IAEA-EBP-LTO-10
10-01-05

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

MINUTES OF THE PROGRAMME'S WORKING GROUP 3 SECOND MEETING

25-27 May 2004
G. Kuzmich Training Center, Kyiv, Ukraine

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/default.htm .

The 2nd meeting of WG 3 was held at G.Kuzmich Training Center, Kyiv, Ukraine, 25-27 May 2004. The purpose of the 2nd meeting of WG 3 was to:

- review and finalize the Tables of Contents of the Country Information Reports and of the Final WG 3 Report,
- review the status of collection of country information to ensure its consistency, and
- plan the optimal review process of the Country Information Reports.

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

2. MEETING SUMMARY

The meeting was opened by Volodymyr Bezsalyy, the WG 3 Chairman, who outlined the objectives of the second meeting for Working Group 3, reviewed the meeting Provisional Agenda and clarified some organizational matters. He also introduced the new members of the group. Radim Havel, the Programme Scientific Secretary, summarized the current status of the Programme, including the results and conclusions of the 2nd SC meeting. Mr. Evhen Shumkov, Energoatom, provided a brief overview of Energoatom's plans regarding the long

term operation of its NPPs, which was recently approved by the Government of Ukraine, and highlighted the importance of the IAEA Programme to Energoatom in their planning activities.

He was particularly interested in the electrical components and I&C area since a significant amount of effort and funds are being expended in updating and modernizing the I&C systems to ensure safe reliable long term operation. He also stated that there was a special procedure developed and its implementation improved the surveillance, reduced number of incidents connected with E/I&C equipment (on 13 Ukrainian units there were 45 events recorded in 2002, 35 in 2003 and 8 during the first 5 months of 2004).

2.1. National presentations

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

CZECH REPUBLIC
To support the long-term operation CEZ established LTO working groups inside the Nuclear Division. There are 5 working groups, where the groups 1 - 4 cover the same topics as IAEA WGs and the supporting Group No. 5 covers "Analysis and Assessments".
There was organized a 3-day workshop for WG members (including regulatory body and external companies) with the primary objective to inform WG members about current as well as planed activities in the Nuclear Division of CEZ in the area of LTO. Additionally, discussions focused on the planned LTO activities regarding the national as well as international legislation, and to discuss the relationship of LTO to other key areas (i.e., ageing management, maintenance, EQ, DB, CM, PSR) and to inform about examples of LTO in foreign countries.

CEZ has issued and approved methodology for LTO (PP043r0 "Provision of Long Term Operation Beyond the NPPs Designed Life (PLEX/LTO)" and directive SM 021, "Design management" describing design management processes (one of the sub-processes is LTO). Methodologies ME 085, "Technical/Economical appraisal of LTO Feasibility" (Describing main steps of Technical/Economical assessment of LTO.) and ME 086, "Preparation of supporting information for LTO" will also assist the LTO team as well.
Regarding the Country Information Report, much information is already available, however at different level of detail. Majority of information is available in Czech language only.

HUNGARY
The Paks Nuclear Power Plant Company was founded in 1976 and has been operating as a share company since 1992. Its site, where four VVER-440/213 type units are operating with a total nominal power of 1860 MW (electrical), is located in the middle of Hungary, 5 km from the town of Paks. 39 percent of the electrical energy generated in Hungary is produced here.
The four units of the Paks NPP were put into operation between 1983 and 1987. Taking into account the designed lifetime (30 years), they should be shut down between 2013 and 2017. In possession of our present technical knowledge it can be considered as a real long-term goal to extend the designed lifetime of the units with at least ten years.
It was recognized at that time that it is difficult to assess the safety of the Paks NPP units solely based on the original documentation. Therefore, in 1992 the Hungarian Atomic Energy Authority (HAEA) decided to launch the AGNES (Advanced General and New Evaluation of Safety) project. The main objectives of the project were:

- to make a report that re-evaluates the safety of the Paks NPP at the level of the 90s;
- to perform - in most cases again - the accident analyses which are vital for the report;
- to determine the order of importance of the safety enhancement measures.

The project had been completed by the end of 1994, and no such dramatic new conditions were disclosed which could have questioned the safety of the units.

In accordance with recommendations of the International Atomic Energy Agency (IAEA), the performing of a periodic safety review in every 12 years is prescribed by the HAEA. This is a necessary condition to renew the operating licence of the units.
The Parliament passed the "atomic energy law" in 1997. The new law applies the principle of "as low risk as reasonably achievable" and reflects an attitude that is in compliance with the spirit of joining to the EU. Based on this law, different regulations were issued associated with safety of NPPs. These documents that include conditions for long life operation are being revised now.

In 2003 the legal conditions (tasks and responsibilities) of HAEA were revised. Its main responsibilities include:

- Establishing qualification rules of safety related equipment for new NPPs, to be applied during design phase,
- Establishing qualification rules of safety related equipment for NPPs already working,
- Governmental review of equipment qualification and ageing management.

In terms of technology, the lifetime of the power plant is determined by the lifetime of those components, which are vital for safety or operation and are not replaceable (e.g. the pressure vessel) or only replaceable at such high cost which is not reasonable (e.g. turbines, condensers etc.). Replaceability and good working condition are not only a question of technology but also economy and business. For example, although a large number of steam generators have been replaced successfully worldwide, it is very improbable that the 24 steam generators in the Paks NPP would ever be replaced; in practical aspects this seems baseless and therefore the steam generators belong to the group of components that limit the lifetime.

Nevertheless, the factors that have an influence on or determine the lifetime of the plant can be followed, inspected and with proper tools controlled and thus the maximum possible lifetime can be achieved by appropriate operation, maintenance, renewal etc.
Long term operation of Paks NPP is a question of demanding need for electrical power, economic aspects and political decisions.

RUSSIAN FEDERATION
Mr. Viktor G Samovichev provided a brief overview on service life extension of Russian NPPs. The overview included a discussion of the related standards, and a brief disccusion regarding the practical implementation as demonstrated at Novovoronezh Unit1.
Main approaches to I&C equipment modernization were described. The impact of I&C equipment on extension of service life for NPPs with WWER reactors has been analysed.

SWEDEN
Mr. Lars-Olof Ståhle provided a brief overview of the current situation regarding NPP modernisation in Sweden and particular at OKG. He also reported that there has been quite a bit of effort since the last meeting to collect material for the Country Information Report.

Aging: A national Report covering how to handle aging for all applications, mechanical and electrical, is under production. This document shall guide the Utilities in how to handle aging related questions and issues. The content is in Swedish. OKG also has its own procedures for handling aging. All this will be reference material to the Country Information Report.

Research and Development: Reported two investigations about aging. The first one is named "Results of experimental studies of methodologies for artificial aging of electrical components in nuclear power plants". This handles 3 types of cables and 2 types of O-rings. The second one contains aging of electronic boards. This is only in Swedish. The results show that no aging mechanisms could be discovered even if the boards were aged in one year in a temperature of 95° C.

UKRAINE
Mr. Oleksii Manko briefly reviewed the structure of NAEK "Energoatom". He also described the process of preparation of work on lifetime extension of NPPs and, hence, of safety systems and I&C and electro technical equipment, involved in systems, important for safety.
He also briefly explained the structure and development of normative documents on lifetime extension of specific equipment. It was noted that the Ukrainian Cabinet of Ministers has approved the "Complex program of activities on prolongation of operational terms of NPP power units".

Mr. Manko highlighted the need to perform deterministic safety analysis, involving both Ukrainian and international expertize. He also described the necessary interaction of scientific organization, operating organization, RB and manufacturing plant in management of LTO process using "Program of technical control on prolongation of design lifetime of drive on regulating body of the reactor WWER-440, type V-213" as an example.

