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

MINUTES OF THE PROGRAMME'S WORKING GROUP 1 SECOND MEETING

23-27 August 2004
Stockholm and Oskarshamn, Sweden

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/projects/salto .

The 2nd meeting of WG 1 was hosted at SIP office, Stockholm, Sweden, 23-27 August 2004. The purpose of the 2nd meeting of WG 1 was to:

- discuss the adequacy and completeness of the Country Information Reports (CIR) collected;
- identify additional information needed;
- agree upon and initiate the review process; and
- plan the reconciliation process.

In the frame of the meeting a visit to Oskarshamn 1 was organized 26-27 August 2004 including an overview of the plant modernization programme, plant tour and a tour of the spent fuel medium term storage facility.

The Agenda for the Meeting is provided in Appendix I. The list of participants is provided in Appendix II. and the presentations made during the meeting are provided in Appendix III.

2. MEETING SUMMARY

The meeting was opened by the chairman of WG-1, P-T Kuo (USNRC). He stressed the important role of WG-1 in the SALTO project and also necessary different style of its work in comparison with other WGs.
He recommended the vertical approach to be used (i.e. by chapter of CIR) for analysis of the similarities and differences in the legal framework for LTO in the participating count fries.

Mr. Kuo also mentioned that ftp folder, which was created by the IAEA, was not working properly and complicates the access to the uploaded working documents of the group, mainly CIRs of the WG-1.

The opening statement of the WG-1 chairman were followed by remarks of WG-1 secretary Z. Kriz. R. Havel, the Programme Scientific Secretary, summarized the current status of the Programme, and pointed out the expected outcomes of the 2nd WG 1 meeting.

2.1. National presentations

If was agreed that the presentations of CIRs will be performed section by section, to better focus the discussion and facilitate the comparison among participating countries. The information presented in CIRs can be summarized as follows:

BULGARIA

The legal framework for safe use of nuclear energy is in place: Atomic Act (ASUNE,2001) which is supported by set of 42 regulations and legal acts issued by BNSA-the regulatory body, Ministry of Health, Ministry of Interior, Ministry of Environment and the Government of Bulgaria. LTO is not explicitly mentioned in the above documents. The Russian regulations (OPB-88 and others) are a part of the legal framework. Bulgarian standards (BNS-EN) have no obligatory character, except the cases when these standards are specified. ISO standards are accepted as national. The most important is the regulation No 3 on nuclear safety of NPP during design, commissioning and operation. Design life time of units WWER 440 is 30 years and units WWER 1000 is 40 years. According to the Act the maximum licensing period for a nuclear facility is 10 years. Actual status of operating licenses for all units in Kozloduy site operated by the utility KNPP is the following:

- units 1/2 were shutdown in December 31, 2002
- units 3/4 received in 2003 operating licenses for 8 and 10 years respectively till the end of the design life (design life time is 30 years),
- units 5/6 received in 2003 licenses for the next 6 years –till 2009, a period that covers the end of the Modernization Program in 2006 and updating of FSAR/PSR etc.

The CIR contains detailed information regarding the safety upgrading programmes of units 3/4 (STP, CMP) and 5/6 (MP). The modernization programmes were reviewed by the IAEA and other organizations (RISKAUDIT, Gidropress) and the safety assessment concluded that it will be possible to extend the design life time by 15-20 years for units ¾ has to be shut down on the basis of governmental decision till the end of 2006.

The license conditions require the implementation of number of activities including the evaluation of rest lifetime and aging management program (AMP).

CZECH REPUBLIC

New Atomic Act issued in 1997 is supplemented by set of 15 regulations issued by the regulatory body – SÚJB. There is no specific regulation for the LTO. PSR have been adopted in 1991 on the basis of regulatory requirement which followed the IAEA recommendations (SG-012).

The first PSR in Dukovany NPP was performed in 1995-96 and the second PSR is planned to be performed in 2005-6. Maximum time for the operating license is 10 years. In 1996 the utility CEZ, which operates both Dukovany NPP and Temelin NPP, declared the long term goal to operate Dukovany NPP at least till 2025 (40 years) and Temelin NPP at least till 2045 (40 years). In the same year the regulatory body gave a principal statement regarding the licensing conditions for LTO.

In 2004 a working group for the PLEX/LTO supporting activities was established by CEZ which will use the results of ongoing activities (PLIM, AMP).

The safety modernisation programme MORAVA has been implemented since 1998 to 2007. The preparatory LTO activities will use the results from other relevant national and international programmes (IAEA, EU-VERLIFE, COVERS). The necessary prerequisites for LTO are being implemented (recovery of DB, PSR, CM, maintenance practices, EQ, QA programmes, in-service inspection and TLAA). The FSAR have regulatory update (OSAR) using RG 1.70 and PSA studies are available including living PSA and risk-monitor. For Temelin NPP, which was commissioned during 2001-3, the LTO activities will be initiated in 2007.

FINLAND

Atomic Act No 990/1987 and set of regulation creates the legal framework in Finland. Original safety requirements were based on US practice. Beside that the regulatory body – STUK issued a large set of YLV guides, which were recently revised to fit for modern plant. There is no specific regulation addressing LTO. Since 80-ties the regulatory practice in Finland was to issued the operating license for maximum 10 years. Since the beginning of operation the Loviisa NPP has been subject of safety improvement programmes. The operating organisation FORTUM identified as its main long-term goal the operation for 50 years. Four major elements of LTO preparatory activities are: SSC life management personnel and investment plans. All necessary activities for LTO are in progress(preventive maintenance, ISI, QA programmes, EQ ,updating of FSAR, use of PSA etc.).

HUNGARY

The legal framework consist of Atomic Act (1996) and Governmental decree (1997) on general rules for the regulatory body – HAEA. As appendices of Gov. decree the set of regulations was issued.

Upon the strategic decision of Paks NPP in 2000, the life extension up to 50 years was declared as long-term goal. The license for the operation beyond designed life-time (OBDL) will be issued in two-step process:

- licence in principle, which has applied for 5 years before the expiration of life-time and new operating license.
- new operating licence

- Besides the binding regulations, the regulatory body has been issuing non-binding guidelines which follows the structure of regulations. More than 10 guidelines were issued till now by HAEA.

In principle Hungary decided to follow the USNRC approach for the licence renewal (10 CFR 54). There is another legal prescription which requires that license has to perform PSR each 10 years and has to apply for license including the submission of prescribed documentation. Currently the PSR and LTO are overlapping each other, so the licensee has to submit application for licence renewal in 2007 and for the next PSR in 2008.

In the framework of the PSR, a number of activities related to LTO have been carried out (AMP for selected SSC, DB reconstruction, EQ, update of FSAR and application of PSA studies). Safety enhancement program – AGNES was performed within the framework of PSR. Hungary has IAEA national TC project oriented to LTO (HUN/4/014).

RUSSIAN FEDERATION

Atomic Act (1995) is supplemented by a set of regulations issued by the regulatory body-GAN (now FSAN). In accordance with governmental decree issued in 1997 the licensing of all NPPs in Russia was introduced. Original design life time was 30 years. Currently the license is issued for minimum 3 years. Part of the legal framework are federal norms and rules OPB-88/97 and PNAE-G-7, which assume the possibility of operation beyond life time.

The requirement (NP-017/2000) established requirements to be performed in order to prepare NPP for long term operation. In the Governmental decree (1998) on Programme of development of nuclear power industry for the period till 2010 the lifetime extension of existing NPPs in Russia is envisaged.

The life time extension process in Russia consists of two phases:

- preparatory phase (at least 5 years prior to expiration of the license) including comprehensive safety evaluation and technical economic study
- implementation phase

The regulatory body – GAN issued several guidelines for this process. On the basis of the above documents the operating organisation – Rosenergoatom will submit to the regulatory body required documents. About 50 procedures and working materials for the evaluation of ageing of selected SSC were elaborated. The design basis upgrading programmes are a part of the preparatory activities for LTO. Russia has IAEA national TC project oriented to LTO (RUS /9/003).

Till now three units received from GAN a licence to operate 5 years beyond design life-time (unit 4 of Novovoronezh NPP, unit 1 and 2 of Kola NPP) and several others unit prepare the similar application.

SLOVAK REPUBLIC

The legal framework of Slovakia consists of Atomic Act (1998) which is followed by a set of 14 regulations. Paragraph 16 of the mentioned Act is dedicated to LTO. Beside that the regulation No 318/2002 stipulates the necessary documentation for LTO and safety guide BNS I.9.2. of the Slovak regulatory body-UJD SR gives further detailed guidance regarding aging management.

Current status of operation licenses in Slovakia is the following:

Units 1/2 of Bohunice NPP will be shut down due to decision of Slovakia government in 2006, 2008 (they have license for 10 year from regulatory body ÚJD till 2009 and 2011).

Units 3/4 Bohunice NPP issued a safety analysis report in 1996 after 10 years of operation and achieved and operational license from regulatory body ÚJD till 2006.

Units 1/2 of Mochovce NPP were commissioned in 1998 and 1999 and have 10 years operation license.

The Slovak utility – SE, operating all six units, has an interest to operate units longer than design life-time 30 years. This has not been declared and approved officially yet because of some green-oriented citizen movements giving the statement that it is not possible to extend the lifetime. Continuing discussions are still necessary.

Units 1&2 of Bohunice NPP were during 90-ties substantially upgraded by means of upgrading programmes (U1/2-Small reconstruction, Gradual reconstruction). Units 3/4 are in a process of modernization, MOD V2, scheduled from 2001 to 2008.

Activities which are necessary prerequisite for future LTO application as maintenance practices, EQ, QA, ISI are in place. FSAR are periodically updated after period of 10 years and PSA studies are widely used. In many aspects the situation in Slovakia is very similar to the situation in the Czech republic.

SWEDEN

The main law in Sweden regulating nuclear safety is the Atomic Act (1956, which was several times amended in the last time in 1994. Other legal tools supplement the law: ordinances, decisions and licenses. Similarly as in Hungary and Slovakia the regulation of nuclear safety and radiation protection are separated (in majority of countries in the world these functions are joined).

The regulation in Sweden is non prescriptive through regulations 'SKIFS'. The main effort of the regulatory body SKI is oriented on continuous evaluation of nuclear safety on the basis of state of the art knowledge. All NPP in Sweden (located on 4 sites) have to comply with requirements of Technical Specifications such as: strengthening of defence – in – depth, maintenance practices, EQ, QA practices, updating of FSAR (ASAR) and application of PSA studies. The PSRs were introduced in Sweden for 10 years period. All units performed the first cycle of PSR already and some of therm also the second cycle. Only one unit (Basveback 1) was shut down on the basis of a governmental decision, all others are realising all necessary measures with the aim to transfer to LTO. The visit of Oskarshamm 1, which is the oldest unit in Sweden fully, confirmed this trend.

UKRAINE

The legal framework of Ukraine consists of Atomic Act (1995) and set of regulation issued by the regulatory body – SNRCU. The most important requirements regarding nuclear safety is NP 306-2000, which is similar to Russian OPB and contains requirements regarding to EQ, QA, ISIS, SSC classification. Safety enhancement activities has been mostly based on IAEA recommendations (issue book) and were realised with assistance of IAEA (TC projects) and EU (TACIS) but with delays due to financial problems.

The licensing practice was introduced in Ukraine in late 90-ties for all units and licences are issued for the rest of life cycle. In 1998 pilot FSAR for all types of VVER units were elaborated according to the RG 1.70.

Under the requirement of OPB (para 3.18.) the PSR are preformed after 10 years of operation using IAEA recommendations.

By the Governmental decree in 2004 the programme was established for LTO for all Ukrainian NPPs. Utility NNEGC Energoatom, which operated all units started preparation of the programme (methodologies, working plans) enabling to extend the design life time up to 10-20 year. The proposed AMP will be developed with assistance of IAEA national TC project UKR/4/013.

USA

The legal framework for the safe regulation of nuclear activities is created by Atomic Act (1954) as amendedand by requirements stipulated by 10 CFR 50, Regulatory guides, industrial standards (ASME), ACI, AISC and others official documents.

On the basis of economional considerations the design life time in USA is stipulated by 40 years. With the aim to enable license renewal (LTO) the licence renewal rule 10 CFR 54 was issued by the US regulatory body – NRC in 1991. This rule defines all conditions of licence renewal process (scope, documentation, regulatory review etc.). Set of guidance documents was issued particulatory Generic Aging Lessons Learned (GALL) report, Standart review plan for license renewal (SRP-LR), Regulatory guide 1.188, and Interview staff guidance. The Nuclear Energy Institute (NEI) issued guidance documents for utilities.

Time for license granting is 22 months (without public hearing) and 30 months (with public hearing).

On the basis of significant NRC determinations that-existing regulatory process is adequate for ensuring safety of operating plants – current licensing date base is adequate for further operation – issues relevant to the current operation will be addressed by the regulatory process the license renewal scope is focussed to:
- safety related systems a components (pressure boundary, shut down of reactor and prevent or mitigation of off site consequences
- non-safety related SAC which can adversely influence safety functions
- SSC relied for compliance with five regulations (10 CFR 50, 48,49,61 and 63)

Due to the fact that USA have the highest number of reactor units in operation-104, which are operated by about 40 different utilities, the licence renewal process is standardised.

The requirements for variuos activities related to licence renewal are subject of the following legal requirements:

- maintenance practices (10 CFR 50.64-1996)
- environmental qualification (10 CFR 50.49)
- quality assurance (10 CFR 50, App. B)
- FSAR update (10 CFR 50.59)

- in-service inspection (ASME 11)
- time limited ageing analyse (10 CFR 54.21)

License renewal process has been successfully running since 2001 (?). Till now: 26 licence renewal were issued by NRC, 15 applications for LR were submitted and about ten applications are expected.

2.2 Country Information Reports

The presentation of CIR and following discussion confirmed that CIR need to be supplemented according to the proposed Member's input to information collection (WG-1 – General LTO framework). It is also necessary to provide all references of legal and other documents which create general framework to LTO. If was agreed that the supplement will be prepared as the first step of further working process of WG-1

2.3 Discussion of the review process

The proposal of the chairman of WG-1 P-T. Kuo was accepted by the WG-1 that the review will be performed using a 'horizontal' approach. Four sub-groups were created with the aim to facilitate the in-depth review and discussion. Each sub-group will review bellow indicated sections of all CIRs prepared in the frame of the WG 1 activities:

- SG 1 (Russia, Ukraine) 2.5, 2.6, 5.0
- SG2 (Czech. republic, Slovakia) 2.3, 2.4, 6.0
- SG3 (Bulgaria, Hungary) 2.2, 2.7, 4.0
- SG 4 (Finland, Sweden) 2.1, 1.0, 3.0

Each sub-group will develop a review report covering the allocated sections of all CIRs. The WG leader and secretary will consolidate the 4 sub-groups review reports into a WG review report that will address the whole WG 1 scope.

During the discussion of the further WG-1 working process it was stressed that it is necessary to have sufficient time for supplementing the existing CIR and for the detailed review process. For the above reasons it was agreed that the 3rd meeting of WG-1 should be held in spring 2005. P.T. Kuo offered that the meeting can be held in USNRC pending the official approval of NRC. This possibility will be confirmed asap to the members of WG-1.

2.4 Visit of Unit 1 of Osharshamm NPP and interim spent fuel storage CLAB

The hosting organization SKP-SKI organized one-day visit to Oskarshamn site, where 3 units are located. The visit was focused on unit 1 which is the oldest unit in Sweden operated since 1972. The safety of this unit was during the last decade enhanced by three large reconstructions (FENIX, 1992-5, MAX, 1996-8, MOD, 1998-2002).

As a result of the above reconstructions the safety of the unit is comparable with current modern units and there are prerequites for operation up to 60 years. The other older units in Sweden will we reconstructed by the similat way. SKI has been preparing a new regulation "on safety enhancement" which will be in the force since 2005. The visit was a very good example of substantial safety enhancement of an older unit.

3. ACTION ITEMS

The following actions items resulted from the meeting:

1. G. Petofi and R.Havel agreed to revise the proposed review procedure as discussed by September 17 2004 and circulate the next draft to WG-1 for comments and subsequently to other EBP participants.
2. The revised CIRs will be uploaded by 15 October 2004 to the SALTO/WG 1 ftp folder by all WG 1 members.
3. Review of particular chapters of CIR will be carried out by the established sub-groups (SG). The results of the review will be sent to ftp folder by the end of February 2005.
4. Consolidation of subgroup reports and preparation of the first draft WG-1 report by the end of March 2005 will be done by the Chairman and Secretary of WG-1
5. The 3rd WG 1 meeting will be held 16-20 May 2005 and will discuss the first draft of the Final WG 1 Report. The draft will be distributed to all WG 1 members by 6 April 2005.

6. REFERENCES

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

[2] Standard review process, IAEA-EBP-LTO-03 Vienna, 2004 (internal EBP report).

[3] Programme's Working Groups Workplans, IAEA-EBP-LTO-08, Vienna, 2004 (internal EBP report).

APPENDIX I. AGENDA

Monday, 23 August 2004

15:30	Welcome address	L. G. Larsson
15:45	Programme status	R. Havel
16:00	Meeting objectives: - Overview of the input collected - Review the objectives - Review the Provisional Agenda	P. T. Kuo/Z. Kriz
17:00	*Adjourn*	

Tuesday, 24 August 2004

09:00	Section 1.0 - Presentation and discussion (10 min. each)	all
10:30	*Coffee break*	
11:00	Section 2.0 - Presentation and discussion (40 min. each)	all
12:30	*Lunch break*	
14:00	Section 2.0 - Presentation and discussion cont'd	all
15:30	*Coffee break*	
16:00	Section 2.0 - Presentation and discussion cont'd	all
18:00	*Adjourn*	

Wednesday, 25 August 2004

09:00	Section 3.0 - Presentation and discussion (10 min. each)	all
10:30	*Coffee break*	
11:00	Section 4.0 - Presentation and discussion (10 min. each)	all
12:30	*Lunch break*	
14:00	Section 5.0 - Presentation and discussion (10 min. each)	all
15:30	*Coffee break*	
16:00	Section 6.0 - Presentation and discussion (10 min. each)	all
17:30	Discussion	P. T. Kuo/Z. Kriz
18:00	*Adjourn*	

Thursday, 26 August 2004

Technical visit to Oskarshamn NPP(OKG)

08:00	Departure from SKI/SIP	
12:00	Arrival to OKG	
12:30	*Lunch*	
14:00	Presentation of OKG	
14:30	Modernisation program Oskarshamn Unit 1(history, status, plans)	
15:30	*Coffe break*	
16:00	WG1 discussion	P. T. Kuo/Z. Kriz
17:00	*Transportation to hotel*	
18:30	*Dinner*	

Friday, 27 August 2004

08:30	Departure for OKG
09:00	Oskarshamn Unit 1- plant tour
11:00	*Lunch*
12:00	Departure for Stockholm
16:30	Arrival to Stockhom (city)

Appendix II. LIST OF PARTICIPANTS

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APPENDIX III.
PRESENTATIONS' HANDOUTS

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

Laws:

- **“Act on Safe Use of Nuclear Energy”(ASUNE);**
- **“Act on Environmental Protection”;**
- **“Act on Energy and Energy Efficiency”;**

The term Long Term Operation is not yet defined in Bulgarian laws and regulations.

