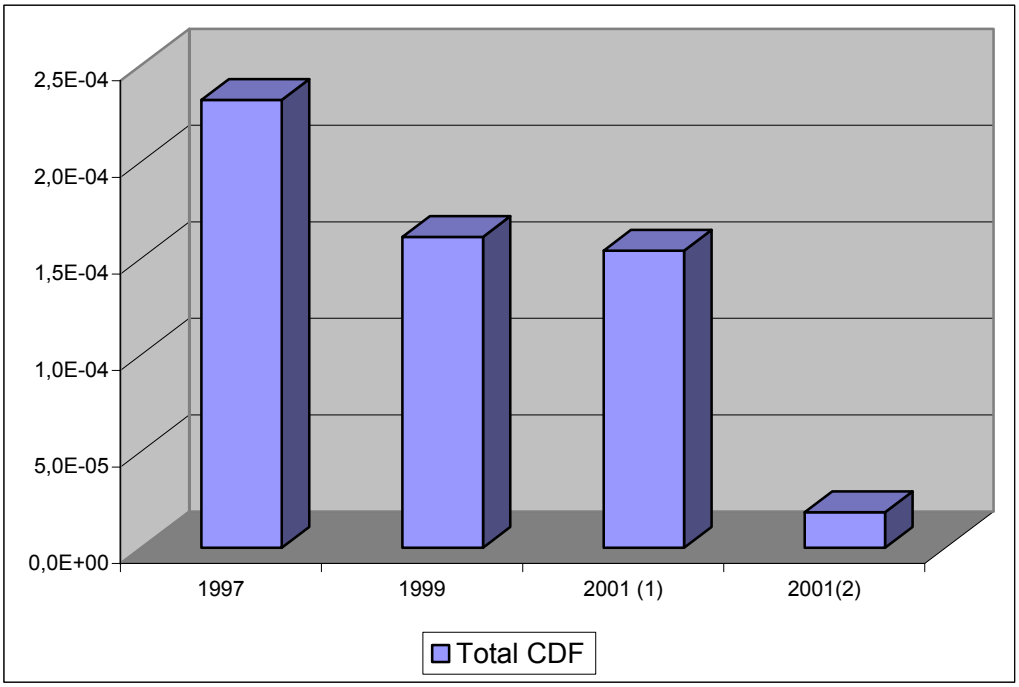
The defence in depth concept of fire protection was achieved in all levels. Fire risk analysis was completed, fire fighting systems reconstructed, new fire detection systems installed and qualified for accident conditions. The present status fully reflects current safety international practice.

Core Damage Frequency due to fire:

Original design: once in 15 000 years

After upgrading: once **in 250 000 years**

PSA for KNPP 3&4 was periodically performed in parallel to the modernizations implementation. The **Core Damage Frequency** has been reduced to 1.6E-05/year – which includes internal events, seismic and fire hazards. That is nearly an order of magnitude better than the international target for operating plants set by IAEA INSAG at 1E-04/year.



KNNP 3&4 Core damage frequency –1.6E-05

Opinions of IAEA on KNPP 3&4 achievements in safety upgrading

Issue	IAEA opinions, 28 June 2002
Cooling the fuel in normal/transient conditions	"Addressed even ***beyond initial expectations"***
Cooling the core in all conditions	"Defense in depth going ***beyond initial expectations*** in cases"
RPV integrity and RPV rest lifetime	"Assured for ***safe operation*** at least until design lifetime"
3 independent leak detection systems	***"Fulfill standard regulatory requirements"***
Reactor heat removal to the ultimate heat sink	"Improved even ***beyond the initial recommendations "***
Common cause failures	"***High level of reliability in all plant conditions "***
Scope of analysis in Safety Analysis Report	***"Goes beyond the usual scope*** required by US and IAEA"
All areas dealing with operational safety	***"High quality standards*** observed"
Control room staff attitude	"Professionalism and ***open and frank discussion"***
Approach to safety and quality	"The ***fundamental tool to maintaining plant safety"***

The modernization has resolved all IAEA safety issues [IAEA-TECDOC-640], the requirements of the Complex Program for Modernization, as well as the IAEA and WENRA missions' requirements.