Mr. V. Bezsalyy presented information on the status of collection of information on legal basis and regulatory requirements for LTO in Ukraine. Periodic safety review approach is adopted in the current regulations, which also allow introduction of changes to the existing licenses on operation of nuclear installations, including also life extension. The requirement stipulate that for operating license extension safety reassessment is required. The standards require periodic safety review at least each 10 years. Further, information on standards' requirements for life extension of electrical and I&C equipment and systems were presented.
A regulatory document, which specifies activities needed to extend an existing operating license is under preparation.

Mr. V. Paslen, SNRCU, and Mr. V. Golovey, Zaporozhe NPP also participated in the WG 3 meeting. Mr. V. Paslen provided information on several aspects of implementation of a regulatory document on the contents of work on life extension of electrical and I&C equipment and systems (НП 306.5.02\2.068-2003). This applies only to equipment and systems important for safety. Positive experience obtained with its implementation resulted in its use for other equipment too. Based on its requirements:

- lists of equipment and work schedule are developed;
- inspection programmes for equipment condition monitoring are developed;
- related work is performed and its results evaluated;
- decisions on life extension of specific equipment are agreed upon with SNRCU.

Mr. V. Golovey provided information on I&C at Zaporozhe NPP and on the implementation of the procedure for life extension. Detailed information on modernization of I&C equipment was also provided.

USA
Mr. Robert Moffitt provided a brief overview of the License Renewal process used in the USA, including:

- Basis for License Renewal
- Principles for License Renewal
- The Scope of License Renewal
- Requirement to conduct an Integrated Plant Assessment
- Requirement to review the Time Limited Aging Analysis

He also described the Generic Aging Lessons Learned (GALL) report and how it is used by the Utilities and the U.S. NRC to facilitate the preparation and review of the License Renewal Applications. He also noted that the U.S. NRC had just recently issued the 25th License Renewal.

EC-JRC
The EU Research in Reactor Safety specific goal is to ensure safe nuclear power generation. This goal is implemented through the EU research priorities such as (i) how to enhance operational safety of existing reactors, and (ii) how to further optimize plant performance and safety.

Results of the research conducted on operational safety of existing installations are presented in number of multipartner projects that are structured in three main areas involving (i) PLEM (Plant Life Extension and Management), (ii) SAM (Severe Accident Management), and EVOL (Evolutionary Safety Concepts). Project costs are normally shared by the EC (approx. 50%) and other project partners. Project results are regularly presented at FISA (international symposium on “EU Research in reactor safety”. Some project results available on web-sites.

For the purpose of the 2nd WG3 meeting, one of the projects from above mentioned EU research areas was selected such as the Cost Effective Modernization of Systems Important to Safety (CEMSIS). The CEMSIS is a 36-month cost-shared contract that started on 1 January 2001. This paper describes the objectives and strategy of CEMSIS, and outlines some of the emerging results. The CEMSIS project seeks to maximize safety and minimize costs by developing common approaches within the EU to the development and approval of systems important to safety (SIS) refurbishments that use modern commercial technology.

The main innovative aspects of CEMSIS are in addressing key issues in the refurbishment of nuclear I&C systems that involves harmonization of safety justification approaches across Member States, definition of safety requirements for the replacement SIS, use of pre-developed software products in SIS, potentially even for Class A systems, application of existing published standards and guidance considered, incorporation of input from regulators on licensing issues and draws on existing experience of nuclear regulators within the EU on acceptable approaches, and incorporation of input from wide range of “stakeholders” in the industry: operators, I&C suppliers, system integrators and software specialists to identify acceptable and economic approaches to refurbishment.

The main results of the project are guidance documents on a proposed approach to safety justification of SIS, on requirements engineering for SIS and a qualification strategy for software and architectural design of "Off-the-Shelf Products" (OTSP). These are being evaluated in a number of industrial-based case studies including a ‘public domain’ example

that will be used to explain and illustrate the guidance. For further details, it is suggested to visit project public web-site *www.cemsis.org*.

2.2 Country Information Reports

Substantial time was devoted to discussion of the CIR Table of Content to improve understanding among the WG members of its individual sections contents. Some of the specific topics discussion included:

- Should modernization of I&C equipment be included
- References, should all referenced documents be in english
- (it was agreed that all appropriate documents should be referenced, and if the document is only available in the native language it should be so noted. Also if referenced documents are available electronically that should also be noted)
- Should Standards and Codes, such as IEEE or ISO be included as references

As a result of these discussions the Country Information Report outline was expanded to include a brief explanation of the type of information that is expected in each section (see Attachment 1).

2.3 Discussion of the review process

The group also briefly discussed the review process and how the WG will develop the Final Report for WG-3. There were several suggestions as to how to best organize and conduct the reviews including:

- Horizontal reviews – have each WG member review a few sections of every report
- Vertical Reviews – have each WG member review 2 or 3 full reports
- Complete Reviews – have every WG member review all the reports

However, there was no consensus as to the best approach and it was agreed that everyone should focus initially on collecting the information and preparing the CIR's and to delay any final decision on how to best conduct the reviews. During these discussions it was pointed out that it is very important that all the Country Information Reports follow the same Table of Contents to facilitate a consist review of all the information from the various countries. Mr. Duchac volunteered to take the lead in proposing an approach for the review of CIRs.

2.4 Other Items of Discussion

There was considerable question raised by the WG members relative to the IAEA website for the LTO EBP and how to access it, so Mr. Havel demonstrated to the group how to access both the open and secure portions of the IAEA website for the LTO EBP. Mr. Havel also pointed out that Mr. Liszka, Sweden is drafting a "QA Manual" describing some of the administrative elements of the Programme, such as the numbering and format for all the various documents. The draft QA Manual will be circulated to all Programme participants for review and comments.

The WG 3 schedule was also discussed and participants confirmed it, in paricular the deadlines for providing the draft CIRs to the ftp site (30 July 2004), deadline for Task 1 (30 September 2004), and that the next WG 3 meeting will take place in mid-June 2005. The place of the meeting needs to be specified.

3. ACTION ITEMS

The following actions items resulted from the meeting.

1. Mr. Moffitt agreed to provide all the WG members with the draft USA Country Information Report for WG-2 as an example.
2. Mr. Moffitt agreed to work with Mr. Havel and prepare the meeting minutes and send the minutes out to all WG members for their review, 15 June 2004.
3. WG members agreed to co-ordinate with experts from their countries on the other WGs to promote consistency of reporting, avoid duplication of efforts and ensure there are no gaps between the various WGs. Action: all
4. R.Havel will circulate the first draft of the QA manual to WG 3 and other WGs for review/comments; 30 June 2004.
5. WG members will send to R.Havel proposals to host the next meeting of WG 3. Action: all, June 30, 2004.

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).

ATTACHMENT 1

Country Information Report

Working Group 3 – Electrical and Instrumentation & Control Components CIR

(Approx. 30-40 pages)

1.0 Applicable laws specific to E and I&C for long term operation *[this Section will be co-ordinated with input from WG 1, each member of WG 3 should contact the colleague on WG 1 ; i.e. co-ordination should be done at national level]*

2.0 Requirements applicable to long term operation *[Regulatory and other requirements. Describe national approach and include references where possible. This info should include short description of references included]*

- 2.1 The process used in developing the scope of systems, structures and components (SSCs) that are within the long term operation (LTO) review *[e.g. PSR in countries where used, US approach where items covered by Maint. Rule are not included.]*
- 2.2 Configuration control practices used to control design basis *[requirements on maintaining design safety basis up to date and on ensuring plant configuration meets this design safety basis]*
- 2.3 Aging management programmes
  - 2.3.1 Research/ process providing basis for applicable aging effects on E and I&C intended function(s) focused by component
  - 2.3.2 Ageing mitigation measures applied in NPP

3.0 Operational approaches applicable to long term operation *[Describe national approach and include references where possible. This info should include short description of references included]*