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

"Act on Safe Use of Nuclear Energy"(ASUNE)

Two types of authorizations issued by BNRA:

1. License for operation of nuclear facility with validity up to 10 years.

2. Permissions for:

- site selection, design, construction and commissioning of nuclear facility
- any changes of the facility's design connected to modification of the systems, structures and components important to nuclear safety and radiation protection.

The License renewal is proceded by a Periodic Safety Review .

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

A license for operation is issued to a legal entity registered in the Republic of Bulgaria that:

1. is the owner of, or the holder of property rights to, the nuclear facility;

2. possesses financial, technical and material resources and organizational structure for maintaining a high level of safety for the entire lifetime of the nuclear facility, for radioactive waste management and for spent fuel management, as well as for safe decommissioning of the facility;

3. possesses sufficient number of qualified and competent personnel with the appropriate level of qualification and training for all activities related to the safe operation of the nuclear facility;

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

4. has adopted a program of measures, including internal rules, as necessary for ensuring and maintaining a high level of quality in all activities related to the operation of the nuclear facility;

5. has ensured conditions for maintaining a high level of safety culture;

6. has approved emergency plans for response in the event of an accident;

7. has provided for necessary requisite physical protection measures;

8. possesses the necessary technical means and has made the appropriate arrangements to keep doses of occupational and public exposure to a level as low as reasonably achievable;

9. has ensured conformity of the installation and declared operating activity with the requirements, standards and rules of nuclear safety and radiation protection.

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

For renewal of a license the applicant must submit:

An updated report for safety assessment of the nuclear facility taking into account:

-a) the regulations in force ;

-b) the actual state of the nuclear facility;

-c) the envisaged operational life time;

-d) the modern analytical methods, own and international operational experience and the latest achievements of science and technology;

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

REGULATIONS (Bulgarian):

- **REGULATION No. 3 on Providing Nuclear Power Plants Safety During Design, Construction and Operation;**
- **REGULATION No. 5 on Issuing Licenses for the Use of Atomic Energy.**
- **REGULATION No. 11 on Safety of Spent Nuclear Fuel Storage Facilities.**

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

REGULATIONS (Russian):

- OPB-88/97 - General Considerations for Ensuring Safety of NPPs; (item 5.1.14. Assumes that an operational utility may require lifetime extention of a NPP unit)

- PNAE G-7-008-89 - Guidelines for Construction and Safe Operation of Equipment and Pipelines at NPPs; The last revision of the code was issued in 2000. According to article 2.1.11 of the code SSC's operational lifetime can be extended for a period that exceeds the lifetime defined by the manufacturer of the SSC, on base of the so called "technical solution" developed by NPP management with participation of the designer and manufacturer.

-- MPK – CXP – 2000 Russian Guide for 'Determination of the Rest Life Time of WWER RPVs in operation'

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

- STANDARDS:

-Bulgarian National Standards, Russian Standards and ISO standards are accepted as national standards according to the existing practice.

-A great number of Bulgarian National Standards are being revised and modified according to EU Standards.(In most cases Russian Standards are stronger than EU).

Section 1: LAWS AND REGULATIONS APPLICABLE TO LTO

IAEA PRINCIPLES, STANDARDS AND CODES:

- **IAEA, INSAG – 8 Safety Assessment Principals**
- **IAEA, INSAG – 3 Safety Goals**
- **IAEA, 50-SG-012 Assessment Procedure**
- **IAEA, TECDOC 640 Database**
- **IAEA, Safety Requirements and Guidelines**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Established in:

- **REGULATION No. 3 on Providing Nuclear Power Plants Safety During Design, Construction and Operation:**

  1. Determines the basic conditions for NPP safety;

  2. Organisational and technical requirements for ensuring NPP safety in operation.

  3. Requirements for spent fuel storage and radioactive waste.

- **OPB-88/97 - General Considerations for Ensuring Safety of NPPs;**
- **PNAE G-7-008-89 - Guidelines for Construction and Safe Operation of Equipment and Pipelines at NPPs;**
- **IAEA-TECDOC-640 FOR UNITS 3&4**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

1. Operation License

The Basic requirements for performance of operational activities are set up in the Licences for operation in chapter 2: "LICENCE CONDITIONS" and they are the following:

- **The Licensee shall operate the unit in compliance with the License conditions and requirements of ASUNE (Act on Safe Use of Nuclear Energy), the regulations for its application and other applicable normative acts, ensuring priority of nuclear safety and radiation protection over the other aspects of operation.**
- **The Licensee shall ensure the adherence of personnel to the operational limits and conditions, contained in the Technical specification for operation.**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

- The Licensee shall perform maintenance, repair, tests and inspections in order to maintain availability and reliability of the safety systems and prevent failures related to nuclear safety and radiation protection, according to the procedures, programs and schedules, following the operational limits and conditions, established in the Technical specification for unit operation.
- The Licensee shall take measures for accident prevention and mitigation of the consequences in compliance with nuclear safety and radiation protection requirements, codes and standards.
- The Licensee shall review the limits and conditions for safe operation of the unit periodically and when the results of tests, in-service inspections and operational experience impose it.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

2. UPGRADING OF ORIGINAL DESIGN –UNITS 3&4

The upgrading measures taken on units 3&4 cover the whole range of safety concerns for PWRs required by the current safety standards and international safety practice.

Strengthening the confinement - the Jet Vortex Condenser assures structural integrity after all RCSs breaks including 500 mm break.

Confinement leak tightness - radiological requirements are fulfilled for all postulated events. Pressure in confinements after LB LOCA does not exceed the design limit of 200 kPa.

Extension of the list of postulated events for which the unit’s safety systems can cope with, in line with the commonly accepted design approach - plant safety systems are proved to be able to cope with a 500 mm pipe break.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

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

PSA for KNPP 3&4 was periodically performed in parallel to the modernization 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.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Starting from DBA Dn32 at the beginning of Units 3&4 operation in 1980 and 1982 correspondingly, through the passed years was extended the core cooling capability in case of LOCA break cross-section more than 80 times and nowadays DBA is LOCA 2xDn200 (conservative approach) and LOCA 2xDn500 (realistic approach). Those basic design cases are substantially proved in the SARs of the Units.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

3. QUALITY ASSURANCE

Configuration Management System

The great number of Design modifications enforced a well established Configuration Management System which consists of several components:

- **Document control and records management**
- **Equipment configuration control**
- **Design change**
- **Design requirements**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Document control and records management

- Control of documentation, including review, receipt, introduction, issuance of new revision, distribution, restoration of original copies, keeping and tracking the status of documents;
- Management of records, which defines the methods, responsibilities and requirements for development, archiving, keeping and accountability of the records and archive documents;
- The system is based on the Standard ANSI/NIRMA CM 1.0 – 2000, Configuration Management for Nuclear Installations (Smartdoc database software).

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Equipment configuration control

To enhance the process for equipment configuration control, a new database for Operational management (DB OM) is under implementation. The design of the new database includes four modules:

- "Equipment" module
- "Operation" module
- "Design changes" module
- "Design requirements" module

A relation will be established between the "SmartDoc" database and "Operational management" database.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Design change control

Approved procedure that covers the activities related to all design changes. Each design change (called Technical Decision –TD) is assessed by qualified plant personnel with regard to:

- **conforming to legislation requirements**
- **impact on the original design**
- **impact on plant safety**
- **impact on operation activities**
- **impact on maintenance activities**
- **conditions for implementation**
- **design change tests**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Design requirements management

The original Russian design documentation is recorded in SmartDoc database. Each of the new design documents undergoes assessment and approval by competent plant personnel before the implementation of the project.

The original plant design is used as input for the newly developed design projects. A review is made for confirming the requirements of regulatory documents in the field of nuclear safety, industrial safety, radiation protection, fire protection, boilers and pressure vessels, quality assurance and the requirements for equipment operation and maintenance.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

4. Ageing Management Program (AMP)

Evaluation of Rest Life Time(RLT) was executed in 2002 by a Consortium between Framatome ANP GmbH and Atomstroyexport, Russia. The project resulted in an Ageing 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.

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 SSC.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

The components addressed in the main scope of the project are:

- **All components of the primary circuit,**
- **Components of the secondary circuit (piping, valves and supports),**
- **Spent fuel storage pool,**
- **Hoisting equipment,**
- **Electrical equipment (generator, transformers (main and house), batteries, switchgears, cables and diesel generators)**
- **Civil structures (reactor building, turbine building, auxiliary building**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

As a conclusion of the Rest Life Time 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.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

For evaluation of the residual life time, powerful tools like the ageing management systems FAMOS, COMSY and the ageing management data base (AMDB) were implemented for continuous follow–up process of RLT management, where:

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

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

As a further result of the Rest Life Time evaluation of SSC executed in 2002, activities were categorized in analyses, inspections, monitoring, repairs and replacements had been recommended and were included in the ageing management programs:

- "Program for assuring the life time of units 3&4 of Kozloduy NPP";
- "Program for surveillance of units 3&4 Reactor Pressure Vessels"
- "Program for future activities for seismic qualification assuring of civil structures, technological equipment and distribution systems of units 3&4 of Kozloduy NPP".

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Activities recommended as a result of the performed RLT evaluations of units 3&4 :

- Full RPV UT NDE equipment, technique and personnel qualification performed, according to IAEA and EU guidelines.
- Development of national qualification organization and procedures within an international project financed by DTI, Great Britain.
- Seismic assessment of the annular tanks and reactor support structures - correspond to the site current seismic characteristics.
- An evaluation of the probability for RPV failure - the requested high reliability of the RPV is achieved.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Following the issued new Russian guide for determination of the rest life time of WWER RPV in operation (MPK-CXP-2000) an actualization of PTS analysis for units 3&4 reactor vessels with the evaluation of probability for brittle failure were undertaken at the beginning of 2003. The results obtained from those analyses for broader initiating events show that the save operation of units' 3&4 RPV is assured with the sufficient margin to critical brittle temperature up to the end of their design life <u>at least.</u>

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

For monitoring and prediction of the RPV material behavior in irradiation conditions a special long term international project was established in 2002 named PRIMAVERA with the participation of FORTUM and VTT - Finland, Kozloduy NPP, Kurchatov Institute – Moscow, ROSENERGOATOM - Russia, JRC Institute in Petten - Netherlands. Within the project a comprehensive investigation of representative samples for weld No4 manufactured with the same technology as the one used for RPV manufacturing started with consequential irradiation of the samples in Rovno NPP, Ukraine. The data obtained will be used for forehead prediction of the material behavior in irradiation conditions, re-irradiation after annealing as well for neutron flux measurement and validation of calculation models.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

5. In-service Inspection Practice/Programs

“Procedures for operation control of the basic metal, cladding and welded joints of equipment and piping in KNPP ” - The accumulated operation experience, the new international approaches and modern requirements are reflected in these documents.

Individual programs for each reactor vessel, based on the data, obtained during the operational control of the metal and its initial state.

Programme for neutron metal embrittlement monitoring of the reactor vessels .

“Programme for Improving the Eddy-Current Control at Kozloduy NPP for the Period 2000 – 2005 г.”

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Qualification of in-service inspection systems

- "Programme for qualification of the non-destructive control of components important to the safety "

Monitoring and surveillance specimen programmes

- Reactor pressure vessel integrity *(RLT and PRIMAVERA)*
- Prevention and monitoring measures in connection with the embrittlement issue of the RPV:

  -Neutron Flux Reduction on RPV wall

  -Annealing

  -Prevention of cold overpressure of the RPV
- Primary Circuit Piping integrity

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

6. Maintenance Practices

- **Long term maintenance plan is developed for 5 years and includes proposals for improvement of both investment and maintenance programmes;**
- **Short term or annual outage plan for plant equipment is developed and completed six mounts before outage date;**
- **Short term plans in terms of work order request to restore detected defects during normal operation of the units.**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Maintenance requirements depend on:

- **Design basis;**
- **Requirements of the equipment manufacturer;**
- **Technical specification and operating instructions;**
- **Data from diagnostic and monitoring systems;**
- **Data received from factory acceptance test and on-site acceptance test;**
- **Own and international experience;**
- **ISI data;**
  - **Vibration monitoring data, chemistry control data, ets**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

- **Preventive maintenance improved through: thermovision; expanded vibrocontrol; control on the status of the breakers and the electric processes; control on the status of the insulation of the electric cables and penetrations.**
- **A computer system for defect monitoring introduced;**
- **Maintenance instructions developed for a specific type of equipment.**
- **Records of the performed maintenance activities are filled in forms and stored in accordance with the requirements of Quality assurance programme.**

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

7. Plant-specific safety analyses

The updated "Safety Analysis Report" (SAR) of units 3&4 has been the basic document for issuing the operation license.

The development of Units 5&6 SAR has been progressing along with the implementation of Modernization Program.It is expected to be completed in the middle of 2006. The new SAR includes an updated list of postulated events.

There are plant-specific PSA developed and updated on a regular basis.

The progress achieved in PSA Level 1 development is a good basis for developing of new probabilistic analyses and PSA applications. Efforts now are focused on PSA level 2 developments that already started for units 3 and 4.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

PSA level 1 for units 5&6 was completed in 1995. At present, an update of PSA-Level 1 is underway and will be completed within this year. The study includes:

- Internal initiator analysis;
- Flooding risk analysis;
- Fire risk analysis.

As part of the modernization program for units 5&6 terms of reference for PSA, Level 2 development have been approved as a next step of plant activities in this field.

Section 2: CURRENT DESIGN BASIC REQUIREMENTS, CODES AND STANDARDS.

Additionally to the above-mentioned analisys the following documents are under development:

- Justification of the strength of the reactors internals according to the current norms;
- Operation reliability analysis for the primary circuit piping with diameter DN 200 and DN 500;
- Determination of the parameters inside the containment in case of a primary circuit large diameter pipe break;
- Static and dynamic strength analysis of the primary circuit and implementation of the necessary restrain;
- Determination of the resource of the reactor vessels.

Section 3: Upgrading of design basis requirements performed during current operation.

KNPP Units 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*

RESOLVED ALL IAEA SAFETY ISSUES [IAEA-TECDOC-640] AND ADDRSESSED ALL AQG TOPICS

The CMP covers the whole range of safety concerns for PWR required by current safety standards and international safety practice

Section 3: Upgrading of design basis requirements performed during current operation.

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Section 3: Upgrading of design basis requirements performed during current operation.

Major safety improvements implemented at KNPP 3&4:

- *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)*

Section 3: Upgrading of design basis requirements performed during current operation.

Major safety improvements implemented at KNPP 3&4: -cont

- *Accident analyses*
- *Fire protection has been strengthened*
- *Emergency power supply upgrading*
- *Elimination of common cause hazards*
- *Improvement of the confinement –Jet Vortex Condenser*
- *Leaktightness of the confinement was improved*

Section 3: Upgrading of design basis requirements performed during current operation.

Major safety improvements implemented at KNPP 3&4: - cont

- *Upgrading of the secondary side systems and electric power supply*
- *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 demage frequency has been reduced to 1.6E-05/year (internal events, seismic and fire hazards)*

Section 3: Upgrading of design basis requirements performed during current operation.

Major safety improvements implemented at KNPP 3&4: - cont

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

Section 3: Upgrading of design basis requirements performed during current operation.

KNPP Units 5&6 modernization programs

Implementation of important improvements before the MP:

- **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.**

Section 3: Upgrading of design basis requirements performed during current operation.

KNPP Units 5&6 modernization programs

Main purpose was to introduce improvements so that the modernized units would be able to meet any new international safety and reliability requirements, and the full scope of improvement steps prescribed by the Chief Design Engineer and IAEA document "Assessment of the Safety Problems of WWER-1000 Model 320 Units".

- **Developed 1995-2000**
- **Approved by RISKAUDIT**
- **Reviewed and approved by IAEA in 1995 and 2000**
- **Implementation 1995 – 2006**
- **Total number of measures 204**

Section 3: Upgrading of design basis requirements performed during current operation.

KNPP Units 5&6 modernization program – Goals to cope with:

- **New international requirements to safety and reliability of NPPs;**
- **Deviations from the requirements of the OPB-88, as a basis for design and construction of nuclear installations;**
- **Deviations from the contemporary international practice related to the approach, scope and quality of the accident analysis;**
- **Safety assessments of WWER 1000/B-320 based on:**

1. Conclusions of OSART and ASSET missions conducted by IAEA in 1991, 1994 and 1997;

2. Recommendations made by the Plant General Designer for improvements of the design systems.

Section 3: Upgrading of design basis requirements performed during current operation.

KNPP Units 5&6 modernization program – Goals to cope with:

- **Operating experience of Kozloduy NPP;**
- **Studies performed by Bulgarian Institutes (PSA, seismic research);**
- **Evaluations of WWER 1000/B-320 performed by French and German institutes**
- **Extention of design life by 15-20 years**

Section 3: Upgrading of design basis requirements performed during current operation.

AREAS OF MODERNIZATION

GROUP 1: New design solutions for improvement of plant safety

- New diagnostics and control systems
- Additional systems for severe accidents
- Operating conditions improvement and status monitoring\
- Seismic stability and fire resistance

Section 3: Upgrading of design basis requirements performed during current operation.

AREAS OF MODERNIZATION

GROUP 2: Analysis and additional research

- Accident analysis
- Mechanical analysis of safety significant equipment
- Risk analysis of external and internal events
- Classification and qualification of components and equipment

Section 3: Upgrading of design basis requirements performed during current operation.

AREAS OF MODERNIZATION

GROUP 3: Replacement of equipment under expiry and critical importance

- **Control Systems**
- **Measuring devices**
- **Safety System Equipment**
- **Equipment important to unit availability**

Section 3: Upgrading of design basis requirements performed during current operation.