Major safety improvements implemented at KNPP 3&4 include the following items:

- ***Complementary Emergency Feed Water System (CEFWS)***
- ***Enhancing redundancy, separation and qualification of equipment***
- ***Qualification of equipment***
- ***Reactor Pressure Vessel (RPV) strength.***
- ***Power Operated Relief Valves (PORV)***
- ***Leak-Before-Break (LBB)*** *System.*
- ***Reactor Trip System (RTS) upgrading***
- ***Main Control Room (MCR) and Emergency Control Room (ECR)***
- ***Emergency power supply upgrading***
- ***Elimination of common cause hazards***
- ***Improvement of the confinement –Jet Vortex Condenser***
- ***Leaktightness of the confinement was improved***
- ***Necessary upgrading of the secondary side systems and electric power***
- ***Intensive accident analyses***
- ***Fire protection has been strengthened***
- ***Seismic upgrading –buildings fully qualified for any of the expected seismic event***
- ***DBAs - LOCA 500 mm***
- ***Operational practice and improved housekeeping***
- ***PSA confirm the core damage frequency has been reduced to 1.6 10E-05/year***

Evaluation of **Rest Life Time (RLT)** of Kozloduy NPP units 3 & 4 was executed by a Consortium between Framatome ANP GmbH and Atomstroyexport, Russia. It comprises an evaluation of the residual service life of components/systems subject to acceptance by international experts, identifying the need for further investigations/calculations in certain cases, and finding solutions for improvements that achieve a consensus of safety and economy. The final phase of the project consists of generating an **Aging Management Program (AMP)** that permits detection, evaluation and mitigation of the relevant aging degradation mechanisms and identification of the plant locations where they are likely to occur. The project was finalized in June 2002 after duration of almost 2 years extensive work.

AMP was dedicated to all components and equipment relevant to safety and critical for the residual service life. It is part of the maintenance program of specific plant units.

As a conclusion of the RLT project was stated, that there are **no general problems that might effect the plant operation till the expected 30 years of operation** .

More of that, for the biggest part of the most-important components was found out that they could operate significantly longer – for 35 or 40 years without major interventions.

Fore enhancing the precision of the evaluation of the residual life time in the future, powerful tools like the aging management systems FAMOS, COMSY as well the Aging management data base (AMDB) were implemented for continuous follow–up process of RLT management, where:

- FAMOS – is the System for monitoring and calculation of the fatigue of the key components and pipelines in the confinement.
- COMSY – is the Conditions oriented computerized system for monitoring and prediction of the wall thickness due to erosion-corrosion phenomena of secondary pipelines, based on real working conditions – Loads, Water chemistry, etc.

KOZLODUY 5 & 6 – WWER-1000/V 320 MODERNIZATION PROGRAM

Before the **Modernization Program (MP)** for Units 5&6 was outlined and designed, implementation of some important **improvements** had started. The **most significant** of them are:

- Transition from two to three-year fuel life cycle;
- Development of a new fast method of checking fuel cladding tightness;
- Improvement of the dynamic stability of the units during transients, introduction of digital control in the automatic turbine governor system;
- Implementation of ultrasonic check of reactor internals and steam generator integrity;
- Updating of the Technological Regulations and the Safety Analysis Report (SAR) taking into account the operation experience;
- Full-scale training simulator for the plant staff.

The Units 5&6 Modernization Program was created in 1995. Its main purpose was to introduce improvements so that the modernized units would be able to meet any new international safety and reliability requirements towards the nuclear power plant and the full scope of improvement steps prescribed by the IAEA document "Assessment of the Safety Problems of WWER-1000 Model 320 Units".