- 3.1 Normal operational practices/programmes applicable to aging management
  - I&C testing and monitoring practices for passive components [*e.g. inspection programmes that address issues such as cable neutron embrittlement in conjunction with thermal flexing, Inspection of cables (e.g. cables for MOVs), Inspection for specific degradation mechanisms such as corrosion in exposed motor control centres (MCCs)*
  - *3.1.1* Maintenance standards or practices for active components *[e.g. IEEE, ISO, IEC, etc.]*
  - 3.1.2 Equipment qualification practices [*impact of LTO on initial EQ*]
  - 3.1.3 Component functional tests [*impact of LTO on functional tests, which ones, surveillance tests, what kind, frequency, etc.*]
  - 3.1.4 Applied diagnostic systems and prognostic systems [*impact of LTO on e.g. diagnostics tests, on-line vs. periodic, etc.*]
  - 3.1.5 Surveillance specimen programmes [*e.g. irradiation damage, thermal loops, is there a prgm., its features, how are results utilized, etc.*]
  - 3.1.6 Nondestructive material properties tests *[e.g. Megger test for electrical resistivity, etc.]*
  - 3.1.7 Destructive tests and material research carried out during NPP operation [*e.g. prgms on destructive examination of aged-replaced cables, how is the info used, etc.*]
  - 3.1.8 Special loading (stressor) measurement systems (temperature, deformation etc.) combined with damage calculation (e.g. on-line and off-line fatigue monitoring) [*e.g. for cables insulation degradation-T monitors to asses the age related degradation, load related degradation, etc.*]
  - 3.1.9 Chemical and environmental monitoring [*e.g. battery specific gravity/capacity testing, temperature monitors, boron monitors etc.]*
- 3.2 Plant specific safety analyses which are based on an explicitly assumed plant life or operating period [*p, T, cycles, transients, other assumptions; e.g. switchgear designed for certain number of cycles, validity of original assumptions for LTO, changes needed; etc.*]

4.0 Compilation of a list of reference documents from which the above information was collected

APPENDIX I.
AGENDA

Tuesday, 25 May 2004		
09:00	Opening, Meeting objective	V. Bezsalyy, R.Havel
09:15	Content of Country Information Report	B. Moffit, V. Bezsalyy
10:30	*Coffee break*	
	Status of collection - national presentations	
12:30	*Lunch break*	
14:00	Czech Republic	P.Zavodsky
14:40	Hungary	Z. Ferenczi, L. Pecanovics
15:30	*Coffee break*	
15:50	Russian Federation	V. Samovichev, B. Mordovin
16:45	Sweden	L-O. Stahle
17:30	*Adjourn*	
18:00	*Reception*	
Wednesday, 26 May 2004		
09:00	Ukraine	O. Manko, V. Bezsalyy
10:30	*Coffee break*	
11:00	SNRC approaches	V.Paslyon
11:20	Zaporozhe NPP	V. Golovey
12:00	JRC - EC	A. Duchac
12:30	*Lunch break*	
14:15	USA	B. Moffit
14:50	Content of CIR, Review approach, miscellaneous	V. Bezsalyy
17:00	*Adjourn*	
Thursday, 27 May 2004		
09:00	Final discussion on CIR contents and Review approach	V. Bezsalyy, B. Moffitt
12:45	*Adjourn*	

APPENDIX II.
LIST OF PARTICIPANTS

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APPENDIX III.
PRESENTATIONS' HANDOUTS

WG-3 (E/I&C SSC) Second Meeting

Volodymyr T. Bezsalyy

25 - 27 May 2004, Kyiv, Ukraine

02.02.2005

Content

- List of participants
- Provisional Agenda
- Objective of the Meeting
- Status of coolection of information

WG-3 List of participants

- 1. Radim Havel, IAEA
- 2. Robert L. Moffitt, USA
- 3. Alexsander Duchac, Netherlands
- 4. Zoltan Ferenczi, Hungary
- 5. László Pekánovics, Hungary
- 6. Lars-Olof Stahle, Sweden
- 7. Viktor Samovichev, Russian Federation
- 8. Boris Mordovin, Russian Federation
- 9. Petr Zavodsky, Czech Republik
- 10. Volodymyr Bezsalyy, Ukraine
- 11. Oleksiy Manko, Ukraine

List of invitees

- 1. Vadym Gryschenko, Head of SNRCU
- 2. Volodymyr Redko, DeputyHead of SNRCU
- 3. Eugeniy Shumkov, NAEK “Energoatom”
- 4. Volodymyr Paslyon, SNRCU
- 5. Viktor Golovey, NAEK “Energoatom”, ZapNPP

Provisional Agenda

- ***Tuesday, 25 May 2004***
- **09:00** *Opening, Meeting objective* **V. Bezsalyy, R.Havel, B. Moffit**
  09:15 **Content of Country Report B. Moffit, V. Bezsalyy**
- ***10:30*** *Coffee break*
- *Status of collection - national presentations*
- **11:00** **Czech Republic P.Zavodsky**
- **11:45** **Hungary Z. Ferenczi, L. Pecanovics**
- ***12:30*** *Lunch break*
- **14:00** **Russian Federation V. Samovichev, B. Mordovin**
- **14:45** **Sweden I. O. Stahle**
- ***15:30*** *Coffee break*
- **16:00** **Ukraine O. Manko, V. Bezsalyy**
- **16:45** **USA B. Moffit**
- **17:30** *Adjourn*
- ***18:00*** *Informal part of Meeting*

Provisional Agenda

- ***Wednesday, 26 May 2004***
- **09:00** **JRC - EC** **A. Duchac**
- **9:45** **ZapNPP V. Golovey**
- ***10:10*** ***SNRC approaches V. Paslyon***
- **10.30** *Coffee break*
- **11:00** *Discussion on national approaches*
- ***12:30*** *Lunch break*
- **14:00** *Content of Country Report, miscellaneous*
  V. Bezsalyy ***B. Moffitt***
- **17:30** *Adjourn*

Provisional Agenda

- ***Thursday, 27 May 2004***
- **09:00** *Final discussion* ***V. Bezsalyy, B. Moffitt***
- ***12.00*** *Adjourn*
- ***12:30*** *Lunch break*

Objective of the Meeting

- **status of collection of country information**
- **Table of Contents of Country reports**
- Table of Contents of Final WG-3 report (**?**)
- **miscellaneous (ftp site, schedule, Workplan, SRP,...)**

Miscellaneous

- **Workplan (LTO-02 (08)):**
- **. In BASKGROUND (para. 5) we declared that WG-1 will be "identifies necessary pre-cond. and scoping criteria" for WG-2, 3, 4. If it really, it need reflect in part 4 (TASKS). For example for Task 3, because WG-1 need time for generate this criteria. In case of WG-1 good advance, we will be use results their work during Task 2.**
- **I like last variant- for Task 2. We need small modify Task 2, (para. 2). It very really because in compliance with EBP schedule WG-1 will be prepare Task 3 Final Rpt. at May 2005. This time for start WG-3 Final Analysis Rep.**

Miscellaneous

- **Workplan (LTO-02 (08)):**
- **Task 1, para. 2, last sentence: "After agreement...". What information will be distributed? - format and content of the final documentation ? - or Country Report ? In Task 2 description (para. 3) we have more correct sentence for similar thing.**
- **The second last sentence (in Task 1, para. 2) - "...discussions and\or meetings..." more correct (like in Task 2).**

Miscellaneous

- **Workplan (LTO-02 (08)):**
- **Part 6 (Conduct of...), last sentence. Today LTO-06 fix\state the date for Task 1 Reports (Initial Report - 31 July 2004, Final Report - 30 September 2004).**
- **Is important to have identical view on these dates. The WG-3 members provide their input one month prior to indicated in LTO-06.**

Miscellaneous

- **Standard Review Process (LTO-03):**
- **In LTO-02 (08), Task 1, we have some requirements for SRP content (for example, sorting the information into similar types or classes of equipment- whether or not the equipment is routinely replaced or seldom or never replaced).**
- **We need including it to SRP, to part 5, for example.**

Miscellaneous

- **ftp site,**
  - **Problems with site use**
- **schedule**
  - **are we need in same schedule exchange?**