AREAS OF MODERNIZATION

GROUP 4: Improvement of plant efficiency and operating conditions

- **Personnel training**
- **Maintenance and support optimization**
- **Documentation improvement**

SALTO WG 1 Second Meeting

Section 1

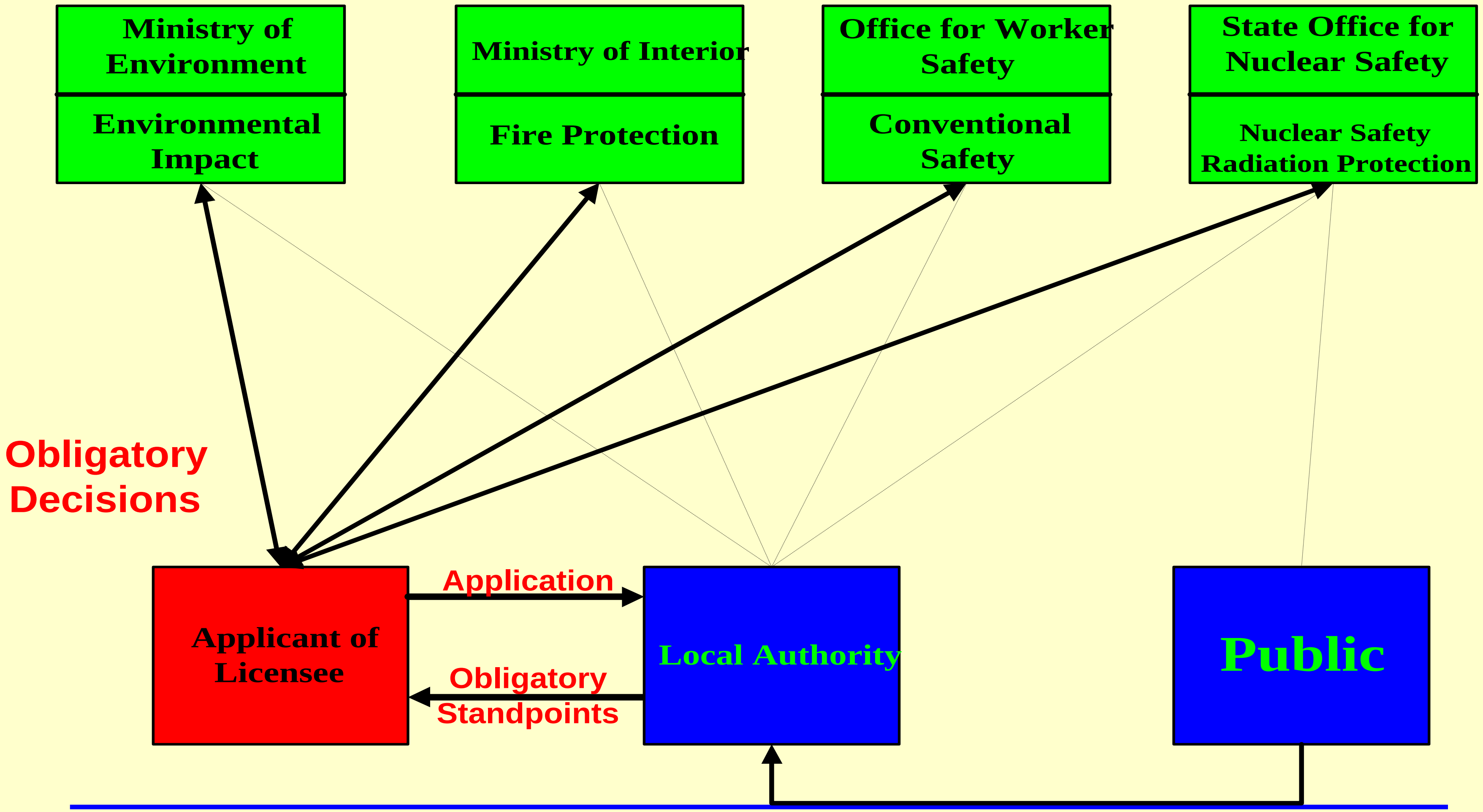
Laws and regulations relevant to LTO

Miroslav Šváb
State Office for Nuclear Safety
August 23 - 27, 2004
Stockholm

Licence

- ➔ Civil Construction Act – permanent operation – decision is unlimited in time; decision of the Construction Planning Authority cannot be issued without SÚJB permission
- ➔ SÚJB permission for operation is mostly issued for 10 years

Licensing Process



SÚJB Approach to LTO

- ➔ Design service life values of the individual components and systems are considered and further approved
- ➔ In respect of the nuclear safety, aging of a power plant finds its reflection mainly in the reduced "NPP safety margin" as a result of some worn out systems, components, and buildings. It must therefore be reliably proved, that this residual "NPP safety margin" is high enough and acceptable.

SÚJB Approach to LTO

- ➔consumption of the design service life of the components, systems, and buildings, controlled aging programs,
- ➔solution of the departures from the applicable international standards and application of the operational experience,
- ➔compliance with SÚJB requirements,
- ➔innovation programs.

Conclusion

The SÚJB does not have specific regulations related to the LTO, but there is sufficient amount of „guidelines“ (Czech or others) and tools which allows, based on the SÚJB competences, to the regulatory authority carefully check the LTO safety of nuclear installations.

SALTO WG 1 Second Meeting

Section 2

Design Basis Requirements

Part 2.1, 2.2, 2.3, 2.4

Miroslav Šváb

State Office for Nuclear Safety

August 23 - 27, 2004

Stockholm

Design Codes and Standards (2.1)

- ➔ Dukovany NPP (constructed in the mid of 80th) design codes represent mixture between former Soviet Union and Czechoslovak standards

- ➔ Ongoing development of technology was reflected in requirements on modernization program for Dukovany and also on regulations and instructions used during its planning

Design Codes and Standards (2.1)

- In compliance with the contract for the NPP Temelín project between the former representatives of the Czechoslovak and Soviet parties, covering the preparation of the so-called “Technical Design” (as a part of the introductory design), the Soviet party prepared this NPP Temelín Technical Design in respect of the nuclear safety requirements assurance on the basis of the following Soviet regulations. The design was approved by the Soviet Nuclear Safety Supervisor

Design Codes and Standards (2.1)

- Temelín NPP has been licensed in compliance with current Czech regulations (based on Atomic Act – 1997)

- Design changes were implemented in compliance with the industrial standards of vendor country

Maintenance Practices (2.2)

- The maintenance is carried out in line with the pre-prepared maintenance program for the individual pieces of equipment, which also contains the preventive maintenance program. The methods and scopes are set out depending on the desirable safety and reliability of the equipment.

- Basic methods of maintenance:

  preventive maintenance, which is subdivided into:

  - regular preventive maintenance,
  - predictive maintenance,

  corrective (random) maintenance

Maintenance Practices (2.2)

➔ Maintenance is being scheduled in material and financial terms from the long-term (5-year) plans up to daily maintenance plans. There is a special information system designed to control the maintenance.

➔ Realization of the preventive maintenance (but of the repairs too) is being ensured via subcontracts, by the qualified companies, mainly the manufacturers of the equipment and those that came to being as a result of the NPPs' own maintenance transformation. The activities are being carried out in line with the defined procedures and under surveillance.

EQ for electrical and mechanical components (2.3)

➔The qualification, as it is now being pushed forward at the Czech NPPs, is primarily striving to verify the functional reliability and service life of the safety system equipment in respect of the environmental impacts in the conditions of the postulated emergency modes of operation. This practice includes the equipment evaluation from the viewpoint of its seismic resistance.

EQ for electrical and mechanical components (2.3)

➔Updated model of the implemented qualification process should make use of the elements and respect the Configuration Management (CM) concept, applied in the given nuclear power plant

EQ for electrical and mechanical components (2.3)

➔ **The following principles could be used to characterize this model**:

- **the qualification only applies to the identified equipment (components, systems and their parts) that forms a part of the safety-relevant systems (hereinafter as "qualified equipment" only);**
- **within its central phase the qualification has to verify the capabilities, using the widely recognized methods of the tests, analyses based on the operational experience and the indirect qualifying methods;**
- **the qualification process must cover the design, manufacture, shipment storage, installation, operation, and maintenance of the qualified equipment;**
- **within the qualification process, the individual activities – as they relate to the qualified equipment – must be followed-up and evaluated in the predefined levels of the qualification agenda; these levels must be set on the side of the equipment manufacturers, suppliers, test laboratories, consulting and engineering companies, and power plant operator.**

Quality Assurance Practices (2.4)

➔During the construction of the Czech NPPs, the quality assurance documentation has been worked out at its three levels:

- 1st level – Quality Assurance Implementation Program (ZPZJ) ,
- 2nd level – Partial Quality Assurance Programs (DPZJ),
- 3rd level – Individual Quality Assurance Programs (IPZJ).

Quality Assurance Practices (2.4)

- In conjunction with the validity of the Atomic Act and the related SÚJB Decree No. 214/1997Sb. the requirement is being applied to implement and document the Quality System (“QS”) for the activities during the location, construction, commissioning, operation, and placing out of service of the nuclear installation carried out by the license holder, but also the activities vital from the nuclear safety and radiation protection point of view, carried out by the supplier. The QS for the licenses activities must be documented in the form of the quality assurance programs before the respective permission is issued.

Quality Assurance Practices (2.4)

➔ Concerning the long-term reconstructions (e.g. the I&C design modification in Dukovany NPP), good experience is available with the elaboration and authorization of PZJs for the individual stages (project preparation, design, realization complete with production, installation, commissioning). The PZJs are also being prepared in the form of revisions, which will ensure the continuance of the control documentation both in the horizontal control plane (i.e. at transition from stage to the next one) and in the vertical plane, i.e. in the sense of the depth-level of the description of the activities being carried out.

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Section 5

Existing Programs Related to LTO
(Temelin NPP)

Miroslav Šváb
State Office for Nuclear Safety
August 23 - 27, 2004
Stockholm

Design Modifications

➔ 60 major modification implemented into design, e.g. I&C replacement, new type of fuel, TMDS, EOP, SAMG, new system of rad-waste treatment, improvement of fire protection (cables, detection system)

Equipment Residual Life

- At the NPPs Dukovany and Temelín, the DIALIFE diagnostic software has been developed, which – using the information from the field information systems (generating units, diagnostics, chemistry, special measurement, non-destructive testing results, and database of the material characteristics) - will determine the remaining life expectancy of the equipment, using the verified computation programs.

Equipment Residual Life

➔ At the NPP Temelín this program is used to follow-up the life expectancy for the low-cycle fatigue of he following machinery and equipment :

1. steam generator
2. pressurizer
3. main circulation pump
4. main circulation piping complete with the connected energy pipelines to the 1st stop valve, including the line between the pressurizer and loops
5. evaluation of the reactor pressurized vessel fatigue damages
6. Bubble-elimination tank and its feeding lines
7. Steam taking lines from the steam generator
8. Reactor Cooling Heat Exchanger
9. Diesel-generating sets

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Section 6

Research Results and Operating Experiences Related to LTO

Miroslav Šváb
State Office for Nuclear Safety

August 23 - 27, 2004

Stockholm

Ongoing Research

- Ministry of Trade and Industry Project „ Assurance of LTO and Increase of Efficiency of Czech NPPs Operation „
- Subtask „ Methodology and Tools of Lifetime Control „ - at present:

  e.g. implementation of international projects results, determination of the most important equipment (categories), proposal of modular lifetime control system, mathematical description of material degradation

Ongoing Research

➔ The IAEA new regional project „ Improvement of Design Basis and Configuration Management Documentation“

➔ Goal of the project:

- to improve the understanding of the need for and the expected content of Documentation of the Design Basis of NPPs
- to improve the understanding of the interaction between the design basis documentation, Configuration Management and the safety and operation of the NPP

SUJB Research Projects

- “Probabilistic Evaluation of a Reactor Pressure Vessel Sudden Rupture”.
- “Research and development of a program used to verify the defects (disintegrity) of the type resting in non-adherence of the welded on piece of the energy reactor’s pressurized vessel“
- “Material sample taking from the interior of the pressurized vessel of the energy reactor for detection of the high-speed neutron fluctuation.“

Experience Feedback

- ➔Other significant activity in support of LTO is an effective feedback. To meet the needs of SÚJB the “NPP Operation Analyses” that assess the nuclear safety affecting defects are being prepared on a half-year basis. The related remedial measures are strictly required by the supervisory authority. The operator is evaluating all the faults in a similar way.

WG 1 SALTO Second Meeting

Section 2

Part 2.5, 2.6, 2.7

ČEZ

SIP/SKI offices, Stockholm, 23-27 August 2004

Nuclear Power Division
Design Bases and Modifications Unit
Locality Dukovany NPP

Miroslav Šabata
PLEX/LTO and Decommissioning manager

Content

Introduction

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Dukovany NPP - Licence practice

- Up dated Safety Analysis Report (SAR) is considered as a base for demonstration of the level of nuclear safety. Apart from other safety important areas up dated SAR (so called Living SAR) contains results from ageing management and prediction for systems behaviour for the time the licence is asked.
- Operation licence is valid for 10 years maximum. Each unit has its own licence. The duration of the licence is not stated in the Atomic Act but it is part of licence practice established in the Czech Republic.
- It is expected that Periodic Safety Review (PSR) will be part of licence process up to 2015 - not only recommendation as now.

2.5 Final Safety Analysis Report Update

Deterministic Evaluation of Nuclear Safety (Operational Safety Analysis Report) NPP Dukovany

Short History of Dukovany FSARs

1984 - FSAR

1994 - 1995 OSAR I (since that annually updated)

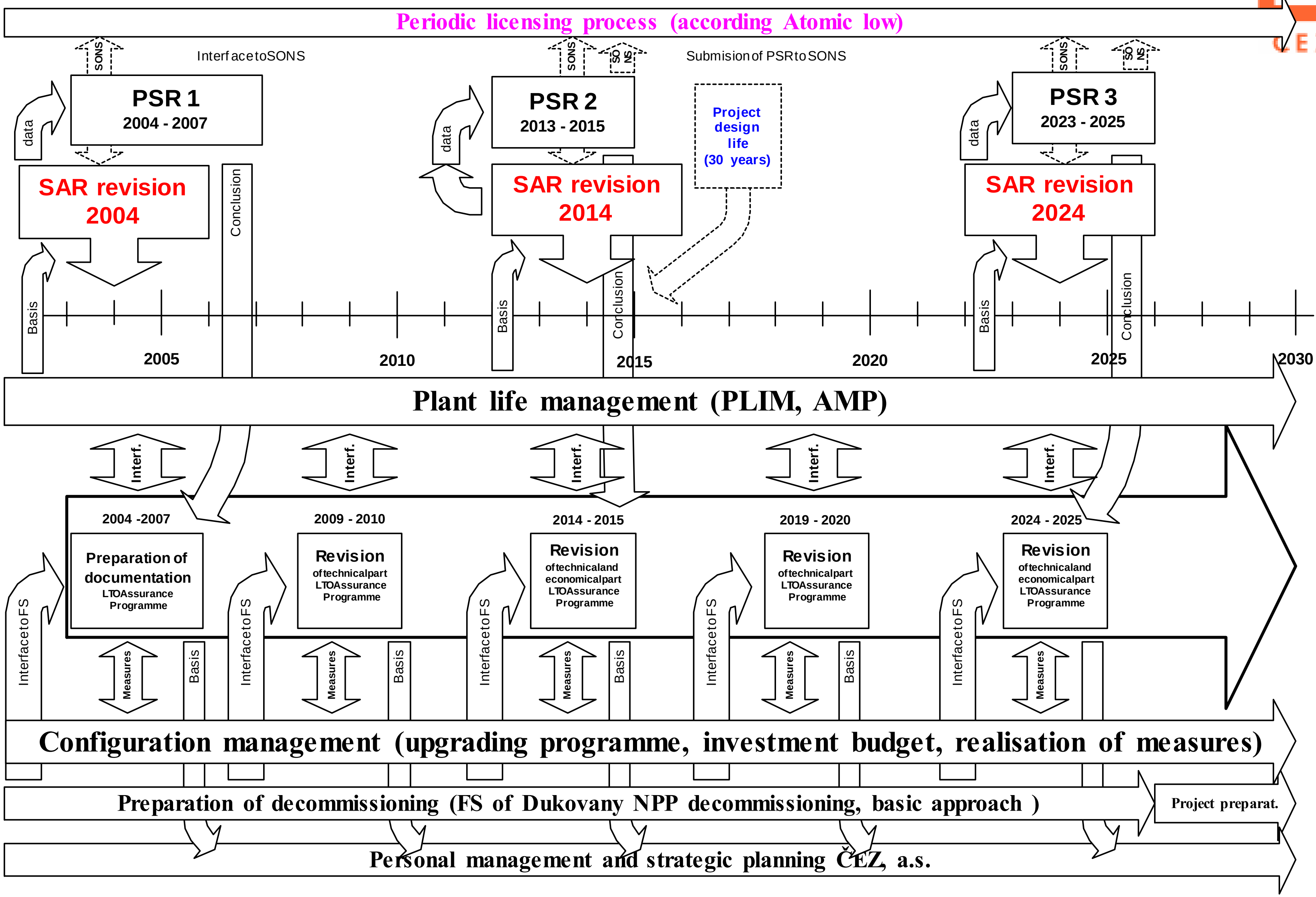
2002 - 2004 OSAR II - total review of OSAR I (new scope in accordance with RG1.70 extended to cover most of review elements from guide 50-SG-O12 for PSR) – 2005 submitted to SONS with application for new licence,

2014 -15 OSAR III should follow on results of PSR II

2.5 Final Safety Analysis Report Update – cont.

- OSAR is regularly up-dated every year
- all changes are submitted once a year to Regulator (with the list of main changes)
- changes of OSAR cover modification, results of maintenance, operational results, procedure development, results of new or additional analyses, new plant and state legislation
- request for annual up date of OSAR is stated as a license condition for operation of units
- the process of regular up dating is into details described in plant documentation (directive 14/121) in which responsibility of persons and required terms are defined
- once in 10 years in depth revision of OSAR is prescribed (license condition)

Interface of LTO preparation (example for Dukovany NPP, LTO till 2030)



2.5 Final Safety Analysis Report Update – cont.

ČEZ

Deterministic Evaluation of NPP Temelín

- The Pre-operational Safety Report of the NPP Temelín 1st generating unit is the cornerstone of the approval process.
- Every change carried out during the startup process is carefully considered by the operator with the goal to justify the change in respect of the conclusions defined in the Pre-operational Safety Report.
- The startup process itself was controlled not to depart from the conclusions verified by the safety analyses.
- The NPP's Pre-operational Safety Report has been prepared in compliance with the requirements of USNRC RG 1.70. Currently, it is being innovated to reflect the startup experience.

2.6 In-service Inspection Programs

ČEZ

Detail information was presented by Dr.Jiri Zdarek

IAEA – EBP – SALTO – PWR – WG 2 (first meeting)

4 – 6 February 2004, IAEA, Vienna, Austria

General:

- The in-service inspections are being carried out in line with the In-service Inspection Programs, approved by SÚJB.
- The Program also covers the nuclear safety vital components, selected by the design engineer.
- The supervisory authority also approved their choice.
- The program of inspections was drawn up for the individual components by their manufacturers, being, at first included in the so-called "individual quality assurance programs", prepared for the individual components.

2.6 In-service Inspection Programs – cont.

- The said programs also contain the requirements for the functionality of the said equipment during the various modes of power plant operation. At present, these requirements form a part of the equipment qualification programs.
- The following test methods are being used during the inspections: visual, capillary, magnetic-powder, stray-current, ultrasonic, through-radiation, ultrasonic thickness measurement, dimensional, tightness, and pressure tests, troubleshooting measurements. The scope and number of he methods are given by the component importance.
- The inspections based on the mechanized methods are mostly being carried out against the contracts, mostly by the manufacturers of the followed-up equipment, or by the specialized companies. The non-mechanized intersections are within the responsibilities of the NPP's own staff.
- Before a generating unit is commissioned, the inspection results are subject to evaluation by a specialized body composed the representatives of the supervisory authorities, equipment manufacturers, and power plant's internal surveillance.