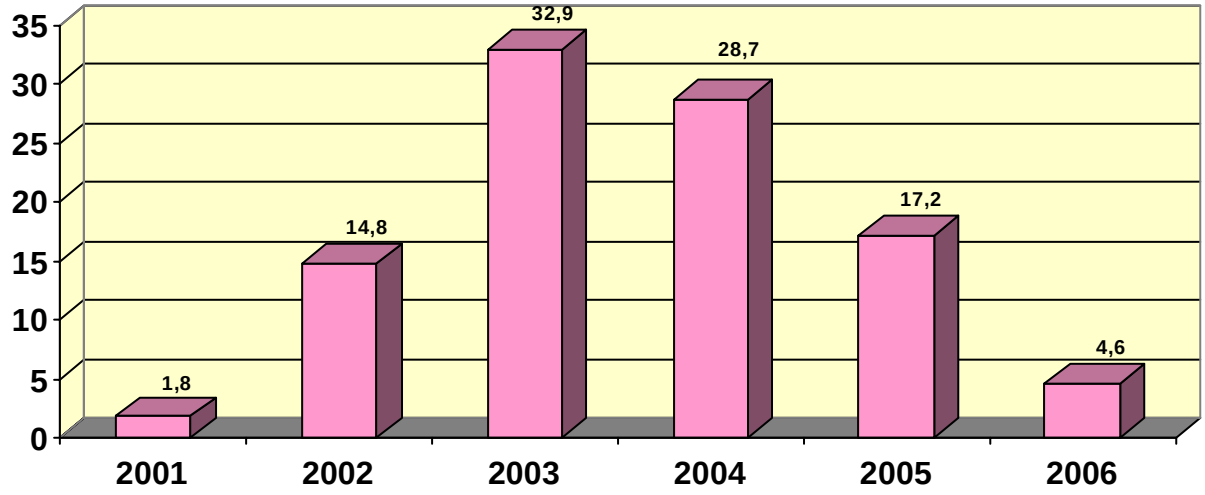
The Modernization Programe was organized as a set of 212 specific measures, distributed in 5 groups:

- Measures to improve the safety of Units 5&6 through implementation of new design solutions;
- Measures aiming at the validation of an adequate safety level by means of various analyses and additional studies in conformity with internationally adopted normative documents;
- Measures for safety upgrading through replacement of the equipment with expiring design life and of critical equipment.

- Measures to improve work efficiency and operating conditions;
- Measures related to preparation for equipment decommissioning. and delivery of the equipment, installation and tests, licensing and commissioning.

The scope of envisaged technical measures as well as the investments required for their implementation render the Units'5&6 Modernization Program the largest-scope current nuclear power project in Europe and in the USA. The funds for performance of the MP total 491M€. Out of that, about 135M€ is planned equity that Kozloduy NPP will invest into the MP, and about 356 M€ was raised through credit agreements with various credit institutions.

Thirteen technical measures were implemented in 2002 within the time of scheduled refuellings. In 2003 thirty one measures were implemented on unit 6 during the annual refuelling and the process will continue on unit 5 from March this year.



MP development was performed by experts from Kozloduy NPP, Energoproject plc, Risk Engineering plc and EDF taking into account the IAEA requirements.

The developed Program was reviewed twice by IAEA (in 1995 and 2000), and in 1997 it was subjected to independent expert evaluation by Risk Audit employing a team of specialists from IPSN and GRS International.

Having committed the best capabilities of European and USA nuclear power communities, proceeding from the most recent requirements in the Chief Design Engineer and IAEA regulatory documents, after completion of the Modernization Program, units 5&6 will definitely rank among the most reliable and safe nuclear facilities and it will be possible to extend their design life by 15-20 years beyond the design limits.

With the Modernization Programs of Units 3&4 and 5&6 and the Rest Life Time Analysis for units 3&4 KNPP has already undertaken activities towards Long Term Operation .