Status of collection of information

- **Laws Applicable to NPP Long Term Operation**
  - ***Law of Ukraine «On the Use of Nuclear Energy and Radiation Safety» (1995), art. 33 . (****Operators time to time, in accordance with regulations, rules and standards, must be re-assess nuclear installation safety****)***
  - ***Law of Ukrain On Permissive Activity in the Area of Nuclear Energy Utilisation" » (2000), art. 33*** *(During the validity term of license the Regulatory authority can introduce changea - prolongation the validity term of License too)*
- **Regulatory Requirements Applicable to Long Term Operation**
  - ***NP306.1.02/1/034-2000 «General provisions of Safety Assurance of NPPs», par. 3.18*** *(Operator not less than onec in 10 years shall re-assess nuclear pawer units safety. The decision on prolongation of operational life of unit over the period, established by the designe, can be taken only on the safety re-assessment basis)*

Status of collection of information

- ***NP306.5.02/2.068-2003 «Requirements to the order and statement of work for prolongation operation of NPP safety related I&C systems» ;***
  - ***order of works***
  - ***order of inspections***
  - ***requirements for I&C reliability analysis***
  - ***requirements for decission concerning prolongation operation for safety related I&C equipment***
- ***GND 306.7.02/2.041-2000 «The principles of assessment conformity safety related I&C systems for nuclear and radiation safety requirements»;***
  - ***list of documents for safety sabstantiation***
  - ***kriterions for assessment***
  - ***ruls for assessment***

Status of collection of information

- ***Draft Document NP 306.1.02/2 NN-2004: "General requirements on the extension of NPP operation beyond its design lifetime with use of periodic safety review results";***
  - ***requirements for organisation measures***
  - ***requirements for motivation factors***
  - ***requirements for ageing management***
  - ***general requirements for routine and periodic safety review***

Status of collection of information

- ***Draft Document NP 306.1.02/2 NN-2004: "Requirements for safety Re-Assessment of NPP Units in Ukraine (Periodic Safety Review)"***
  - ***establish PSR procedure***
  - ***establish PSR metodology***
  - ***determine fields of analisis of PSR***

Что сделать к следующему отчету

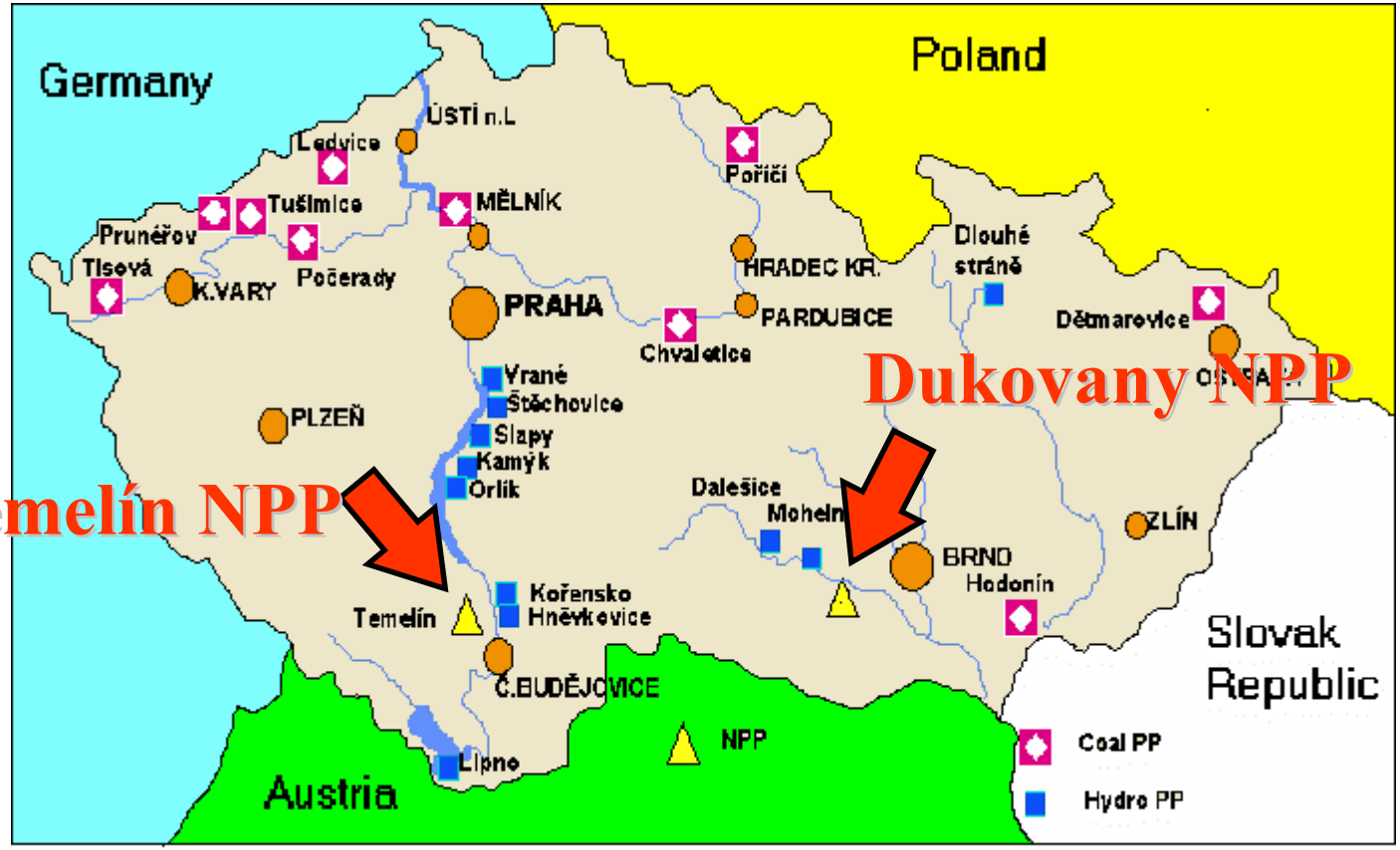
- **Дата следующего отчета**
- **Список предполагаемых работ**
  - **перечислите, что нужно сделать**
  - **вопросы, которые должны быть решены**
- **Убедитесь, что исполнители понимают план действий**

WG3 meeting at Kiev

SALTO – WG 3

MS: The Czech Republic
WG member: Petr Závodský
ČEZ, a. s. – Nuclear Energy Division
zavodp1.ete@mail.cez.cz

Czech R. - Status of information collection



Czech R. - Status of information collection

- **Installed power capacity:**
  - **The Czech Republic ~16 300 MW**
  - **ČEZ ~11 100 MW**
- **ČEZ production in 2003 - 60,9 TWh (2002 54,1 TWh)**
  - **NPPs 25,9TWh (i.e. 42,5%)**
  - **ČEZ strategic goals:**
  - **Continue the Dukovany station (four WWER 440 units) operating until at least 2025**
  - **Continue the Temelín station (two WWER 1000 units) operating until at least 2045**