2.7 Time-limited Aging Analysis

ČEZ

- The Service Life Monitoring Program is mainly focused on the power plant's main components, vital from the nuclear safety viewpoint.
- As for the primary circuit equipment, the pressurized vessel is followed-up for its residual life, including embedded devices, as well as the steam generators, main circulation pumps, and pressurizers, main circulation piping.
- In depth revision of OSAR once in 10 years is prescribed to include ageing analysis as part of equipment status description. There is necessary to demonstrate ability of equipment keep safe operate during the next 10 years.
- Exist differences between evaluation of passive and active components (active – use the results of tests and reliability evaluation, passive – inspections and calculation)

Thank you for your attention !

WG 1 SALTO Second Meeting

Section 3

Past upgrading of DB requirements performed, including PSR

ČEZ

SIP/SKI offices, Stockholm, 23-27 August 2004

Nuclear Power Division
Design Bases and Modifications Unit
Locality Dukovany NPP

Miroslav Šabata
PLEX/LTO and Decommissioning manager

Content

- Continuous Monitoring and Periodic Evaluation of Nuclear Installations' Nuclear Safety
- PSR (Dukovany)
- PSA (Dukovany and Temelin)

Continuous Monitoring and Periodic Evaluation of Nuclear Installations' Nuclear Safety

ČEZ

- Continuous periodic monitoring of the running generating units' nuclear safety, carried out by the operator, is mainly focused on the adherence to the safe operation limits and conditions.
- During the shutdowns, the observance of the additional requirements is checked.
- The information giving account of the nuclear safety, radiation protection, fire safety and occupational safety is subject to periodic evaluations (within the nuclear status weekly reporting and in the monthly and yearly reports about the states of nuclear and radiation safety and NPP operational reliability).

Continuous Monitoring and Periodic Evaluation of Nuclear Installations' Nuclear Safety – cont.

ČEZ

- Within the operative evaluation of their nuclear safety NPPs use the risk monitors that analyze the CDF upon inoperability of the individual NPP generating units during their normal configuration (load operation of the reactor).
- Yearly reports on the NPP nuclear safety status and on the operational reliability contain the evaluation of the most significant equipment inoperability in respect of the accumulated risk and of the main contributors to this total NPP accumulated risk in the given year.
- Some permissible periods of the equipment inoperability and some combinations of the contemporary equipment inoperabilities, defined in the Safe Operation Limits and Conditions, and of a choice of the hypothetic scenarios were also analyzed with the Risk Monitor.

PSR (Dukovany NPP)

PSR I (2005-2006) scope IAEA 50-SG-O12 (DS 307) - training PSR.

Main goal - assessment of compliance with Czech requirements for new NPP, complete set of IAEA guides for operational plants. Secondary goal: Assessment of preparedness for LTO

PSR I will not have been part of license process yet (in 2005 renewal of operational licence based on up dated OSAR is expected) Results of PSR I will serve especially for validation of plant modernisation program and program for LTO

Cooperation with SUJB is planned in accordance with DS307

PSR II (2012 -2013) - goal: assessment of preparedness for LTO up to 2025 (assessment of the results of programme for LTO)

PSR (Dukovany NPP) – cont.

ČEZ

PSR I (2005-2006)

Preliminary phase 2003-2004: preparation of detailed methodology for PSR derived from DS307, preparation of the set of evaluation criteria, presentation of methodology and criteria to regulator, QA program(?), preparation of support documents, nomination of team member and their training

PSR phase: 2005 - evaluation of each elements in accordance with methodology, identification of shortcomings and strength

PSR phase: 2006 - experts and detailed evaluation of findings, categorization of shortcomings, list of corrective actions, presentation of results to NPP administrative, presentation of results to regulator, corrections, final report, implementation of program for corrective actions into plant modification program

PSA Dukovany NPP

ČEZ

- The first study of the PSA at the level 1, was finish to end for the NPP Dukovany in 1993.
- The study was prepared for an internal initiation event and the reactor run at its nominal power.
- As a continuation of this study, there were additional works within which this Level 1 PSA Study was further developed and extended to include the low-power modes and shutdown processes. Currently, the Level 1 PSA Study is assigning to the NPP Dukovany the resulting frequency of the reactor active zone damages (CDF) as follows:
- CDF = 1.27x10-5/reactor-years for the operation at the power level 2 ÷ 100 %
- CDF = 3.69x10-5/ reactor-year for the low-power modes and shutdown periods
- **Total CDF = 4.96x10-5/ reactor-year** for all the modes of operation (sum of previous values

PSA Temelín NPP

ČEZ

- Probabilistic evaluation of the NPP Temelín 1st generating units was carried out in 1993 - 1996.
- The PSA ETE Project included the evaluation of the Level 1 PSA at both the power operation and the low power conditions and shutdowns, as well as the evaluation of the risks, fires, floods, and seismic and other external events. The project also included the evaluation of Level 2 PSA, including the localization of the source members.
- In the last year, the update of he NPP Temelín PSA Analyses was brought to end, based on the NPP's current condition at its initial startup. The analyses, updated during the course of 2001-2003 represent the last state of knowledge of the NPP response to the emergencies, of the current project and operating condition after the realization of a series of safety improvements.

PSA Temelín NPP – cont.

ČEZ

Main results of the PSA NPP Temelín updated models for the analyzed list of the initiating events and the condition of the ETE at the beginning of 2004 are represented by the point-to-point estimation of the damage frequency at reactor core ETE:

- CDF = 1.49x10-5/years for power operation
- CDF = 9.28x10-6/years(shutdown) for all the shutdown operating conditions
- CDF = 7.42x10-6/years for internal fires
- CDF = 1.35x10-6/ years for internal floods
- CDF = under 1.00x10-8 f for seismic events
- CDF = pod 1.00x10-7 for other external events

Total CDF = 3.32x10-5/years for all operational modes and events.

Thank you for your attention !

WG 1 SALTO Second Meeting

Section 4

Activities related to LTO

ČEZ

SIP/SKI offices, Stockholm, 23-27 August 2004

Nuclear Power Division
Design Bases and Modifications Unit
Locality Dukovany NPP

Miroslav Šabata
PLEX/LTO and Decommissioning manager

Contents

1. Strategic goals of Nuclear Power Division
2. Development of activities in the LTO area
3. Main points of the LTO conception
4. Management of the LTO programme
5. Milestones of the LTO assurance
6. Summary

Strategic Goals of Nuclear Power Division

ČEZ

Short-term goals…

Long-term goals …

Continue operating EDU until at least 2025
Continue operating ETE until at least 2045

Nuclear Power Division has to have a clear conception and effective LTO programme!

What was the development of activities in the LTO area?

Past LTO Activities at Dukovany NPP

ČEZ

1970 – unified design VVER 440/213 (LOTEP – USSR)

1978 - implementing design by Energoprojekt Praha

1985 – construction, manufacture, installation and commissioning - Skoda, Vítkovice, Sigma and other Czechoslovakian companies

1987 – all four units in operation (designed lifetime - 30 years)

1992 – IAEA – TRS No.338 – Methodology of aging management (established working team Dukovany NPP)

1993 – first seminar of WANO MC devoted to the area of aging management

– proposal for common programme of “Users group of VVERs”

1996 – a challenge given by Governing Board of ČEZ, a. s. – to continue with modernisation of EDU with a goal to operate until at least 2025

1996 – first statement of SUJB (Regulatory body) on licensing requirements for LTO

Past LTO Activities at Dukovany NPP

ČEZ

- LTO project was deferred for several years because of other priorities (safety issues of IAEA and AQG recommendations) – e.g. safety approval of bubble condenser (the project finalised in 2002-3)
- January 2004 – a new organisation structure of ČEZ, Nuclear Power Division – LTO is defined as a specific subprocess in activities of Engineering Department, Design Management Section
- The working group for the PLEX/LTO supporting process was established

Statement of SONS from 1996

1996 - Dukovany NPP received the statement of SUJB on LTO

(an extract from the statement)

Issuing of the operation licence is a result of the licensing process which has to consider all aspects of nuclear safety and radiation protection including aging of NPP (incl. aging of SSC).

Values of calculated lifetime of specific SSCs are technically significant and are specified in the approved documentation by SUJB.

From a technical point of view main tasks relating to issuing the operation licence can be divided into four areas:

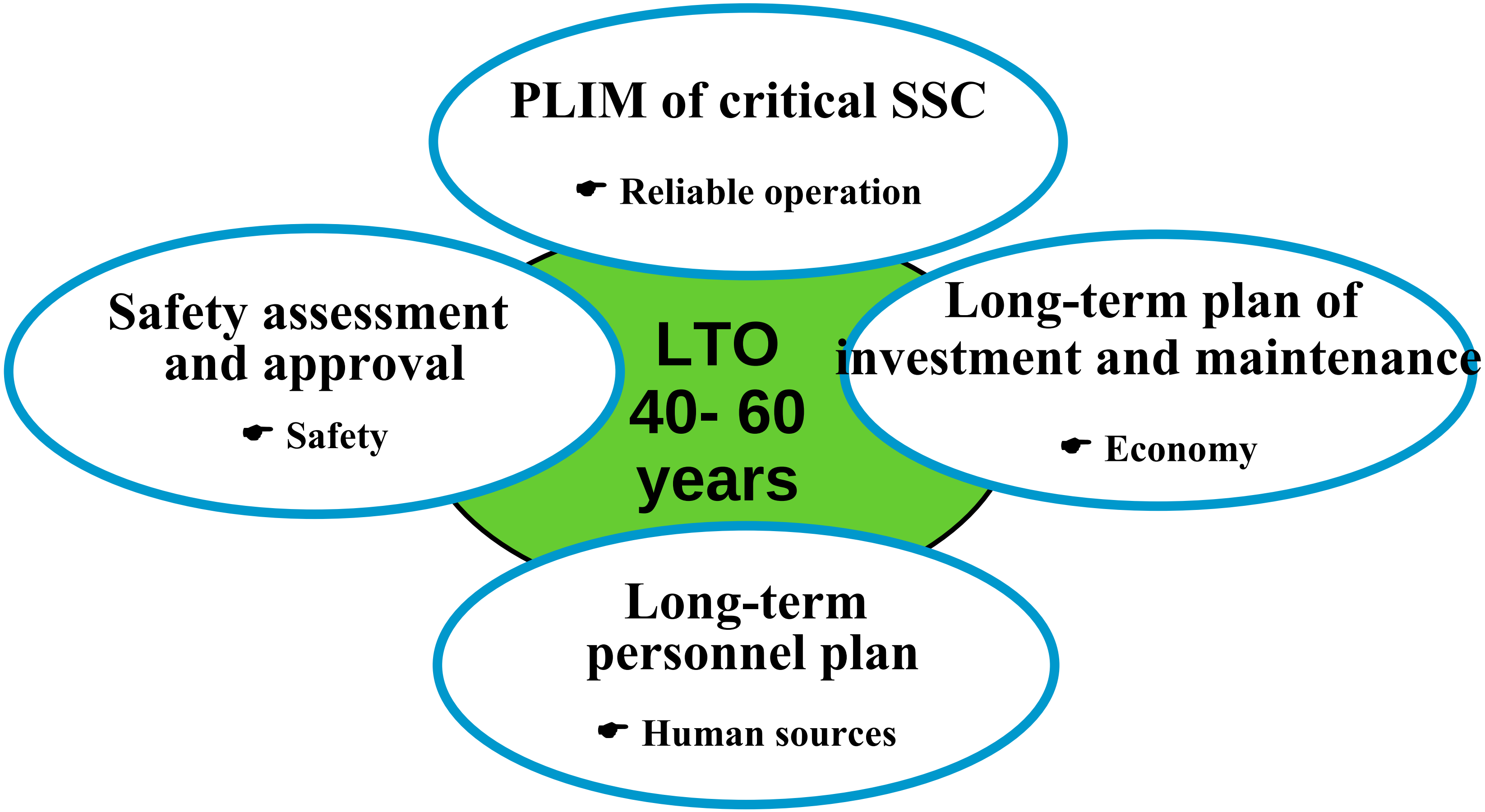
1. **managing of calculated lifetime of SSCs and aging management programmes**
2. **deviations from international standards and application of experience from operation (IAEA Safety Issues)**
3. **SUJB requirements**
4. **up-grading programmes**

What are the main points of the LTO conception?

Strategic long-term „tools“ for LTO

ČEZ

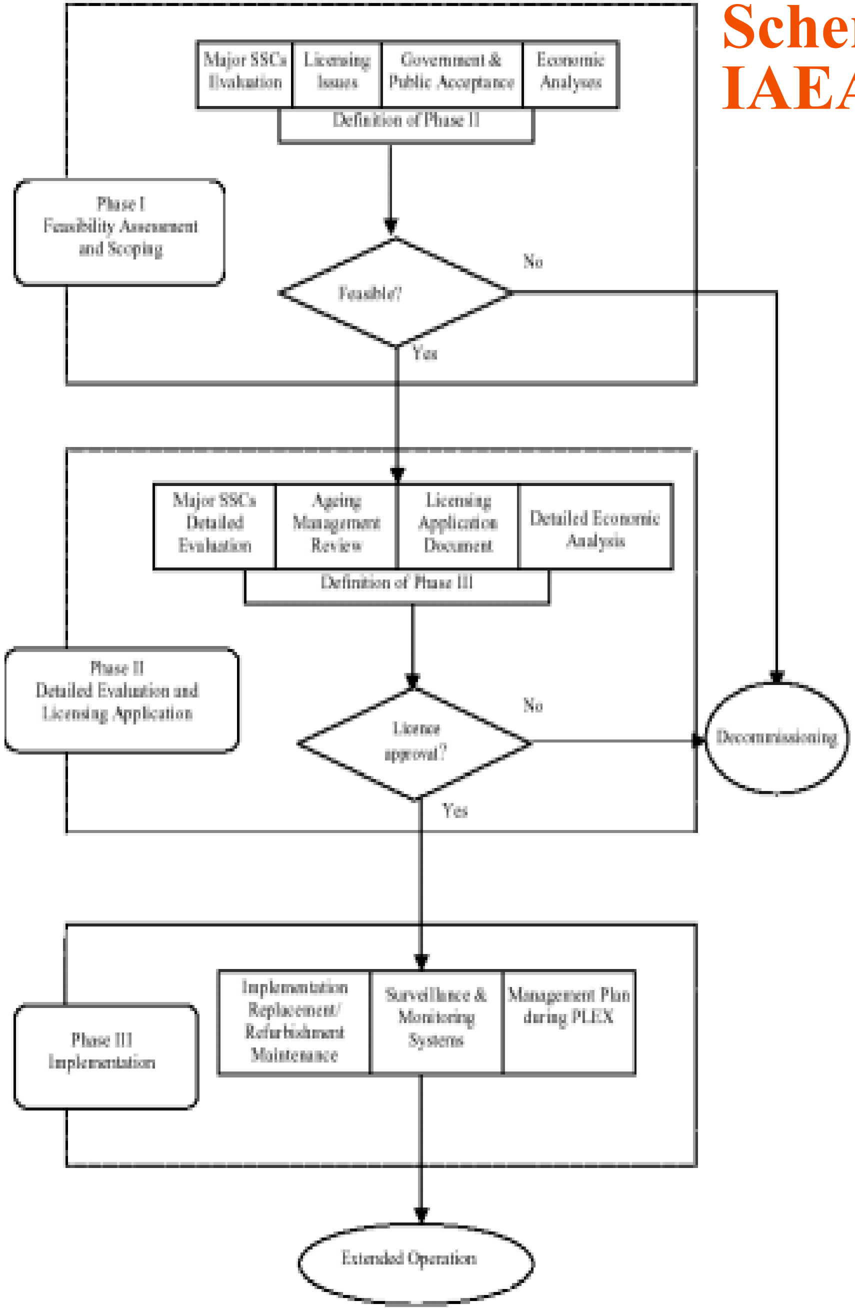
Following „tools“ are necessary for assuring requirements arising from the LTO programme:



Main Tasks

Our approach to LTO rises from the assessment of internal and external conditions for LTO and indicates following tasks:

- To determine and periodically verify **technical-economic optimum** of LTO
- **To periodically analyse** internal and external conditions for reaching the **optimal time of LTO**
- To define, **manage**, evaluate and periodically verify the **technical programme**, rising from analysis of LTO conditions and setting a scope of activities for reaching the optimal time of LTO
- **To co-operate with related processes**, provide output from assessment of LTO conditions and incorporate requirements of those processes to the LTO technical programme
- **provide output for strategic planning** of ČEZ company from technical-economic analysis, including assessment of internal and external conditions for reaching the optimal time of LTO



Schema of PLEX decision process - IAEA-TECDOC-1309 (Dukovany)

Phase I

1996 – decision given by Governing Board of ČEZ, a. s. – to continue with modernisation of EDU with a goal to operate until at least 2025

➔**MORAVA** programme (1998 – 2009)

Phase II

2004 – 8 Completing of Dukovany NPP LTO Prg. documentation (PSR 2004 – 2007)

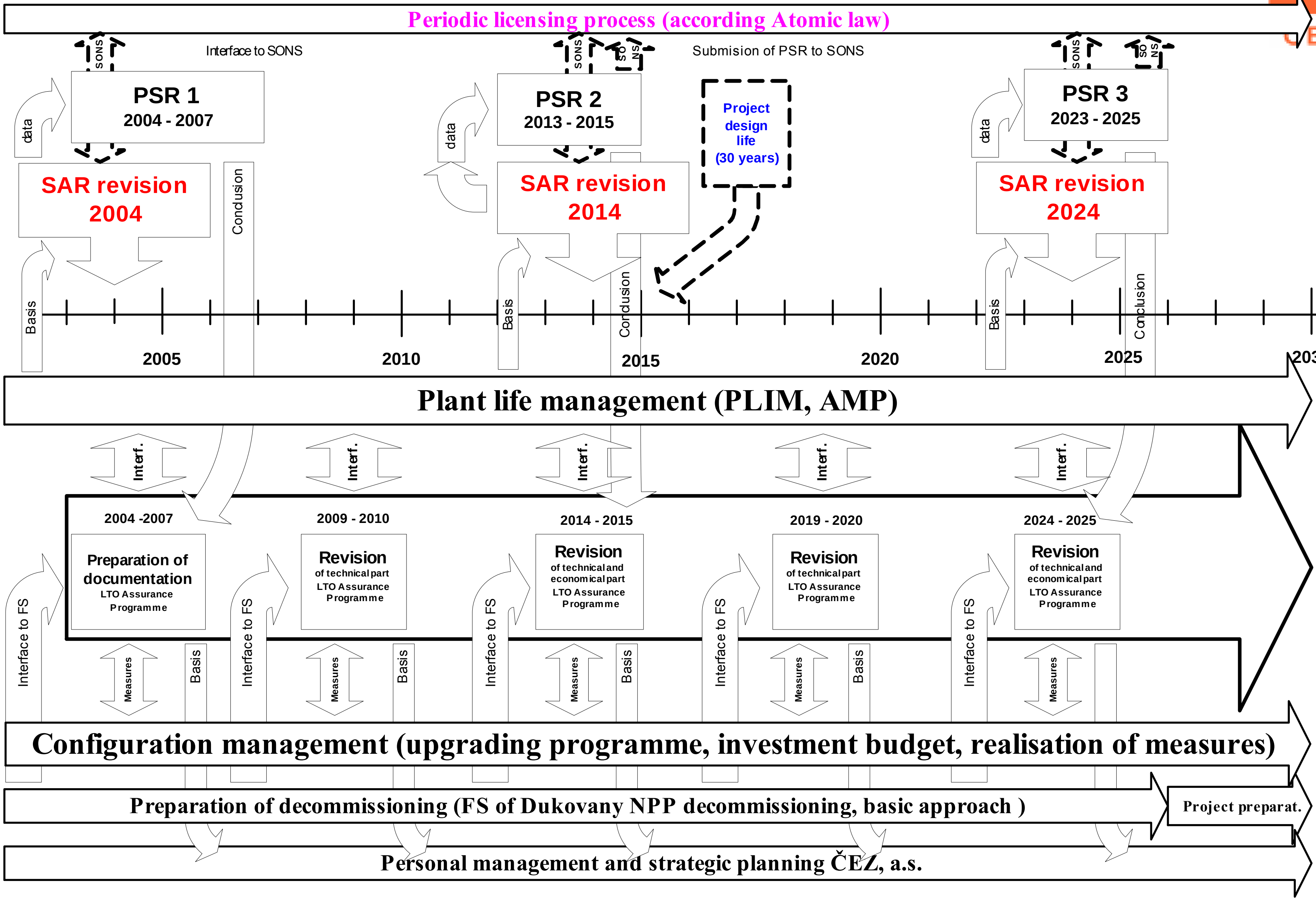
2008 – 15 Implementation of the Dukovany NPP LTO programme

2015 - Operation license extension issued by SUJB

Phase III

2016 - Updating of the Dukovany NPP LTO programme (licence condition fulfilment)

Interface of LTO preparation (example for Dukovany NPP, LTO till 2030)



Milestones of the LTO Programme

2004 – 8 Completing of Dukovany NPP LTO documentation

2004 – 6 Technical part of the LTO programme
2006 Economic part of the LTO programme
2005 – 8 Finalising of other chapters of LTO Documentation

2004 – 6 Parallel activities and outputs from EBP-SALTO-PWR

2007 – 8 Verification of range and content of PLIM and LTO projects (due to outputs of SALTO and other supporting projects)

2008 – 15 Implementation of the Dukovany NPP LTO programme and preparation of the Temelin NPP LTO programme

2015 (35) Operation license extension for EDU (ETE) issued by SUJB

2016 Updating of the Dukovany NPP LTO programme and finalising of the Temelin NPP LTO programme

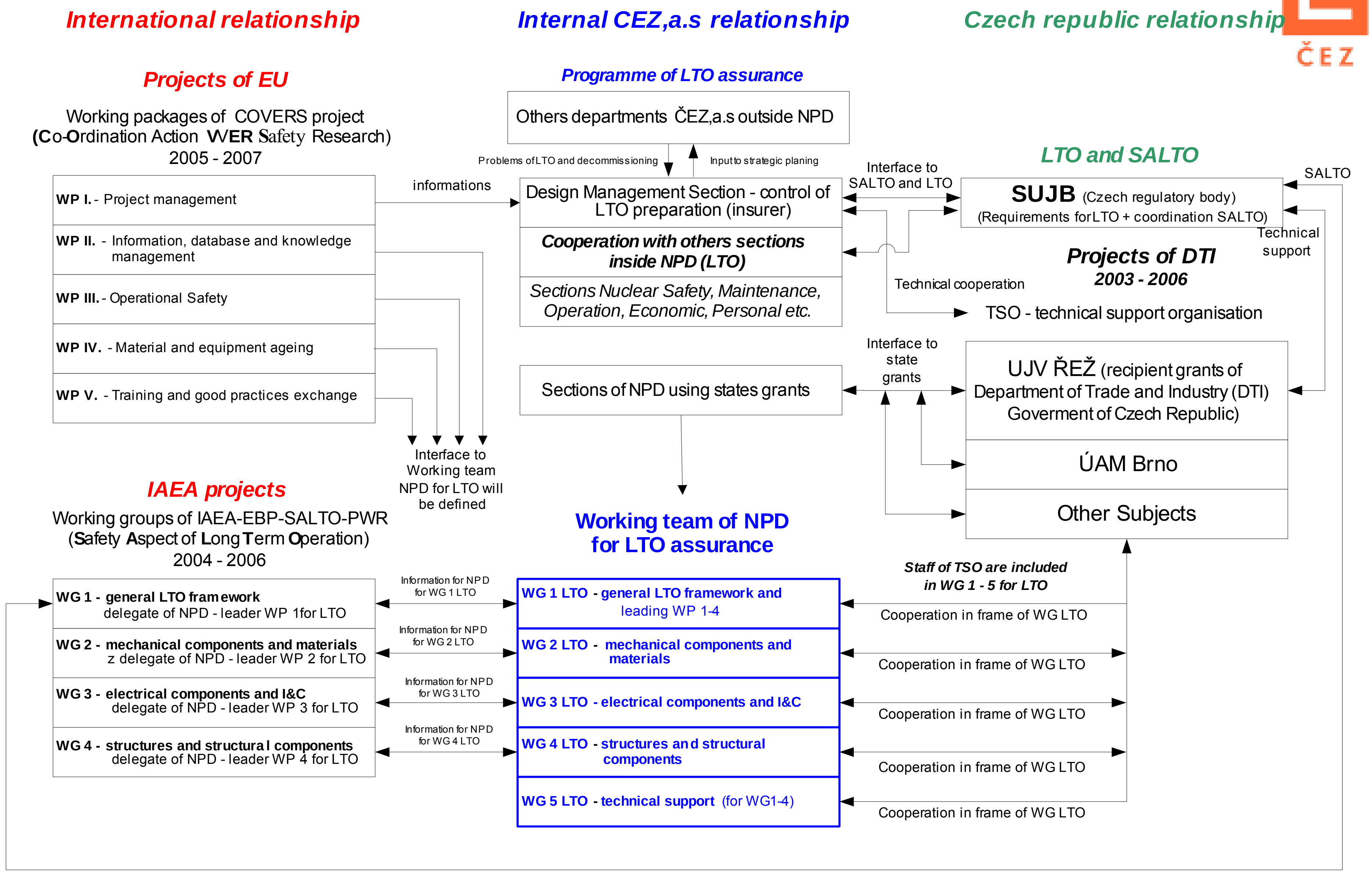
In parallel – connection to the technical part of the decommissioning processes (EDU, ETE)

Management of the LTO Programme

ČEZ

- Sponsor of the subprocess „ Assurance of LTO“ is the Design Management Section, Design Bases and Modifications Unit.
- Internal procedures on the „ Assurance of LTO“ appointed a working group of 40 specialists. The group was divided into 4 subgroups and 1 support group in accordance with the IAEA project (IAEA-EBP-SALTO-PWR).
- Continuity between NPD and the IAEA project is managed via 4 leaders of NPD project subgroups who are also members in 4 working groups of the IAEA project SALTO.
- Our working group will also derive benefit from other relevant national and international programmes.

Organisation of LTO preparation



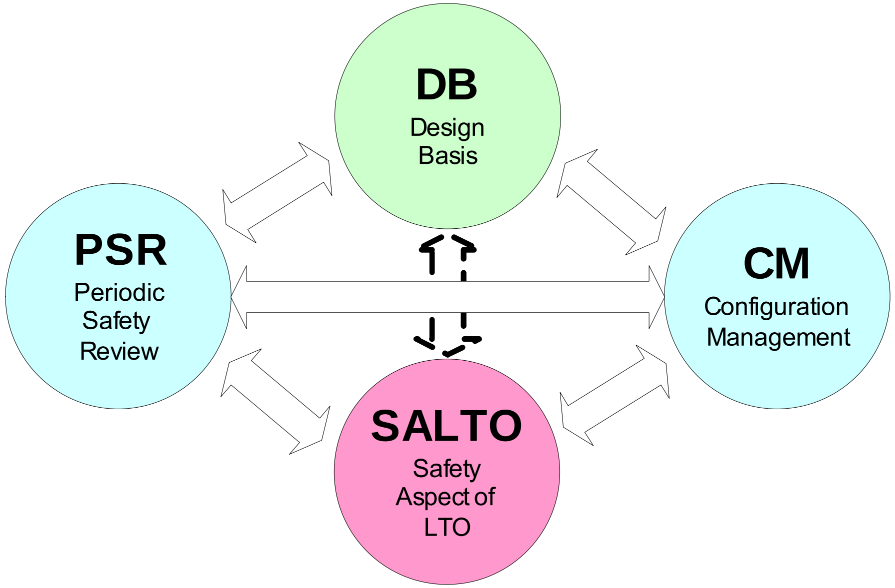
Main starting assumptions of Programme

Independent of PLEX/LTO assurance programme the following will be performed within UJE:

Recovery of project database (DB)

EDU and ETE will implement the programme of recovery of necessary information constituting the DB. To ensure safe operation during LTO the NPP has to be always able to find project, operational and nuclear-safety information which is accurate and reflects real configuration – NPP status. It has to be always able to assess safety reserves during the whole period of operation.

DB links with activities important to ensure LTO



Main starting assumptions of Programme

ČEZ

Independent of PLEX/LTO assurance programme the following will be performed within UJE:

Complex safety assessment

- Safety of individual UJE power plants will be regularly reviewed and the outcome of the review will be documented in the revision of the Pre-operation Safety Report (PpBZ).
- Sufficient conservatism will be accepted from the point of view of long-term safe operation.
- The PpBZ revision will match up-to-date power plant configuration.
- Using regular thorough assessment of the condition of key safety-affecting areas (PSR) it will be determined up to what extent the power plant meets current internationally recognized safety standards and practice, up to what extent license documentation remains valid, and whether relevant measures are taken to maintain the power plant safety until the next PSR. Furthermore, safety improvements will be set that should be implemented to solve safety variances identified.

Main starting assumptions of Programme

ČEZ

Independent of PLEX/LTO assurance programme the following will be performed within UJE:

Qualification for surroundings

- Safety-related power plant equipment is qualified in both NPPs for such conditions of the surroundings in which it will fulfill its function.
- Special emphasis is laid on the qualification for especially adverse conditions (qualification of prematurely aged equipment for operating conditions which are only possible during maximum project accidents)
- Qualification of equipment for the surroundings is maintained for the whole period of LTO of the UJE power plants.

Risk assessment

- During the UJE power plants operation new knowledge on external risk sources may appear, particularly the risks arising from human activities. The power plant safety assessments will be based on valid risk assessment.

Main starting assumptions of Programme

Independent of PLEX/LTO assurance programme the following will be performed within UJE:

Ensuring long-term experience keeping

- To ensure LTO in UJE, high culture of safety is needed.
- Average age of EDU and ETE employees and institutions providing technical support has experienced significant growth. To ensure transferability of information from UJE processes and projects the analysis of age distribution and potential retirements will be carried out for individual professions at UJE.
- To ensure LTO such a strategy in the field of labour will be employed which will in the future provide for the availability of qualified people at required terms.
- Knowledge and experience gathered by operating staff will be collected and passed on the new generation of the NPP operators.
- Strategy management adopted at the ČEZ,a.s., level, focused on labour and maintaining knowledge, will have to be ensured in connection with revitalization of technical capacity of the whole field and educational system related thereto.

Main starting assumptions of Programme

ČEZ

Within PLEX/LTO assurance programme the following will be performed:

- **Setting basic license materials for PLEX/LTO and their interconnection with the IAEA project output (IAEA-EBP-SALTO-PWR).**
- **Proving the sufficiency of storage capacity for storing increased amounts of r/a waste including spent nuclear fuel.**
- **Reviewing scope and content of life management programme**

The extent of assessment will correspond to the IAEA requirements formulated within the IAEA-EBP-SALTO-PWR project and EU COVERS project.

Findings from PSR will be utilized, supplemented by SSC assessments important for a chosen alternative of the programme of NPP decommissioning and by economically significant SSCs.

- **The documentation of the PLEX/LTO programme documentation will also include the assessment whether the scope and level of records available from hitherto operation is sufficient or not, and whether remedies should be adopted for future periods.**

Main starting assumptions of Programme

For NPP it will be proven that for a long-term operation (LTO) the following is applicable:

1. Either: the originally performed analyses remain valid until the end of the intended long-term operation;
2. Or: the analyses need to be expanded (completed) for the time period until the end of the intended long-term operation;
3. Effects of aging on relevant safety function(s) will be adequately controlled.

Conditions for realisation of LTO Programme

Limiting factors and Initial conditions

Limiting realisation factors

- **keeping present cabling (present cabling will not be replaced – in case of any changes, we will add new cables)**
- **No extension of the length of outages**
- **Use CR legislation, IAEA standards, EU standards**
- **Fulfill SUJB requirements**
- **Implementation of the technical programme will be managed by a standard configuration management process**

Initial conditions

- **Implementation of the whole LTO programme will be managed in the present organisational structure of UJE – we will not create any additional new department**

Short-term Timetable for Dukovany NPP

ČEZ

up to 12/2004 **Programme thesis**

Content: a summary of basic principals and limiting conditions of the LTO programme, including definition of programme goals, assurance of its organisation and programme milestones (based on the approved conception of CEZ)

2004 – 03/2006 **Technical part of the LTO programme**

2004 – 8 **Completion of the Dukovany NPP LTO programme documentation**

Short-term Timetable for Dukovany NPP

ČEZ

12/2004 - 12/2005 Assessment of SSC technical status

- **Criteria for SSC selection and for technical assessment (12/2004)**
  Supply through a grant Dep. Trade and Industry project (with NRI Rez).
- **Determination of the group of SSC for LTO (12/2004)**
  Supply through a grant DTI project (NRI Rez).
- **Assessment of technical status of defined SSC group**
  (beginning from **12/2004**)
- **Determination of technical constraints for LTO (06/2005)**
- **Determination of necessary technical measures for the selected LTO scenarios** – from 35 to 60 years of operation **(12/2005)**

Inputs from Related Projects

Main planned activities with outputs influencing to "Dukovany NPP LTO programme "

2004 – 7 PSR

2004 – 7 Outputs from PLIM and DTI project "MPO 3 and 4" in LTO area

2005(6) Expected IAEA mission on SI - „Safety improvement mission to Dukovany NPP"

2005 FSAR in accordance with RG1.70

2005 PSA actualisation (PSA 1 and PSA 2)

2005 (6,7) Issuing of operating licence for 10 years – fulfilling SUJB conditions

2007 Outputs from DB reconstitution projects and equipment qualification projects (Dukovany NPP and Temelin NPP also)

2007 Outputs from a new IAEA Regional project – "Improvement of DB and CM Documentation"

Timetable for Temelin NPP

Main planned activities with outputs influencing “Temelin NPP LTO programme “

2007 **Collecting of preliminary requirement and activities**
(based on Dukovany NPP programme results)

2007 **Beginning of “Temelin NPP LTO programme“**

2010 **PSR**

2011 **FSAR revision**

Summary

- ⇨ the LTO conception was approved by the board of directors of NPD including the expected timetable and scope of activities
- ⇨ related processes were defined, including linkages
- ⇨ working group of 40 specialists was established for managing the LTO process
- ⇨ technical-economic optimum of LTO for Dukovany NPP will be determined by the end of 2006
- ⇨ "Technical programme of LTO for Dukovany NPP (Temelin)" will be completed by 2008 (2016)
- ⇨ implementation of the LTO Programme assures safe and optimal technical-economic operation of the NPP and optimal use of installed technological equipment.

Thank you for your attention !

WG 1 SALTO Second Meeting

Section 5

Existing programs that are directly related to LTO

ČEZ

SIP/SKI offices, Stockholm, 23-27 August 2004

Nuclear Power Division
Design Bases and Modifications Unit
Locality Dukovany NPP

Miroslav Šabata
PLEX/LTO and Decommissioning manager

Existing Programs that Are Directly Related to LTO

ČEZ

Since Jan. 1, 2004, both NPPs form a part of the ČEZ Nuclear Power Plant Section (UJE), being viewed as on NPP with six generating units.

Current Strategy of UJE has set out the long-term-strategic goals:

- **To run the EDU generating units at least by 2025**
- **To run the ETE generating units at least by 2045**

At the UJE ČEZ,a.s. the following documents have been prepared to cover the life control:

- Working Procedure **Guideline 19/108** defines the unified rules designed to control the service life of the ČEZ-EDU equipment that can affect the technical concepts and necessary binds between the sections responsible for the service life control.

- Metodology for **Follow-up and Evaluation of Equipment Residual Life** (former **Guideline 19/112)**) is used to monitor and evaluate the **residual life** of the following structures, systems, and components:

Followed up equipment at Dukovany NPP

generator	6 kV substations
turbine	power outlet lines R400 kV and R110 kV
inserted rods	assurance of the 1st category power supply
main circulation piping	sectional distribution frames 0.4 kV
pressurizer	air-sealed bushings
steam generator	cable distribution systems
main circulation pump – body	air-sealed lining
main stop valve – body	non-air-sealed lining
reactor pressurized vessel	primary circuit concretes delimiting the containment area
reactor inner parts	reactor shaft concretes
TH, TJ, TC piping systems	CČS I,II concretes
erosion – corrosion pf piping systems	technical water piping in CHV No.1 - 8
AT01, AT02 transformers	
BT01, BT02 transformers	

Followed up equipment at Temelín

At the NPPs Dukovany and Temelín, the DIALIFE diagnostic software has been developed will determine the remaining life expectancy of the equipment, using the verified computation programs.