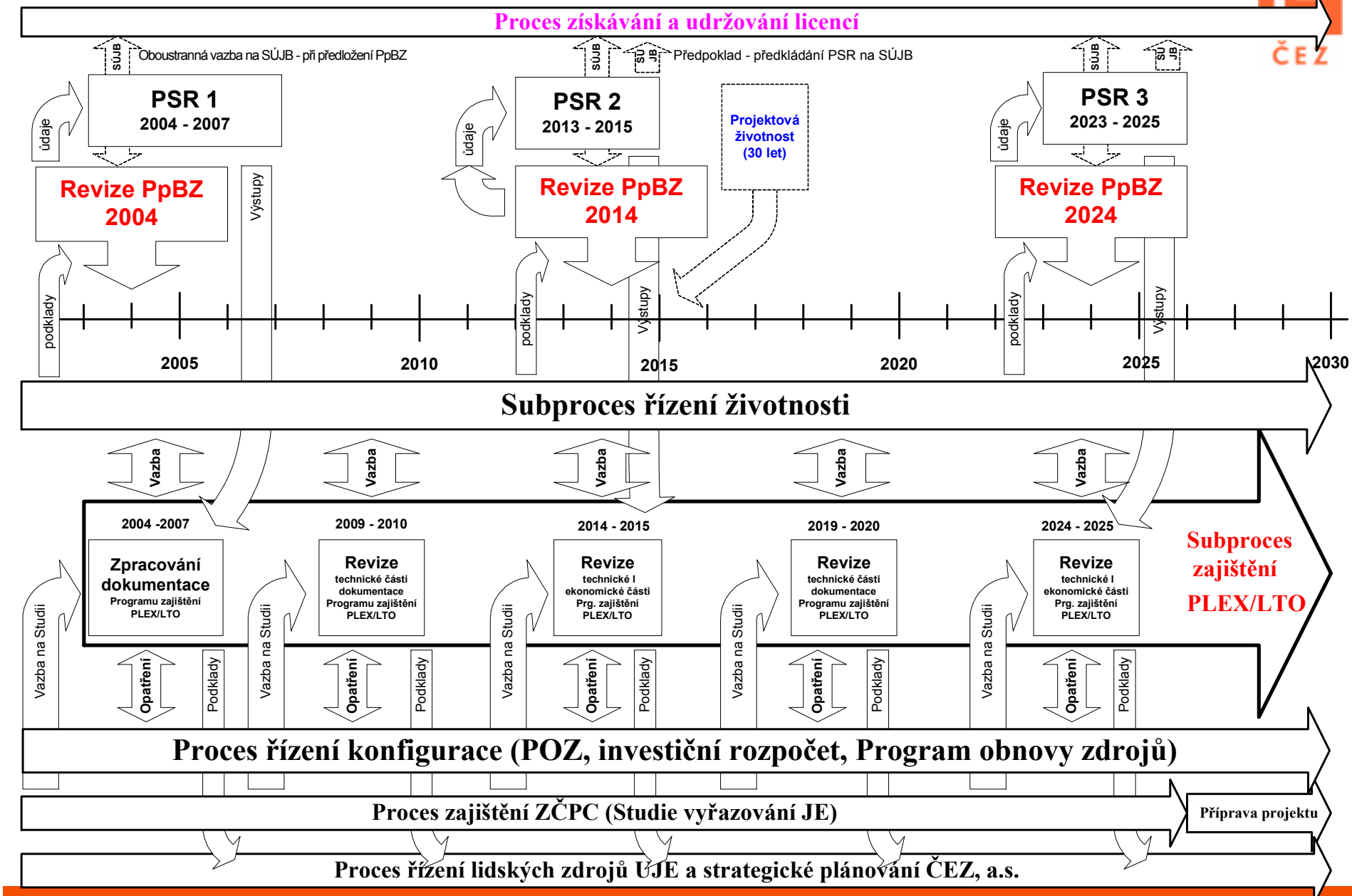
Czech R. - Status of information collection

- ČEZ issued and approved methodology for LTO (PP043r0 „Provision of Long Term Operation Beyond the NPPs Designed Life (PLEX/LTO)“
- This methodology should help to assure timely and complete preparation of required information for LTO.
- It is mainly supplementary documentation:
  - Evaluation of component residual life of SCC,
  - Evaluation of ageing management programs,
  - Handling of deviations from international standards and application of operational experience,
  - Fulfillment of SÚJB requirement,
  - Modernization programs etc..

Czech R. - Status of information collection

- ČEZ also issued directive SM 021 „Design management“ describing desing management processes (one of the sub-proceses is LTO)
- Additional ČEZ normative:
  - ME 085 Technical/Economical appraisal of LTO feasibility (Describing main steps of Technical/Economical assessment of LTO. It includes main principles and steps for optimal duration LTO.)
  - ME 086 Preparation of supporting information for LTO (under preparation – it should specify scope of SSC and requirements to information collection)

Vazby přípravy PLEX/LTO (na příkladu EDU pro variantu LTO do 2030)



Czech R. - Status of information collection

- support the LTO activities Working Group has been established. The WG is divided into 5 subgroups:
  - Group 1 General LTO framework (ČEZ, ÚJV Řež, SÚJB);
  - Group 2 Mechanical and materials (ČEZ, ÚJV Řež, SÚJB supervisor);
  - Group 3 Electrical and I&C (ČEZ, ÚJV Řež, SÚJB supervisor);
  - Group 4 Structures (ČEZ, ÚJV Řež, SÚJB supervisor);
  - Group 5 Analysis and assessments (ČEZ, ÚJV Řež, ÚAM Brno).

Czech R. - Status of information collection

- 3-days workshop for Working groups members (including SÚJB and external companies)have been held with goals to:
- ✓Inform WG members about current as well as planed in Nuclear Division of ČEZ in the area of LTO;
- ✓Unify terminology used and opinion to (PLEX)/LTO;
- ✓Explain planed activities in LTO area base upon explanation of national as well as international legislation;
- ✓Explain relation of LTO to key areas, i.e. ageing management, maintenance, EQ, DB, CM, PSR and;
- ✓Give an overview about decommissioning;
- ✓Inform about examples of LTO in foreign countries.

Czech R. - Status of information collection

- **Czech republic - Status of National report in particular groups:**
  - **WG1 Report issued to IAEA**
  - **WG2 Report exists in draft form (in Czech)**
  - **WG3 Collecting activities started (all inputs in Czech to be available by 16th June) [content – see next slide to be discussed]**
  - **WG4 Collecting activities started (issue of different scope then at other groups)**

Discussion on extend of detail, scope and content …

The WG2 developed more detailed table of content of National report and it was agreed to use similar content in all WG (at Czech Republic level).

Czech R. - Status of information collection

Proposed content of the National report:

1.0 (LTO-02) Applicable Laws Specific to Electrical and I&C Components for Long Term Operation.

2.0 (LTO-02) Regulatory Requirements Applicable to Long Term Operation.

2.1 (LTO-03 4.1) The process used in developing the scope of systems, structures and components (SSCs) that are within the long term operation (LTO) review.

2.2 Configuration Control Practices used to Control Design Basis.

Czech R. - Status of information collection

2.3 (LTO-03 4.4) Aging Management Programs.

2.3.1 (LTO-03 4.3) Research/Process Providing Basis for Applicable Aging Effects on Electro and I&C Component Intended Function(s).

2.3.2 Ageing mitigation measures applied in NPP (change of operation parameters, component design change, component material change, material properties recovery methods applied).

Czech R. - Status of information collection

3.0 (LTO-03 4.2) Operational Approaches Applicable to Long Term Operation.

3.1 Normal Operational Practice/Programs Applicable to Ageing Management.

3.1.1 In-service Inspection Practices.

3.1.1.1 (LTO-03 4.2.1) Augmented inspection programs (that address issues such as insulation degradation).

3.1.1.2 (LTO-03 4.2.2) Equipment Qualification Practices for Electrical and I&C components.

3.1.1.3 Cable ageing management.

Czech R. - Status of information collection

3.1.1.4 Component function tests.

3.1.1.5 Applied diagnostic systems.

3.1.1.6 … (any other activity related to LTO per component or group of component)

3.2 (LTO-03 4.5) Plant-specific safety analyses which may have been based on an explicitly assumed plant life or operating period.

3.3 (LTO-02 chapter 3) Decision on modernization (life-cycle consideration).

4.0 (LTO-03 4.6) Compilation of a list of reference documents from which the above information was collected.

Czech R. - Status of information collection

- **WG3 Czech National Report:**
  - **Many information available at different level of detail (in this moment mainly general information related to legal frame of LTO).**
  - **Majority of information is available in Czech only (the National report will be created in Czech and then translated to English).**

Czech R. - Status of information collection

Goals of the meeting at Kiev (from my point of view):

- **Final Table of content with common understanding particular items meaning.**
- **Agreement on extend of the National Reports (15-25 pages…) with the goal to collect information in particular countries at comparable level of detail.**
- **To confirm the schedule to make clear the Task 1 (2&3) milestones to all WG3 members (meaning of Draft Task 1 Report - 30 July; Final Task 1 report - 30 September).**

Федеральная служба по атомному надзору
Концерн «Росэнергоатом»

Внебюджетная программа МАГАТЭ «Аспекты безопасности долгосрочной эксплуатации реакторов с водой под давлением»

Рабочая группа №3.
Задача №1.