At the NPP Temelín this program is used to follow-up the life expectancy for the low-cycle fatigue of he following machinery and equipment :

- steam generator
- pressurizer
- main circulation pump
- main circulation piping complete with the connected energy pipelines to the 1st stop valve, including the line between the pressurizer and loops
- evaluation of the reactor pressurized vessel fatigue damages
- Bubble-elimination tank and its feeding lines
- Steam taking lines from the steam generator
- Reactor Cooling Heat Exchanger
- Diesel-generating sets

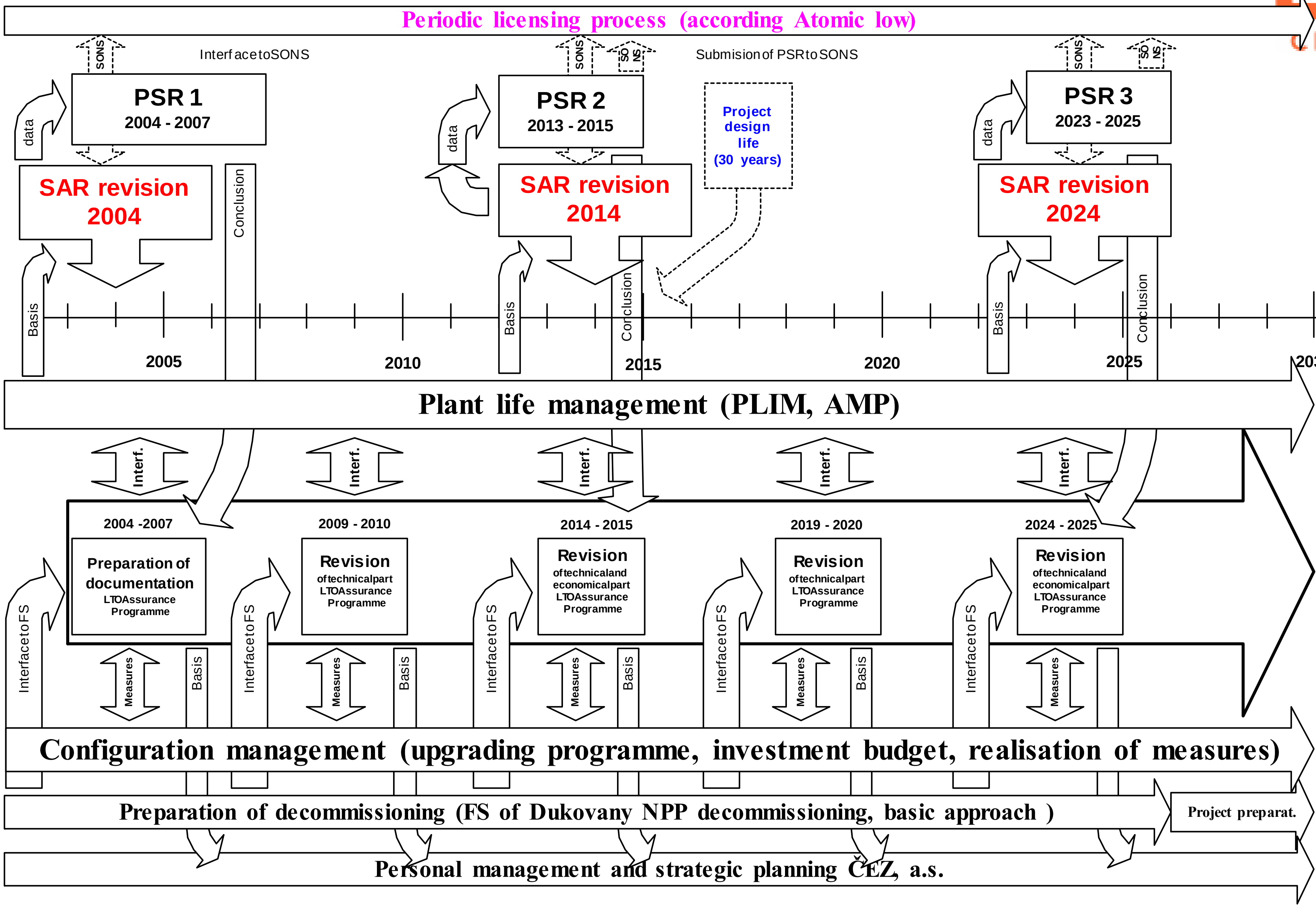
The follow-up comprises some 2,000 points (with 1,160 of them on the reactor, 638 on the piping, 104 on the main circulation pump.)

DIALIFE also contains the mathematical description of the material damaging processes due to stress corrosion.

Area of LTO preparation

- A sub-process called “**Assurance of Long-term Operation beyond Scope of Design Life Expectancy**” (PLEX/LTO Assurance) was defined within the UJE process module, being there incorporated in the “Project Administration” process. It is characterized in SM 021 Project Administration and described in PP 043 “Assurance of Long-term Operation beyond Scope of Design Life Expectancy” (PLEX/LTO Assurance).
- In order to support the PLEX/LTO Assurance sub-process the process with the same name (“PLEX/LTO Assurance Program”) has been designed. The program is there to carry out the primary evaluation and subsequent periodic reviews of the environment for PLEX/LTO, evaluation of the equipment condition and cooperating processes in respect of the PLEX/LTO requirements, and formulation of the measures for reaching the optimum length selected. It also provides a feedback to the cooperating processes.

Interface of LTO preparation (example for Dukovany NPP, LTO till 2030)



Thank you for your attention !

LTO, work group 1
FINLAND

TASK 1

REPORT

WG 1, Task 1

- Laws, regulations and practices

No specific law or guideline exist

New, first of kind approach for Loviisa NPP

WG 1, Task 1

- Plant design

<u>SSCs classification</u>

YVL guideline

Classes 1, 2, 3, 4 and EYT (non nuclear)

Class 1 presents highest safety significance

WG 1, Task 1

Major differences between plant and stds

N + 2 is required, plant satisfy N + 1

New design basis events ;

Large prim. / sec leak

Non homogenious boron dilution

ATWS

Severe accidents

WG 1, Task 1

<u>Safety significance of improvements</u>

Starting from 1990 PSA was the tool to evaluate the impact of design short comings on plant core melt risk.

WG 1, Task 1

- Equipment qualifications

  <u>Scope</u>

  Structures, materials and installations of electrical components and cables.

  Tests to demonstrate capability to operate in postulated accidents

WG 1, Task 1

<u>Feedback procedure</u>

A program to check the condition of qualified equipment.

Environment temp., insulation cond., surface temp. and radiation level are monitored.

Ageing reports yearly and corrective actions.

WG 1, Task 1

- Ageing

<u>Policy, organization and resources</u>

Strategy to operate for 50 years.

Important issues;

Safety upgrading.

Equipment life management.

Personnel plan.

Investment plan.

WG 1, Task 1

Criteria for identification

The following classes are adopted;

A Limit plant life

B Impact on plant availability & economy

C Less impact than B

D Others

WG 1, Task 1

- Safety analysis

Deterministic safety analysis

List of design basis events, vendor`s + new.

New events, for example :

Large prim/sec. leaks.

Cold shutdown events.

Criticality events.

Severe accidents.

WG 1, Task 1

Radiation dose and release limits

The dose limits applicable, per year ;

Normal operation	0,1 mSv
Anticipated transients	0,1 mSv
Postulated accidents	0,1 mSv
Severe accidents	100 TBq
(cesium-137)	

WG 1, Task 1

Guidelines for safety analysis

Guideline YVL 2.2 deals with requirements, calculation methods and acceptance criteria. Severe accidents are included. Guideline YVL 2.7 deals with safety functions and failure criterion.

WG 1, Task 1

<u>Probabilistic safety analysis</u>

A complete PSA, internal, external and shut down events.
Living PSA application.

WG 1, Task 1

- Safety performance

<u>Reporting safety related incidents</u>

Regulatory guide YVL 1.12 requires reporting based on INES.

Finnish regulator and IAEA responsible for informing the public at home and abroad.

WG 1, Task 1

Root cause analysis

Power plant required to perform analysis of events that have deterministic or, probabilistic impact on safety.

Human performance system (HPES) & investigation process (HPIP) are used.

WG 1, Task 1

<u>Feedback from other plants</u>

Continuous review of foreign plant events.

WANO, IAEA/IRS, NEA/IRS, WWER-club are available channels.

Recommendations are dealt with by a specific organization.

WG 1, Task 1

- Organization and adminstration

Safety policy

The owner company has a policy that defines safe and economic use of nuclear power plants for short and long term targets.

WG 1, Tassk 1

<u>Operating safety targets</u>

Quality policy guides management, nuclear safety and production.

Strategy plan sets targets for plant safe operation and production.

Plant manager is responible for implementation.

WG 1, Task 1

Experience feedback

Regulatory guide YVL 1.11 defines criteria and requirements.

Continuous montoring and reporting home and abroad.

Corrective actions are taken if necessary.

WG 1, Task 1

<u>Maintaining plant configuration</u>

Documents and responsible organizations are identified and updating instruction is implemented.

WG 1, Task 1

QA program and audits

Plant specific program to ensure that operation and environment targets are met.

Compliance with regulatory requirements

Approved instruction defines the routine of handling letters, inspection protocols etc.

WG 1, Task 1

- Procedures

<u>Approval</u>

Cover sheet where inspection and approval are marked.

<u>Modifications</u>

Modifications are marked, inspected and approved.

WG 1, Task 1

<u>Understanding and acceptanc</u>

Each procedure contain a background information file.

Classroom and simulator training to improve understanding and commitment.

Hungarian Country Input Report

to

IAEA EBP SALTO

Section 1

2nd meeting of IAEA EBP SALTO
WG1, 23-27 August, 2004,
Stockholm, Sweden

LAWS AND REGULATIONS RELEVANT TO LTO

- Atomic Act
  - operating licence may be granted for a defined or undefined period of time, licence granted for a defined period may be extended when so requested
- 108/1997 Korm. Governmental Decree
  - issuance of operating license could mean the extension of the designed lifetime
  - license in principal needs preliminary environmental impact study;
  - operating license for OBDL shall be preceded by obtaining the environmental license substantiated by detailed environmental impact study.

Detailed Requirements: Nuclear Safety Regulations

- Volume 1: Regulatory procedures
- Volume 2: Quality assurance
- Volume 3: Design
- Volume 4: Operation
- Volume 5: Nuclear Safety Regulations of Research Reactors
- Volume 6: Nuclear Safety Regulations of Spent Fuel Storage Facilities

LICENSE OF OPERATION BEYOND THE DESIGNED LIFETIME (OBDL)

- Two step process
  - license in principal
  - new operating license

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IAEA EBP SALTO

Section 2

2nd meeting of IAEA EBP SALTO
WG1, 23-27 August, 2004,
Stockholm, Sweden

Step 1 - Licence in principal

- safe operation shall be continuously maintained
- problems of the actual operation shall be handled within the valid operating license
- safety margins shall never be consumed
- activity for maintaining the technical conditions of the safety SSCs shall be launched and continuously performed already within the designed lifetime
- efficiency of maintenance activity shall be systematically supervised and evaluated.

Step 1 - Licence in principal

- determination of safety improving measures, deriving from the modern international requirements, shall be carried out within the frame of PSR and not for the LTO issue
- possible methods of fulfilling the requirements for the content of the license application will be issued in the related guidelines

Step 1 - Licence in principal

- application 5 years before the expiration
- application can be submitted for one or more units of the same plant
- at least 20 years of operating experience shall be considered
- the legally binding license determines the individual unit specific conditions and technological requirements, certifying the fulfillment of which is enough to obtain the license for the OBDL

Step 1 - Licence in principal

- binds the licensing authorities to the scope of the already formulated conditions if
  - data and information substantiating the license in principal has not changed much than it had been prognosed
  - no new data, influencing the safe future operation, was revealed
  - the general legal requirements have not been changed under the validity period of the license in principal

Step 1 - Licence in principal

- all necessary modification shall be performed within the frame of the valid operating license
- valid: maximally until end of designed lifetime
- validity is lost if its conditions are not fulfilled
- requirements for the content of LP application:
  - shall be based on the requirements for the application of the new operating license,here only fulfilment or activity planned for the fulfilment of the requirements should be demonstrated.
  - shall contain the planned duration of OBDL.
  - shall contain the necessary contributions

Step 2 - Operation licence

- licensing of OBDL is performed in the new OL
- application is submitted 1 year before the expiration of lifetime
- validity: until defined time period if all conditions are fulfilled
- attachmenets:
  - actualised FSAR
  - modified version of the relevant documents
  - necessary special authority contributions
  - substantiating documents upon request

Step 2 - Operation licence

- In the application followings are demonstrated:
- appropriate scoping of SSCs performed
- LTO relevant ageing mechanisms are addressed
- condition of LTO relevant SSCs are surveyed, efficiency of the former ageing programs are evaluated, new ageing management aspects and requirements are elaborated
- scope of TLAAs involved is determined, former TLAAs are re-evaluated and their validity is checked
- FSAR is actualised

Step 2 - Operation licence

- Necessary modification of operating conditions and limits are surveyed and substantiated
- Relevant documents (operating limits and conditions, maintenance policy, symptom oriented accident management procedures, other emergency procedures, emergency response plan) are surveyed and their modifications necessary to OBDL are justified
- During LTO the safe operation is ensured based on the safety analysis. The safety functions are fulfilled, operating limits and conditions are in harmony with LTO requirements

Requirements for demonstrating the Operability Beyond Designed Lifetime

- The followings are included into the licensing scope of the OBDL:
  - SSCs fulfilling safety functions.
  - Those non-safety classified components whose failure can prevent safety SSC fulfilling their safety functions.
  - SSCs included due to regulatory decision.
- The safety functions shall be indicated due to the fulfilling of which the given SSC is included into the OBDL scope.

Requirements for demonstrating the Operability Beyond Designed Lifetime

- The scope of OBDL shall be in accordance with the current licensing basis.
- The Licensee shall conduct review to demonstrate that the degradation processes requiring ageing management of the SSC included into the licensing scope of OBDL are appropriately identified, and they are adequately handled during LTO and the fulfilment of these functions are not endangered.
- Based on the results of the review the Licensee shall identify those SSCs that need ageing management program or modification of the existing program.

Requirements for demonstrating the Operability Beyond Designed Lifetime

- The activities aimed at maintaining the necessary conditions of the SSCs fulfilling safety functions shall be launched and continued during the designed lifetime, and its efficiency shall be monitored.
- For substantiating the OBDL of the unit the ageing management program of passive safety components (fulfilling their safety function without change in conditions or movement) and those that are not designed to be substituted within the lifetime of the unit (long-lived components) shall be demonstrated.

Requirements for demonstrating the Operability Beyond Designed Lifetime

- The demonstration of the ageing management program contains:
  - Description of method how the examined systems or system groups fulfil their safety function.
  - The identification of degradation mechanisms requiring ageing management
  - Description of ageing management programs applied for the detection and mitigation of ageing mechanisms or for the management of their consequences
  - Demonstration that the above programs are appropriate for maintaining the designed safety function for the LTO.

Requirements for demonstrating the Operability Beyond Dsigned Lifetime

- The Licensee shall identify those analyses serving the demonstration of the adequacy of the system components belonging to the licensing scope of OBDL that take the ageing mechanisms into account and that accepted the designed lifetime and the connected stressors as licensing basis (TLAAs). It shall be also demonstrated that these analyses are still valid for the OBDL.

Requirements for demonstrating the Operability Beyond Dsigned Lifetime

- The maintaining of validity of TLAAs can be performed by decreasing the conservatism applied in the calculation methods and by changing the analysis data, but in that cases the schedule of necessary measures shall be demonstrated, and their adequate efficiency and the possible changing of analyses data shall be justified.
- The actualisation of TLAAs and the connected measures shall be scheduled to be completed before the issuance of the license for OBDL.

Requirements for demonstrating the Operability Beyond Dsigned Lifetime

- If based on the TLAA the end of safe operability of the system component can be justified between the designed lifetime and extended license period of the unit then for the actualisation of the analysis and for the performing of the necessary measures a deadline in accordance with the analysis results, but ensuring the necessary safety margins shall be initiated.
- For licensing the OBDL of the unit it shall be clarified if there were any regulatory exemptions concerning the TLAAs. If yes, its sustainability shall be substantiated for OBDL.

Role of PSR

- Tool of renewing license in every 10 years
- PSR shall address:

  design of the unit, state of the SSCs, EQ, ageing, safety analysis, risk assessment, safety compliance, experience and research feedback, organization and administration, procedures, human factor, emergency preparedness, environmental radiation exposure.

In the PSR the Licensee shall

- Demonstrate that the technical status of the structures and equipment and the operating conditions meet the safety and regulatory requirements.
- Survey the actual status of the unit, considering the ageing and deterioration of the SSC, and all internal and external factors that potentially affect the future operation.
- Identify those deviations from the internationally accepted modern requirements that can limit the operability of the unit.
- Classify the risk factors, revealed based on the above considerations, and elaborate safety improvement progra.

PSR contains 3-level documentation

- Summary report: addressing the comprehensive safety evaluation of the unit, indicating the most important statements, classifying the safety problems and the necessary improvement measures, their goals and schedule.
- Inspection reports: report from the revised fields containing the performed activity, its limitations and results, the drawn conclusions, the risk-assessment and safety classification of the revealed deficiencies, and the scheduled improvements.
- Work reports: documentation used as source documentation

Design basis

- The safety analysis performed during the design shall be periodically reviewed and modified if necessary throughout the lifetime of the unit, considering the changes, the related state-of-the-art, the previously not considered quality degradation or material changing due to ageing.

Strength analysis

- It shall be demonstrated that the lifetime of the system component is long enough, considering all phenomena occurring during the lifetime, i.e. the ageing and the prescribed safety comply with the operating and assumed accidental conditions.
- The analysis shall be performed by justified methods.

Equipment qualification

- Qualification procedures shall be elaborated to demonstrate that all safety SSCs fulfil the required function throughout its whole lifetime.
- For the safety SSCs it shall be ensured that the safety related assumptions are valid throughout the lifetime of the SSC.
- The qualification can be performed through testing, analysis or operating experience or through combination of these.

Maintenance, inspection, cycle periods

- It shall be ensured that the periodic inspection, functional testing, tightness testing, structural intact inspection, material testing is possible, and based on them the determination of radiation effects, ageing of structural materials are ensured.
- The cycle period of functional testing and inspection of the SSCs, the requirements for the execution and the method and conditions of their maintenance shall be determined to be in accordance with the design concept, the construction and the safety function and classification of the SSC.

Other issues

- QA
- Reliability
- PSA
- Preventive and corrective maintenance program (MP)
- Condition monitoring
- Periodical checks and inspection
- In-service inspection, testing and performance tests
- Chemistry
- Pressure vessels

No specifically LTO related requirements exist!

Hungarian Country Input Report

to

IAEA EBP SALTO

Section 3, 4, 5, 6

2nd meeting of IAEA EBP SALTO
WG1, 23-27 August, 2004,
Stockholm, Sweden

Updating of DB

- AGNES project
- Seismic resistance project
- RP reconstruction
- etc.
- There are still missing analyses

Upgrading of requirements

- Modification of
  - Atomic Act
  - Related decrees
  - Nuclear Safety Regulations

were performed.

- Issuance of guidelines were performed and are under way
  - 4 addressing EQ
  - 3 addressing Ageing Management
  - 2 addressing Lifetime Extension
  - 2 addressing Maintenance Rule impl.

Standards

- No legally binding technical standards
- NSRs require high level, uniform standard application
- Mainly Russian standards are followed
- NPP willing to change to ASME

Service Life extension program of the NPP

- Methodology for scoping of licensing and lifetime management (criteria documents, data acqisition)
- Comprehensive review of the ageing management program (scoping, review of MT, CM, etc)
- Important lifetime management tasks (SGs, control rods, FSAR updating)
- TLAAs (cycle numbers, pressure vessel fluence and lifetime)
- Introduction of known new ageing management practice (extension of material testing, concrete structures)

Lifetime extension program of the NPP cont.

  - New maintenance practice
  - Improvement of equipment qualification
  - New ageing management practice based on the review results
  - Licensing tasks
  - Supporting activity (involvement of experts boards, research and development, informatic background)
- Other programs
  - IAEA
  - NRC

Research Activities

- Before and after 2000 quite a few research programs were launched
  - feasibility studies
  - TLAAs
  - etc.
- Common use of TSOs

International Atomic Energy Agency

Safety Aspects of Long Term Operation of PWR Reactors in Russia

N. Sulkhanishvili

(Federal Nuclear Regulatory Authority)

P. Medvedev

(Rosenergoatom)

2-nd Meeting of the Working Group 1 on General Long Term Operation Framework.

Stockholm, Sweden, 23-27 August, 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

1. Laws and regulations relevant to LTO.

Activities on NPP power unit lifetime extension are conducted in accordance with requirements of the legislation currently in force in the Russian Federation (RF) and federal norms and rules in the field of use of atomic energy, including first of all the following:

Federal Law "On Use of Atomic Energy":

Article 9 provides the RF Government authorities in the field of use of atomic energy to make decisions on design, construction, operation and decommissioning of federal-owned nuclear installations. Within this authority scope, the RF Government by its decree of 21.07.98 (№ 815) approved the Programme of Development of Nuclear Power Industry for 1998-2005 and for the period till 2010, and endorsed the Strategy of Development of Nuclear Power Industry in the 1st Half of XXI Century. Both of the documents envisage provisions for lifetime extension of existing NPP power units after expiration of the initially assigned lifetime of 30 years.

1. Laws and regulations relevant to LTO (cont)

Federal norms and rules in the field of use of atomic energy:

***"General Regulations for Ensuring Safety of Nuclear Power Plants OPB-88/97"* (item 5.1.14) assumes that an operational utility may put a question of lifetime extension of a NPP power unit. In such a case, new license on the NPP power unit operation have to be obtained from the regulatory body (Gosatomnadzor*) in accordance with established procedure.**

***"Norms and Rules for Establishing and Safe Operation of Equipment and Pipelines at Nuclear Power Installations PNAE G-7-008-89"* (item 2.1.11) allows a possibility of operation of equipment and pipelines beyond the timeframe established by design, provided that their residual life has been justified.**

***"General Requirements to Lifetime Extension of a NPP Power Unit NP-017-2000"* establishes requirements to the activities to be carried out in order to prepare a NPP power unit to the extended operation, as well as success criteria for the accomplished activities.**

***The State Standard "Reliability of NPPs and their Equipment"* defines the assigned lifetime as a calendar period of time established by the design, beyond which further operation can be continued upon the decision made on the basis of studies of plant safety and economic effectiveness.**

In accordance with "*Regulation for Licensing Activities in the Field of Use of Atomic Energy*" approved by the RF Government decree of 14 July 1997, in order to obtain license on a NPP unit operation during additional period of time, the operational utility, Rosenergoatom, have to submit to Gosatomnadzor of Russia the results of activities aimed to operational lifetime extension of the NPP unit.

*** since April 2004 - Federal Nuclear Regulation Service (FSAN)**

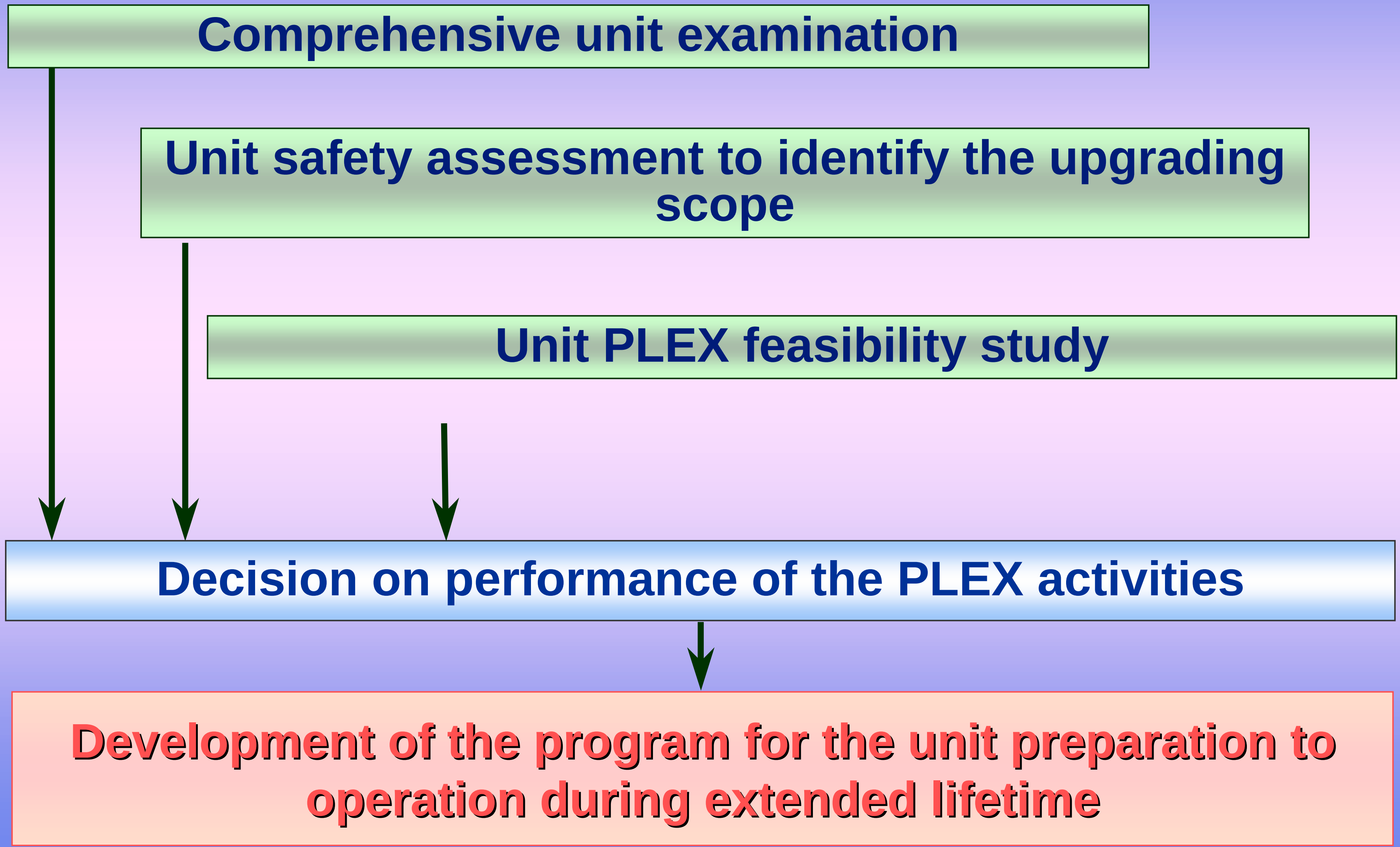
Stages of the NPP units preparation to **PLEX**

- 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

2.2. Comprehensive Examination of a NPP Power Unit

"General Requirements to Lifetime Extension of a NPP Power Unit" NP-017-2000.

The main tasks of the comprehensive examination are:

- **Assessment of technical conditions of all elements of a power unit (thermal mechanical equipment, electromechanical equipment, I&C items, structures, etc.) from the point of view of the influence of ageing processes on them;**
- **Assessment of technical feasibility of further operation of the examined elements and, consequently, of the whole power unit.**

Design and architect engineering organizations developed the design of the plant and the reactor unit are involved in the comprehensive examination activities. Besides, in the activities may be involved, as necessary:

- **Other organizations taking part in NPP / reactor unit design development;**
- **Design organizations and manufacturers developed and manufactured the NPP unit elements (or those specializing on development and manufacturing of the examined elements and possessing a license of Gosatomnadzor of Russia on relevant kind of activity);**
- **Organizations specializing on material condition studies;**
- **Other specialized organizations possessing a license of Gosatomnadzor of Russia on relevant kind of activity.**

2.2. Comprehensive Examination of a NPP Power Unit (cont)

The main works to be carried out within the comprehensive examination applicably to the power unit elements are:

- **Review of design documentation;**
- **Review of operational history: operational parameters and modes, damages and failures, reliability;**
- **Analysis of the data provided by in-service inspections of metal, diagnostics, tests and studies;**
- **Review of the maintenance & repair system existing at the plant in respect to maintaining life of recoverable elements.**

2.2. Comprehensive Examination of a NPP Power Unit (cont)

On the basis of the comprehensive examination results the following should be identified:

- **Technical feasibility of further operation of the unit elements taking into account the margins and conservatism put at the design stage;**
- **Recommendations on implementation of the measures required to ensure operability and reliability (during the additional operation period) of recoverable elements of the power unit;**
- **Package of necessary additional jobs to be implemented for justification of residual life of non-replaceable and non-recoverable elements of the power unit;**
- **List of the power unit elements whose life is maintaining and restoring within scope of the maintenance & repair programme;**
- **List of the elements which, due to their insufficient residual life, obsolescence or termination of manufacture of wares / spare parts for them, are appropriate to be replaced on the routine basis;**
- **Capability for storage and safe management of radioactive waste being generated during the additional operational lifetime of the NPP unit.**

The results of the NPP unit comprehensive examination are formalized in a report which has to be submitted by the operational organization to Gosatomnadzor of Russia in compliance with requirements of the Gosatomnadzor's guidelines "*Requirements to Composition of Document Package and Contents of the Documents Justifying Safety of a NPP Unit During Additional Operational Period*".

2.3. Evaluation of Economic Expediency of NPP Power Unit Lifetime Extension

The evaluation of economic expediency of power unit lifetime extension allows one:

- **To evaluate social, commercial and budgetary effectiveness of the PLEX project in comparison with the option of denial of its implementation;**
- **To compare economical effectiveness of the PLEX project with economical effectiveness of alternate project of construction of a power source capable to replace generating capacity of the NPP to be withdrawn in case of power units shutdown after expiration of the assigned lifetime,**

The above activity is performed in compliance with "*Procedure for Evaluation of Economic Expediency of NPP Power Unit Lifetime Extension*".

The evaluation of economic expediency of power unit lifetime extension is performed taking into consideration comparison of two groups of costs related with:

- **lifetime extension of the power unit plus its decommissioning after expiration of the additional lifetime;**
- **New construction of replacing capacities plus decommissioning after expiration of the assigned 30-year lifetime.**
- **Performing the evaluation one should consider commercial, social and economic effects of each of the two options of plant lifetime management.**

2.3. Evaluation of Economic Expediency of NPP Power Unit Lifetime Extension (cont)

The main components of cost of power unit PLEX are:

- **Costs of modernization aimed at improvement of power unit safety;**
- **Costs of justification of power unit elements life extension, including replacement of elements with expired life;**
- **Costs of justification of power unit safety throughout the additional operational lifetime;**
- **Costs of management of radioactive waste to be generated during the additional operational lifetime.**

The evaluation of economic expediency of PLEX should demonstrate that the region (or electricity grid) needs in this generating capacity during the prospective additional period of its operation while electricity generated by the NPP will be competitive with that generated by other generating facilities.

Results of evaluation of economic expediency of PLEX in line with results of comprehensive examination and safety assessment of the NPP unit are taken into consideration in decision making regarding preparation the unit either to lifetime extension or to decommissioning. j

2.4. Programme of NPP Unit Preparation to LTO

Programme of NPP unit preparation to operation during additional period of time (Programme) is developed in accordance with requirements of federal norms and rules *"General Requirements to Lifetime Extension of a NPP Power Unit" NP-017-2000.*

In compliance with requirements of Guidelines of the operational organization "*Standard Requirements to Contents of Programme of NPP Unit Preparation to Operation During Additional Period of Time*" the mentioned Programme is developed for particular power unit taking into account results of:

- **comprehensive examination of the NPP power unit;**
- **assessments of the NPP power unit safety;**
- **evaluation of economic effectiveness of the NPP power unit PLEX.**

Programme of NPP unit preparation to operation during additional period of time should determine procedure, order, main performers and terms of implementation for jobs on ensuring safe unit operation throughout the additional operational lifetime as well as their scopes and financial sources.

The Programme has to be agreed with the organizations designed the plant and reactor unit and be approved by the operational organization.

2.4. Programme of NPP Unit Preparation to LTO (cont)

The Programme should envisage the following main activities:

- **justification of life extension for non-recoverable and non-replaceable items, replacement of the items with expired life;**
- **NPP unit modernization aimed to improve safety;**
- **justification of safe operation of the power unit during the additional period of time.**

The following should be provided for each of the above Programme activity:

- **work schedules including designation of composition, order, terms and main performers for each particular job;**
- **QA programmes including requirements to acceptance of performed jobs;**
- **List of work programmes, technical specifications and other design and organizational documents needed to be developed;**
- **Planned cost of the activity.**

In compliance with Guidelines of Gosatomnadzor of Russia on *"Requirements to Composition of Document Package and Contents of the Documents Justifying Safety of a NPP Unit During Additional Operational Period"* the operational organization submits to Gosatomnadzor of Russia the Programme of NPP unit preparation to operation during additional period of time together with a report on its accomplishment.

2.5. Ageing management (management of NPP equipment service life)

According to the "Regulations.." the plant equipment is subdivided into the following three groups:

- **equipment which service life is maintained by maintenance & repair according to *«Rules for Organization of Maintenance & Repair of NPP Systems and Equipment», RD EO 0069-97;***
- **equipment replaceable on regular basis during the operation at the cost of the amortization, O&M and reserve and development funds;**
- **non-replaceable equipment which determines the operational lifetime of a power unit. Its residual life is evaluated in accordance with methods approved by Gosatomnadzor of Russia taking into consideration the *"General Requirements to Lifetime Extension of a NPP Power Unit" NP-017-2000.***

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

2.6. In-depth Safety Assessment Report (Russin prototype of FSAR)

The main purposes of the OUOB report are:

- **Reflection of actual safety performance of a power unit;**
- **Identification of possible deviations from the applied regulatory requirements and of the compensatory measures taken;**
- **Justification of level of engineering condition of the NPP structures, systems and elements ensuring safe operation of a power unit;**
- **validation of completeness of the operational procedures, the administrative control, utility supervision and quality assurance schemes being implemented at the power unit and at the whole plant and allowing to the operational organization to ensure safe operation of the NPP power unit;**
- **provisions for ensuring safe operation of the NPP power unit;**
- **demonstration that actual impact of the power unit operation to personnel, population and the environment does not exceed the limits prescribed by regulatory documents.**

2.6. In-depth Safety Assessment Report (Russin prototype of FSAR) (cont)

The OUOB of a NPP power unit includes the following analyses:

<u>Deterministic analysis</u>:

- **Analysis of power unit conformance to requirements of regulatory documents**
- **Analysis of systems**
- **Analysis of deviations from normal operation and design basis accidents**
- **Analysis of beyond design basis accidents**
- ***Analysis of operational experience*;**

<u>Probabilistic safety analysis.</u>

- **The outcomes of accomplished in-depth safety assessment are as follows:**
- **Deviations from regulatory document currently in force have been identified and their influence on the safety has been reviewed;**
- **Conditions of the systems after modernization have been analyzed, and the initial events – the most important for safety failures of elements – have been identified;**
- **the list of design basis accidents has been specified; and their analysis using accepted methods have been performed;**
- **the list of beyond design basis accidents has been specified; and their analysis using accepted methods have been performed;**
- **1st level PSA with unit modernization activities taken into account has been developed.**

2.6. In-depth Safety Assessment Report (Russin prototype of FSAR) (cont)

2.6.1. Analysis of power unit conformance to requirements of regulatory documents

Assessment of influence on safety of the identified issues is performed taking into consideration the following factors:

- **frequency of initial event occurance;**
- **completeness of performed safety function;**
- **severity of consequences.**

Significance of influence of each issue on safety is evaluated by means of assignment to the issue one of the four recommended by the IAEA categories (high, medium, low, insufficient).

2.6.2. Analysis of NPP unit systems

The analysis of NPP unit systems is carried out in compliance with requirements of the regulatory document *“Standard Contents Of Technical Justification Of Nuclear Power Plant Safety” (TS TOB AS-85)*. Frameworks of the analysis include development of the following sections:

- **Purpose and design basis;**
- **Classification of elements;**
- **Analysis of normal performance and interrelations;**
- **Analysis of system’s performance in case of failures;**
- **Analysis of performance in accident conditions;**
- **Reliability analysis;**
- **Residual life analysis.**

2.6.3 Analysis of deviations from normal operation and design basis accidents

List of initial events (IEs) is compiled on the basis of the list of initial events given in the Appendix 2 to "*Recommendations on In-depth Safety Assessment of Operating NPP Power Units with WWER and RBMK Type Reactors (OUOB AS)", RB G-12-42-97* taking into account the results of identification within the system analysis of the failures treated as IEs.

In the analysis of deviations from normal operation and design basis accidents there should be demonstrated that the acceptance criteria related with fuel rod integrity and with radiological consequences of an accident and applied in the accident sequence review are observed.

Calculation studies of the accident scenarios are performed by means of certified software, input data related with parameters and characteristics of power unit systems and equipment are verified to be actual ones. A conservative approach is applied throughout the studies.

2.6.4. Analysis of beyond design basis accidents

List of the beyond design basis accidents (BDBAs) to be reviewed is compiled on the basis of the list of accidents given in the Appendix 2 to *"Recommendations on In-depth Safety Assessment of Operating NPP Power Units with WWER and RBMK Type Reactors (OUOB AS)", RB G-12-42-97*, and also of probabilistic evaluations and operational experience of the NPP power units.

One analyses whether the acceptance criteria established for design basis accidents are observed or not in course of accident evolution. In case of noncompliance with acceptance criteria in course of evolution of an accident the integrity of physical barriers should be checked and the parameters of radioactive release beyond the confinement as well as off-site consequences should be assessed. Possible actions of personnel aimed to control and mitigate consequences of such accidents are analyzed. Calculation studies are performed by means of certified software.

2.6.5. Review of operational experience

The review of operational experience includes the following main sections:

- **operational safety indicators for NPP unit;**
- **operational organization;**
- **operational personnel;**
- **operational documentation;**
- **provisions for independent industry level surveillance;**
- **provisions for technical support and maintenance & repair;**
- **quality assurance;**
- **provisions for radiological protection;**
- **provisions for fire safety;**
- **measures of protection of personnel and population in case of beyond design basis accidents;**
- **account and control of nuclear material;**
- **system for acquisition, treatment and usage of operational data;**
- **analysis of deviation from normal operation of NPP unit.**

In the operational experience analysis there are used the materials from "Annual reports on NPP unit safety status", which the operational organization develops annually in accordance with "*Provision for Annual Reports on Assessment of NPP Unit Operational Safety Performance" RD EO-0143-99*, approved by the Gosatomnadzor of Russia.