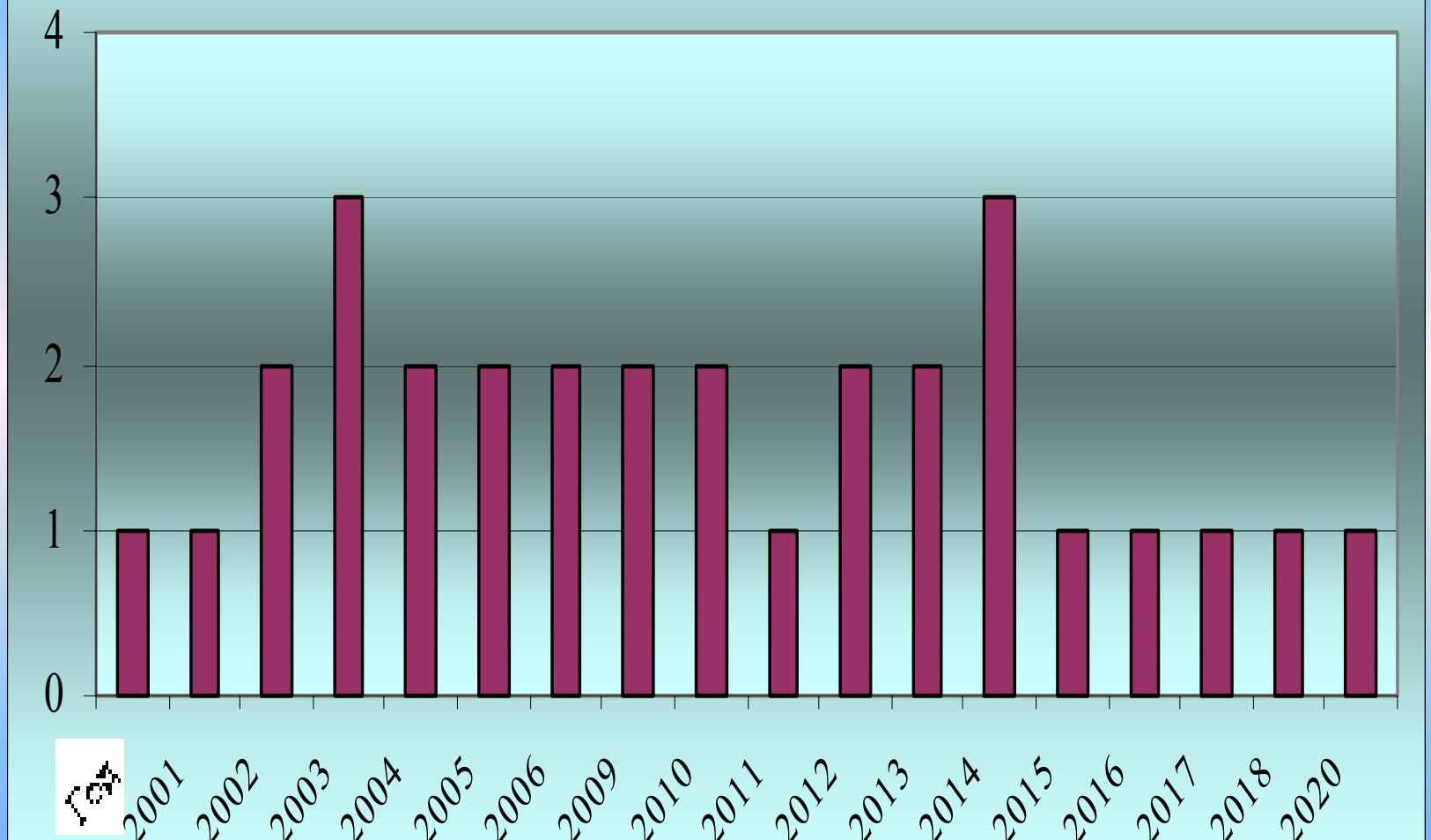
Проектные сроки вывода блоков из эксплуатации

АЭС	Блок	Проектный срок вывода блока из эксплуатации
Нововоронежская	3	2001
Нововоронежская	4	2002
Кольская	1	2003
Ленинградская	1	2003
Кольская	2	2004
Билибинская	1	2004
Билибинская	2	2004
Билибинская	3	2005
Ленинградская	2	2005
Билибинская	4	2006
Курская	1	2006
Курская	2	2009
Ленинградская	3	2009
Нововоронежская	5	2010
Белоярская	3	2010

Проектные сроки вывода блоков из эксплуатации

АЭС	Блок	Проектный срок вывода блока из эксплуатации
Кольская	3	2011
Ленинградская	4	2011
Смоленская	1	2012
Курская	3	2013
Балаковская	4	2013
Кольская	4	2014
Калининская	1	2014
Курская	4	2015
Смоленская	2	2015
Балаковская	1	2015
Калининская	2	2016
Балаковская	2	2017
Балаковская	3	2018
Смоленская	3	2020
Волгодонская	1	2032

Количество блоков АЭС с наступившим проектным сроком вывода из эксплуатации.



«Основные требования к продлению срока эксплуатации блока атомной станции», НП-017-2000.

«Положение по управлению ресурсными характеристиками элементов энергоблоков АС», РД ЭО 0281-01

«Правила организации технического обслуживания и ремонта систем и оборудования атомных станций», РД ЭО 0069-97

«Типовые технические требования к методикам оценки технического состояния и остаточного ресурса элементов энергоблоков АС, РД-ЭО-0141-98».

Федеральные нормы и правила «Общие положения обеспечения безопасности атомных станций», ОПБ-88/97.

- Устанавливают общие принципы классификации систем и элементов атомной станции по их назначению, влиянию на безопасность реакторной установки (РУ) и выполняемым функциям безопасности.
- Класс безопасности является обязательным признаком при формировании других классификаций элементов АС (п. 2.8. ОПБ-88/97), устанавливаемых в нормативных документах.
- Классы безопасности элементов АС назначаются разработчиками проекта РУ и разработчиками проекта АС (п.2.9) в соответствии с требованиями ОПБ-88/97.

«Положение о порядке организации и проведения модернизации оборудования и систем атомной станции», РД ЭО 0238-01.

- На основании выполненной разработчиками РУ и разработчиками АС классификации по влиянию на безопасность формируется специальный перечень оборудования (элементов АС), для которого проводится анализ возможности продления срока эксплуатации.
- Для перечня разрабатывается график проведения работ по управлению ресурсными характеристиками

В соответствии с нормативными документами на атомных станциях определены три группы оборудования:

- оборудование, ресурс которого поддерживается техническим обслуживанием и ремонтом в соответствии с «Правилами организации технического обслуживания и ремонта систем и оборудования атомных станций», РД ЭО 0069-97;
- оборудование, которое периодически заменяется в процессе эксплуатации за счет средств амортизации, ремонтно-эксплуатационных расходов и резерва развития;
- незаменяемое оборудование, определяющее срок службы энергоблоков, остаточный ресурс которого определяется по согласованным с Госатомнадзором методикам с учетом НП-017-2000 «Основные требования к продлению срока эксплуатации блока атомной станции».