2.6.6. Probabilistic safety analysis (PSA)

Performance of PSA in frameworks of in-depth safety analysis report pursues the following main goals:

- **Assessment of safety level by means of evaluation of core damage frequencies (CDFs) for internal initial events (IEs) under condition of full power operation and safety improvement measures taken into account;**
- **Identification of dominant contributors and development of supplementary recommendations and measures for further enhancement of the safety.**

2.6.6. Probabilistic safety analysis (cont)

Within level 1 PSA the following tasks are completed:

IEs analysis, selection and grouping.

Accident sequences analysis. **Event trees (ETs) simulating the possible ways of accident evolution (accident sequence), which may occur as a result of accomplishment (or failure to accomplish) of one or several separate safety functions, are developed for each of the IE group. For each of accident sequences the final states (with or without core damage) are identified. The ET development is based on analysis of the success criteria stated in terms of minimal configuration of systems and personnel actions enough for accomplishment of safety functions. The success criteria are established on the basis of the analyses of accident processes included into design basis, which have been performed earlier in scopes of other studies, as well as analyses specially performed within the PSA;**

Analysis of systems. **Good analyses of reliability of systems (the analyses of element failure types and impact of their failures on accomplishment by the system its intended safety function) are performed, and descriptions of systems and failure trees are developed. Interrelations including common cause failures are considered.**

Data analysis **includes:**

- **acquisition and review of IE frequency data;**
- **acquisition and review of equipment failures, maintenance and repair data;**
- **evaluation of common cause failures parameters.**

Human reliability analysis **includes identification, simulation and quantitative assessment of the probabilities related to human failures.**

Quantitative assessment **includes identification of frequencies of occurrence for accident sequences with core damage, calculation of total CDF value and analysis of uncertainties of the results.**

Analyses of significance and sensitivity. **Within this task the evaluations of safety improvement measures influence on the CDF are performed inter alia.**

Development of recommendations on further CDF reduction.

3. Current design basis requirements including any upgrades

The work scope necessary for modernization of power units is determined on the basis of results of the following analyses:

- **Deterministic analysis of compliance the NPP power unit design with applicable regulatory documents on safety**
- **Probabilistic safety analysis;**
- **Review of operational experience.**

This process takes into account the IAEA recommendations for the given type of reactor unit as well as international experience with modernization of power units of similar design.

- Planning, preparation and implementation of the modernization activities aimed to improve safety of a NPP unit are undertaken according to requirements of the operational organization's normative document *"Provision on Procedure for Organization and Implementation of Modernization of NPP Systems and Equipment".*

In conformity with the "Provision…" the following should be established for each nuclear power plant:

- **Integrated long-term modernization programme – for long-term (5-year) planning of activities;**
- **Annual modernization plans – for current planning and organization of works.**

3. Current design basis requirements including any upgrades (cont)

The goal of the Integrated long-term modernization programme is to develop schedule of further actions focused on elimination and/or compensation of the identified safety issues. The Integrated long-term modernization programme sets priorities for planned activities based on their influence on the plant safety.

The activities on modernization of the systems important to nuclear or radiation safety shall be implemented in accordance with "*General Provisions for Preparation, Reviewing and Decision-Making Concerning the Changes of Design, Engineering and Operational Documentation Affecting Nuclear and Radiation Safety*" (RD-03-19-94). In this case the changes introduced into design documentation involve the license terms correction stipulating that the operational organization have to submit to the Gosatomnadzor of Russia the justification documents which scope is determined by requirements of the RD-03-19-94 guidelines. Implementation of the mentioned activities is allowed only upon obtaining the relevant change of the license terms issued by Gosatomnadzor.

Procedure of expert review of the design documents is based on "*Provision on Procedure for Expert Review of Documents Justifying Nuclear and Radiological Safety of Nuclear Installation, Radiation Source or Storage Facility and (or) Quality of the Declared Activity" (RD-03-13-99).*

Activities involved use of imported equipment should be performed in compliance with *"Terms of Supply of Imported Equipment, Wares and Component Parts for Nuclear Installations, Radiation Sources or Storage Facilities of the Russian Federation" (RD-03-36-97).*

Modernized equipment is put into operation for its testing or run-up operation in accordance with *RD EO 0069-97 "Rules for Organization of Maintenance and Repair of NPP Systems and Equipment*" document.

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**

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 06.07.2008
   - Kola NPP unit 2, Validity of the license - till 30.06.2009

EBP on Safety Aspects of Long Term Operation of Water Moderated Reactors

WG1 Second Meeting

NATIONAL REPORT PRESENTATION - SLOVAKIA

VÚJE, a.s. - Division of Nuclear Power Plant Operation Preparation

Prepared : Miroslav Lukáč

STOCKHOLM, SIP Office, 23 ÷ 27 august 2004

Section 1

Laws and regulations relevant to LTO

The basic part of the Slovak Republic legislation is the :

"Act on Peaceful Use of Nuclear Energy" ("Atomic Act") - No 130/1998 Coll.

- adopted by the National Council of Slovak Republic on April 1, 1998
- in force from **July 1, 1998**.
- During 2003 the work was running on preparation of new Act on peaceful use of nuclear energy.The most important changes made are :
  - new official title
  - extended scope of definitions
  - rearrangement of some provisions and structure of the Act and
  - changes according to EU legislative requirements.

Section 1

Nowadays:

- the Act has passed the governmental comments
- procedure prepared for submitting to the Parliament.

In the present "Atomic Act" **No 130/1998** Coll. § 16 is dedicated to conditions of LTO.of nuclear power plants.

Section 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

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

Section 1

REGULATION No. 318/2002 Coll.

ON SAFETY DOCUMENTATION OF NUCLEAR INSTALLATIONS

- **DEFINES THE CONTENT AND FORMAT OF SAFETY DOCUMENTATION SUBMITTED TO NRA FOR:**

  - **CONSTRUCTION**
  - **COMMISSIONING**
  - **OPERATION**
  - **LIFETIME EXTENSION**

Section 1

- **§ 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**

Section 1

Exept of the „Atomic Act" a safety guide of Nuclear Regulatory Authority of the Slovak Republic dealing with aspects of NPP ageing management exist:

BNS I.9.2/2001

"Ageing management of nuclear power plants. Requirements"

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**

Section 1

- **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**

Section 1

- **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**

Section 1

Safety related / oriented regulations as follows:

No 121/2003 “Coll on nuclear safety assessment“

No 167/2003 “Coll on requirements for nuclear safety of nuclear installation

EBP on Safety Aspects of Long Term Operation of Water Moderated Reactors

WG1 Second Meeting

NATIONAL REPORT PRESENTATION - SLOVAKIA

VUJE, a.s. - Division of Nuclear Power Plant Operation Preparation

Prepared : Miroslav Lukáč

STOCKHOLM, SIP Office, 23 ÷ 27 august 2004

Section 2

Current design basis requirements including design codes and standards used.

Current design basis requirements are in accordance with the international and IAEA recommendation.

2.1 General . Design codes and standards used, structures and components

2.2 Maintenance practices

The maintenance practices are plant specific, performed according to quality assurance programs, relevant technical standards and maintenance procedures.

Section 2

2.3 Environmental qualification (EQ) for electrical and mechanical equipment

Environmental qualification is a non-separate part of EQ requirements and activities.

Related to environmental qualification an accident analyses using internationaly recognized computer codes have been performed and are available.

The output of computer analyses are neccessary temperature, pressure and radiation conditions represented by temperature and pressure profiles and accident radiation doses in relevant NPP areas.

Section 2

2.4 Quality assurance (QA) practices

Nuclear power generating plants have been introducing Quality Assurance Programmes since as early as 1990 under CSKAE Regulation No. 436/90 Coll.

In the year of 2002 the regulation No. 436/90 Coll was replaced by regulation as follows:

Regulation ***No 317/2002 :*** “Coll on requirements on quality systems of the authorization holders as well as on alteration and amendment of the Decree of the Nuclear Regulatory Authority of the Slovak Republic No. 187/1999 Coll. on nuclear installation personnel competence *(effective from 1-st July 2002)*

Section 2

In the area of the quality of the safety documentation the following guide is effective:

BNS I.2.6/2001 : “Quality assurance of safety documentation.
Basic equirements and rules“

Quality assurance programs of nuclear facilities are permanently monitored by ÚJD SR.

Section 2

In 1996, the decision was made at SE, a.s., to develop and introduce an uniform quality system.

The Quality System goals and main priorities and principles are set out in the Quality Concept dated 20 December 1996.

The quality system shall be in accordance with the requirements of the laws of the Slovak Republic, standard STN EN ISO 9000 and International Atomic Energy Agency recommendations on 50-C-Q atomic energy.

Section 2

2.5 Final Safety Analysis Report (FSAR) update

Final safety analysis reports for particular NPPs are periodically updated after period of 10years and accordingly to significant deign basis updates:

NPP Bohunice V1, U1 & U2 : Older generation of VVER 440.

The major amount of work related to two complex programs of V1 power plant safety improvements was carried out in so called “Small reconstruction" in 1991-1993 and the “Gradual reconstruction" in 1996-2000.

Section 2

NPP Bohunice V2, U3 & U4

Beside the hundreds of activities related to power plant safety improvemnts the first complex program of safety improvement was accepted in 1986.

The other pograms and projects were incorporated into a Safety concept, based on which activities are being carried out leading to improvement of nuclear safety, reliability and economical effectivness of the operation during the design basis lifetime and leading to conditions for long term operation license achievement.

Section 2

NPP Mochovce V2, U1 & U2

New power plant, units 1 and 2 gradually commissioned in 1998 and 1999

2.6 In-service inspection (ISI) program

In-service inspection activities are an ordinary and regular activities of ÚJD SR in all nuclear or related to nuclear facilities. Inspection plan of ÚJD SR for 2004 is easily available at the official web site of ÚJD SR.

2.7 Time limited ageing analysis (TLAA)

Ukrainian report

S. Bozhko,
M. Zaritsky

SALTO WG-1 Second Meeting
August 23-27, 2004
Stockholm

Section 1

Laws and regulations relevant to LTO

- The law of use of atomic energy
- The norms and regulations in nuclear power
  - Rules for design and safe operation of equipment and pipes of atomic energy facilities. PNAE G-7-008-89
  - “General Provisions of safety assurance of NPPs” NP 306.1.02. /1.034-2000
  - “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 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."

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**

Section 2

Current design basis requirements including any upgrades

Based on the design features the Ukrainian nuclear power units can be split into the tree following groups:

1. power units with WWER - 1000 reactors (B-320) . large series (11/2);
2. power units with WWER - 1000 (B-302, B-338) . small series (2);
3. power units with WWER - 440 (B-213) (2).

List of SSCs important to safety and their classification.

Classification of SSCs:

Par.4 “General provisions on safety assurance for nuclear power plants” NP 306.1.02/1.034-2000 (OPB).

In accordance with the regulations the list of SSCs important to safety and their classification is the part of the Safety Analysis Report.

Comprehensive program of modernization and safety raising of nuclear power units of Ukraine NPPs

In 2002 based on comprehensive analysis of current safety problems related to the deviations from requirements of effective national norms, standards, rules on safety and from achieved world level of safety and operation regulation, the NNEGC Energoatom developed the «Comprehensive program of modernization and safety raising of nuclear power units of Ukraine NPPs». This program is planned to be implemented in the 5 years period. The document was agreed upon with Regulatory Body and approved by Cabinet of Ministers of Ukraine.

«Problems of NPP safety with WWER-1000/320 type reactors and their categories» IAEA-EBR-WWER-05;
«Problems of NPP safety with WWER-440/213 type reactors and their categories» IAEA-EBR-WWER-03;
«Problems of safety and their categories for NPPs with WWER-1000 (small series) reactors».

QA practices

1. RD 306.1.02./1.034-2000 “General Provisions of safety assurance of NPPs”:

3.5. The structure and quality of the systems and elements, documentation and diverse types of the operations, which have impact to the safety assurance of a nuclear plant, must be the objects of the full-scale activities aimed at the quality assurance.

3.6. The operating organization provides elaboration and implementation of the measures aimed at the quality assurance at all stages of the NPP life-time, and -with this purpose it outlines a general program of the quality assurance and inspects the activities of companies (organizations), which perform works or render services for the NPPs. The designing-, building-, assembling-, adjusting organizations, plants-manufacturers of the NPP equipment, outline, within the framework of the general program on quality assurance, the individual programs of quality assurance on their types of activities.

2. «Requirements for the Quality Assurance Program at All Stages of the Nuclear Installation Lifetime», 1998.

FSAR or Periodic Review Update

- "Requirements to the Contents of Safety Analysis Report of WWER Nuclear Power Plants operating in Ukraine", 1995.

"Requirements to the Contents of Safety Analysis Report of Nuclear Power Plants with WWER reactors under commissioning in Ukraine", 1996. KND-306.302-96.

FSAR or *Periodic Review Update*

IAEA
SAFETY GUIDE
No. NS-G-2.10 Periodic Safety Review of Nuclear Power Plants

(see above, Section 1)

Time Limited Safety Analysis

Law of Ukraine “On the use of nuclear energy and radiation safety” 1995

Art. 43 Licence to Operate a Nuclear Installation or Radioactive Waste Management Facility

Submission of documentation demonstrating nuclear and radiation safety, and the provision of financial guarantees covering compensation for possible nuclear damage, are mandatory for the issue of a licence to operate a nuclear installation.

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.

EQ practices

The grounds for performance of works on equipment qualification at the Ukrainian power-units are documents as followed:

- **a. 5.1.4. NP 306.1.02/1.034-2000 “General Provisions for NPP safety” ;**
- **a. 4.2. NP 306.5.02/2.068-2003 “Requirements to order and maintenance of works for longing-term operation of information and regulating systems important to safety of NPP” ,**
- **IAEA recommendations, stated in report IAEA-EUR-WWER-05.**

In the a. 5.1.4. NP 306.1.02/1.034-2000 “General Provisions for NPP safety” is pointed that:

“Systems and elements important to safety should perform their functions in volumes fixed by the project, taking into consideration the influence of natural phenomenon which is possible in the NPP area (earthquakes, hurricanes, floods), external man-caused influence and/or in the case of possible mechanical, thermal, chemical and other effects that can occur as a result of project accidents.”

EQ practices

For performance of the branch program of EQ there were developed “The working schedule of equipment qualification of NPP power-units of Ukraine to 2008” and plant working programmes of equipment qualification.

Plant working programmes cover all types of power-units, operated on the Ukrainian NPP, namely WWER-440/213, WWER-1000/320, WWER-1000/338 and WWER-1000/302.

There was developed the first edition of standard “Equipment qualification and technical facilities of NPP. General requirements”.

There were developed detailed equipment lists under qualification, pilot power-units (KhNPP-2, Rivno NPP-1, SUNPP-1), which examination in the Company Directorate shows necessity to finish them off with General Designer.

To finish their revision is planned in 2004.

Maintenance practices, ISI programs

Regulation on Maintenance and ISI programs have existed since the beginning of the NPPs commissioning
Special divisions with the fixing of certain functions and responsibilities is created on each NPP.

- Rules for design and safe operation of equipment and pipes of atomic energy facilities.PNAE G-7-008-89

- "General Provisions of safety assurance of NPPs" NP 306.1.02. /1.034-2000

Maintenance practices, ISI programs

Topic and working ISI programs:

- for all types of power-units
- methods, volumes, zones, periodic
- procedure of result assessment
- documentation and data base
- qualification of inspection system
- experience

Ageing management

According to requirements being developed by the Regulating authority of Ukraine, application of ageing management program on NPP is the most important condition for the long-term operation of power-units.

NNEGC «Energoatom» has developed the first edition of the document «Standard ageing management program of NPP components». The document AMP is the basic branch regulating technical-organizational document about the long-term operation of NPP power-units.

The objects of the AMP Document are as followed:

- ascertainment of general requirements to organizing and ordering of application of aging management system of NPP components;
- definition of volume and consecution of taking technical measures to provide a systematic and effective ageing management of NPP components.

Ageing management

The Document AMP contains sections as followed:

- Ageing management methodology and program of power-units of NPP;
- Requirements to making up of lists of NPP components for reassessment of lifetime and ageing management;
- Requirements to the typical programs of technical state evaluation and reassessment of lifetime of NPP components;
- Requirements to organization of information system of ageing management of NPP components;
- Requirements to fulfillment of technical state evaluation and reassessment of lifetime of NPP components;
- Requirements to planning and taking measures for ageing management of NPP components;
- Requirements to monitoring of ageing process, technical state of systems and NPP components;
- Documental accompaniment of works on ageing management of NPP components;
- Organization of scientific and technical support and accompaniment of works on ageing management;
- Quality assurance of ageing management of NPP components;
- Evaluation of actions in ageing management of NPP components.

Ageing management

At the present time the Document AMP was handed over to IAEA experts for analyzing and was discussed on the work-meeting in the frame of the project UKR/4/013 «Action plan to issues of operation term management» in July 2004.

After elimination of reviews of IAEA experts the Document AMP was sent to the Regulating authority for approval, and then to NPP for application.

Section 3
Planned LTO Activities or Programmes

Planned LTO Activities or Programmes

“The comprehensive program for the prolongation of operational life of NPP units of Ukraine”
(approved by Decree of Cabinet of Ministers of Ukraine, April 2004)

- general goals;
- technical-economical calculation,
- main measures.

Planned LTO Activities or Programmes

“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.

Planned LTO Activities or Programmes

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 was 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).

Available research results and operating experiences that are directly related to LTO

For scientific and technical support of realization of LTO there have being recruited the specialized organizations and institutes of the National Academy of Sciences. Moreover, the Company has created a specialized subdivision «Scientific and technical center».

Physical-Technical Institute (Kharkov)
Nuclear Research Institute (Kiev)

Validation of time limited safety analysis for LTO

At the first stage the safety analysis is conducted for the reference Unit 1 at Rivne, Unit 1 at SUNPP and Unit 5 at ZNPP that covers all WWER design reactors under operation in Ukraine. In accordance with the Regulation "Requirements to the Contents of Safety Analysis Report of WWER Nuclear Power Plants operating in Ukraine", 1995 at this stage the safety analysis is limited to the development of:

– extended (supplemented) safety substantiation;
– additional materials on safety analysis;
– design accident analysis;
– probabilistic safety analysis, level 1, internal (on-site events).

At the second stage the level 1 probabilistic safety analysis would be additionally developed (external events and low power level) along with the level 2 probabilistic safety analysis beyond-design basis accident) and the safety analysis report for all units based on the pilot project implementation.