Комплексное обследование электротехнического оборудования АЭС проводится посистемно, а именно:

- Электрооборудование главной схемы
- Электрооборудование системы электроснабжения собственных нужд нормальной эксплуатации
- Электрооборудование системы электроснабжения от генераторов собственного расхода
- Электрооборудование системы аварийного электроснабжения I группы надежности
- Электрооборудование системы аварийного электроснабжения II группы надежности
- Электрооборудование системы резервного электроснабжения
- Электрооборудование механизмов собственных нужд, важных для безопасности
- Силовые и контрольные кабели систем безопасности, контроля, измерения и управления

Электротехническое оборудование 2 класса безопасности по ОПБ - 88/97 бл. № 3 Нововоронежской АЭС, для которого определяется остаточный ресурс

- Комплектные распределительные устройства 6 кВ системы аварийного электроснабжения II группы надежности ст. №№ КРУ-6-9А-II, КРУ-б-10А-II
- Понижающие силовые трансформаторы 6/0,4 кВ ст. №№ М2Т, М3Т
- Комплектные распределительные устройства 0,4 кВ и вводные шкафы силовых сборок системы аварийного электроснабжения П группы надежности ст. №№ КРУ-0,4-2С,3С; М1А, М2А, М5А, М7А, М1Б, М2Б, М3В, М4В, М3М, М12М, М2Э, М1АМ
- Комплектные распределительные устройства 0,4 кВ системы аварийного электроснабжения I группы надежности ст. №№ НП-1, НП-2
- Электродвигатели 6 кВ привода насосов системы аварийной подпиточной воды ст. №№ ЗАПН-1+6
- Электродвигатели 0,4 кВ привода насосов аварийной питательной воды ст. №№ ЗАЭПН-1,2 и привода насосов сплинкерной системы ст.№№ ЗНБС-1+3

- Распределительные щиты постоянного тока ст. №№ ЩПТ-1 и ЩПТ-2
- Зарядно - подзарядные устройства аккумуляторных батарей системы аварийного электроснабжения I группы надежности ст. №№ ВПЗ-1,2
- Релейные устройства автоматики главных циркуляционных насосов (ГЦН) на панелях типа ПН-550
- Релейные устройства автоматики ступенчатого набора нагрузки (ступенчатого пуска) дизель-генераторов ст. №№ ДГ-1,2,3
- Силовые кабели напряжением 6 кВ Силовые кабели напряжением 0,4 кВ Контрольные кабели
- Оборудование автоматики системы обнаружения и тушения пожаров защищаемых помещений

Электротехническое оборудование 3-4 класса безопасности по ОПБ-88/97 энергоблока № 3 Нововоронежской АЭС, для которого определяется остаточный ресурс

- Турбогенераторы типа ТВВ-220-2АУ3 ст. №№ Г-9, Г-10 с системами их возбуждения
- Турбогенераторы собственного расхода типа ТБС-6-2 ст. №№ ГСР-9,10 с системами их возбуждения
- Силовые блочные трансформаторы ст. №№ Т-9, Т-10
- Силовые трансформаторы системы электроснабжения собственных нужд ст. №№ Р-9Т, Р-10Т
- Силовой трансформатор резервного электроснабжения ст. № ЗОТ
- Высоковольтное оборудование яч. №№ 15,16 ОРУ-220кВ:

- Понижающие трансформаторы 6/0,4 кВ системы электроснабжения собственных нужд ст. №№ МlТ, М4Т, М5Т, М6Т, М7Т, М8Т, М9Т, МОТ-1.
- Комплектные распределительные устройства 6 кВ ст. №№ КРУ-6-9А-1, 9Б, 9В;
- **КРУ-6-10А-1, 10Б, 10В; СРП-5, СРП-6**
- Комплектные распределительные устройства 0,4 кВ ст. №№ КРУ-0,4-1С, КРУ-0,4-4С+9С
- Электродвигатели 6 кВ привода насосов систем важных для безопасности
- Электродвигатели 0,4 кВ привода насосов систем важных для безопасности
- Релейные устройства защит, управления, автоматики, сигнализации и измерений блоков генератор-трансформатор ст. №№ ТГ-9, ТГ-10
- Релейные устройства защит, управления, автоматики, сигнализации и измерений турбогенераторов собственного расхода ст. №№ ГСР-9, ГСР-10

Оценка возможности продления срока службы электрооборудования и КИПиА проводится в рамках работы по продлению срока эксплуатации энергоблока атомной станции.

Первый этап, на котором выполняются:

- **комплексное обследование электротехнического оборудования и КИПиА в составе работ по комплексному обследованию энергоблока;**
- **оценка безопасности энергоблока с целью определения объема необходимой модернизации;**
- **оценка экономической выгоды от ПСЭ электрооборудования и КИПиА**

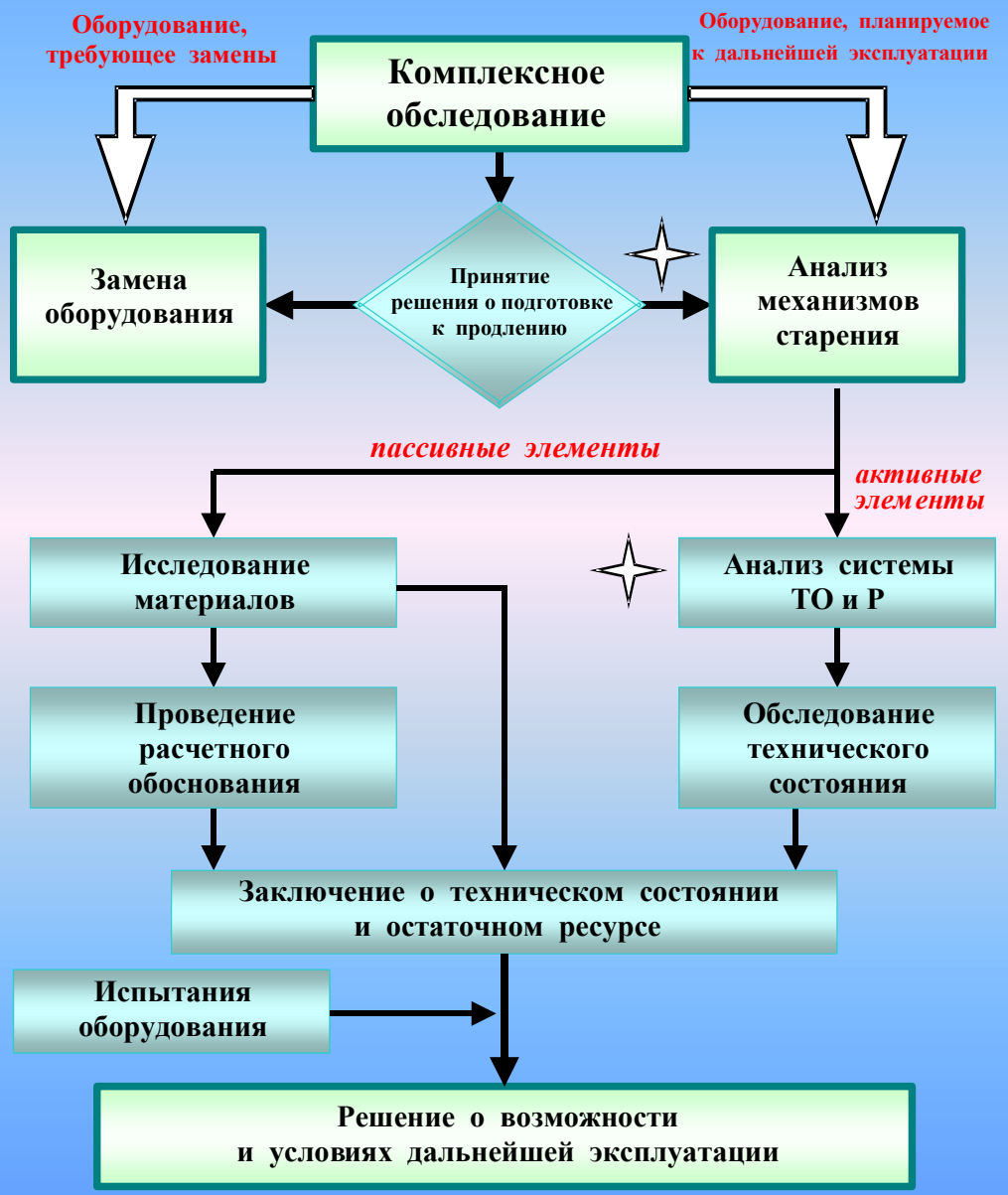
По результатам указанных работ не менее чем за 5 лет до истечения назначенного 30-летнего срока службы энергоблока АЭС принимается решение о подготовке энергоблока к эксплуатации в период дополнительного срока или о подготовке энергоблока к выводу из эксплуатации.

Руководящий документ Госатомнадзора России *«Требования к составу комплекта и содержанию документов, обосновывающих безопасность в период дополнительного срока эксплуатации блока атомной станции», РД-04-31-2001*

- Основные работы, выполняемые при комплексном обследовании::
- - анализ проектно-конструкторской документации;
- - анализ истории эксплуатации: параметров и режимов эксплуатации, повреждений и отказов, надежности;
- - анализ данных эксплуатационного контроля металла, диагностики, испытаний и исследований;
- - анализ действующей на АС системы технического обслуживания и ремонта с точки зрения поддержания ресурса восстанавливаемых элементов.

- **Второй этап** включает в себя Выполнение комплекса работ с целью обеспечения безопасной эксплуатации энергоблока АЭС в период дополнительного срока:
- - обоснования продления срока службы невосстанавливаемых и незаменяемых элементов; замена элементов, выработавших ресурс;
- - модернизация электрооборудования и КИПиА с целью повышения безопасности;
- - обоснование обеспечения электрооборудованием КИП и А безопасности энергоблока АЭС в период дополнительного срока эксплуатации
- Руководящий документ эксплуатирующей организации ***«Типовая программа комплексного обследования блока АС при продлении срока эксплуатации», РД-ЭО-0283-01***

Организация работ по управлению ресурсом элементов энергоблоков АЭС



ПЕРЕЧЕНЬ ОБОРУДОВАНИЯ

по оценке состояния и продлению срока службы элементов и систем АЭС

1. «Основные требования к продлению срока эксплуатации блока атомной станции», НП-017-2000.
2. «Положение по управлению ресурсными характеристиками элементов энергоблоков АС», РД ЭО 0281-01.
3. «Правила организации технического обслуживания и ремонта систем и оборудования атомных станций», РД ЭО 0069-97.
4. Методика оценки технического состояния и остаточного ресурса дизель-генераторов АС, РД ЭО 0195-00.
5. Типовая программа оценки технического состояния устройств вычислительного комплекса СМ-2М энергоблоков АЭС после выработки показателей долговечности и методика оценки остаточного ресурса.

6. Типовая программа оценки технического состояния устройств информационного комплекса М-64 энергоблоков АЭС после выработки показателей долговечности и методика оценки остаточного ресурса.
7. Методика и программа оценки технического состояния остаточного ресурса аппаратуры системы внутриреакторного контроля энерговыделения СВРК энергоблоков АЭС после выработки показателей долговечности, РД ЭО 0289-01.
8. Методика и программа оценки технического состояния и остаточного ресурса аппаратуры авторегулирования «Каскад-2» РД ЭО 0302-01.
9. Методика и типовая программа оценки технического состояния и остаточного ресурса комплекса электрооборудования системы управления и защиты ядерных установок типа ВВЭР, РД ЭО 0294-01.
10. Методика и программа оценки технического состояния и остаточного ресурса блоков модернизированного унифицированного комплекса технических средств (блоки УКТС-М), РД ЭО 0301-01.
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12. Мониторинг технического состояния и оценка остаточного срока службы силовых кабелей среднего и низкого напряжения с полиэтиленовой изоляцией, РД ЭО 0287-01.
13. Мониторинг технического состояния и оценка остаточного срока службы силовых кабелей среднего и низкого напряжения с бумажно-масляной изоляцией. РД ЭО 0288-01.
14. Методические указания по оценке состояния и продлению срока службы силовых трансформаторов, РД ЭО 0410-02.
15. Методика определения технического состояния и остаточного ресурса электродвигателей 6 кВ, РД ЭО 0342-01.
16. Методика определения технического состояния и остаточного ресурса электродвигателей 0,4 кВ, РД ЭО 0343-01.
17. Положение по определению технического состояния и управлению старением кабелей на АС, РД ЭО 0322-02.
18. Методика и программа оценки технического состояния и остаточного ресурса измерительных преобразователей типа Ш-78 и Ш-79, РД ЭО -0300-01.
19. Методика и программа оценки технического состояния и остаточного ресурса системы управления механизмами перегрузочной машины МПС-В-1000-3У4 для АЭС с реакторами ВВЭР-1000, РД ЭО 0319-01.

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21«Типовые технические требования к методикам оценки технического состояния и остаточного ресурса элементов энергоблоков АС, РД-ЭО-0141-98».

22. Методика и программа оценки технического состояния и остаточного ресурса сборок внутриреакторных детекторов контроля энерговыделения (КНИ) в активных зонах ядерных реакторов класса 2Н по влиянию на безопасность, РД ЭО 0413-02.

23. Методика и программа оценки технического состояния и остаточного ресурса шкафов модернизированного унифицированного комплекса технических средств (шкафы УКТС), используемых в системах АЗ, ПЗ, СБ классов 2У, ЗНУ, ЗН (важные для безопасности), РД ЭО 0404-02.

24. Методика оценки технического состояния и остаточного ресурса агрегата бесперебойного питания АБП-1500, РД ЭО 0438-02.

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The structure of creation of normative documents for prolongation of operation terms of operating organization equipment E, I & C

Manko O.O. **Engineer of Directorate of Long Term Operation**

Documentation Structure

- Documents of State Level
- Normative documents of State Committee of Nuclear Regulation
- Document of NAEC «ENERGOATOM»

Documents of State Level

- The law of Ukraine on use of a nuclear energy and radiation safety
- The order of the Cabinet of Ministers of Ukraine “Complex program of activities over prolongation of operational terms of NPP power units “.

Normative documents of State Committee of Nuclear Regulation

- The general provisions of maintenance of NPP safety
- The requirements to the order and contents of work for prolongation of term of operation of information and managing systems, important for safety of NPP.

ЕНЕРГОАТОМ
ENERGOATOM

Дирекция по продлению эксплуатации

Document of NAEC «ENERGOATOM»

The concept of management in term services of energy units NPPs of Ukraine

Regulations

Regulation about organization structure for managemrnt of operational term of NPP power units

Regulation about order LTO equipment important for safety

The program

The program of work on qualification of the equipment NPP of Ukraine.

The NPP programs (system) quality

Program inspection of the state of complexes and systems for prolongation of operational terms (LTO)

DECISIONS
TECHNICAL DECISIONS

U. S. License Renewal Process

Presented to Working Group 3

Safety Aspects of Long Term Operation

May 25, 2004

by

Bob Moffitt,

Pacific Northwest National Laboratory

Battelle

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Presentation Outline

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

What is License Renewal?

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

Significant Basis of Life Extension

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

Principles of License Renewal

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

Scope of the License Renewal Rule

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

Scope of the License Renewal Rule

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

Integrated Plant Assessment (IPA)

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

Time-limited Aging Analyses (TLAAs)

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

TLAAs (continued)

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

Other Requirements of the License Renewal Rule

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

Standards for Issuance of Renewed License

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

GALL Report

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

GALL Report (continued)

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

Standard Review Plan (SRP-LR)

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

SRP-LR (continued)

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

Program Attributes (continued)

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

Regulatory Guide 1.118 & NEI 95-10

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

Summary

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

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Joint Research Centre

EC Contribution to Nuclear Safety & Nuclear Power

by
Alexander DUCHAC (EC/JRC-IE)

IAEA Extrabudgetary Programme on Safety Aspects of Long Term Operation of Pressurised Water Reactors

Electrical Components and I&C WG3

Institute for Energy

Summary

- *EU Research in Reactor Safety*
- *Specific EU research activity on I&C modernisation at NPPs*
  - *Cost Effective Modernisation of Systems Important to Safety (CEMSIS)*

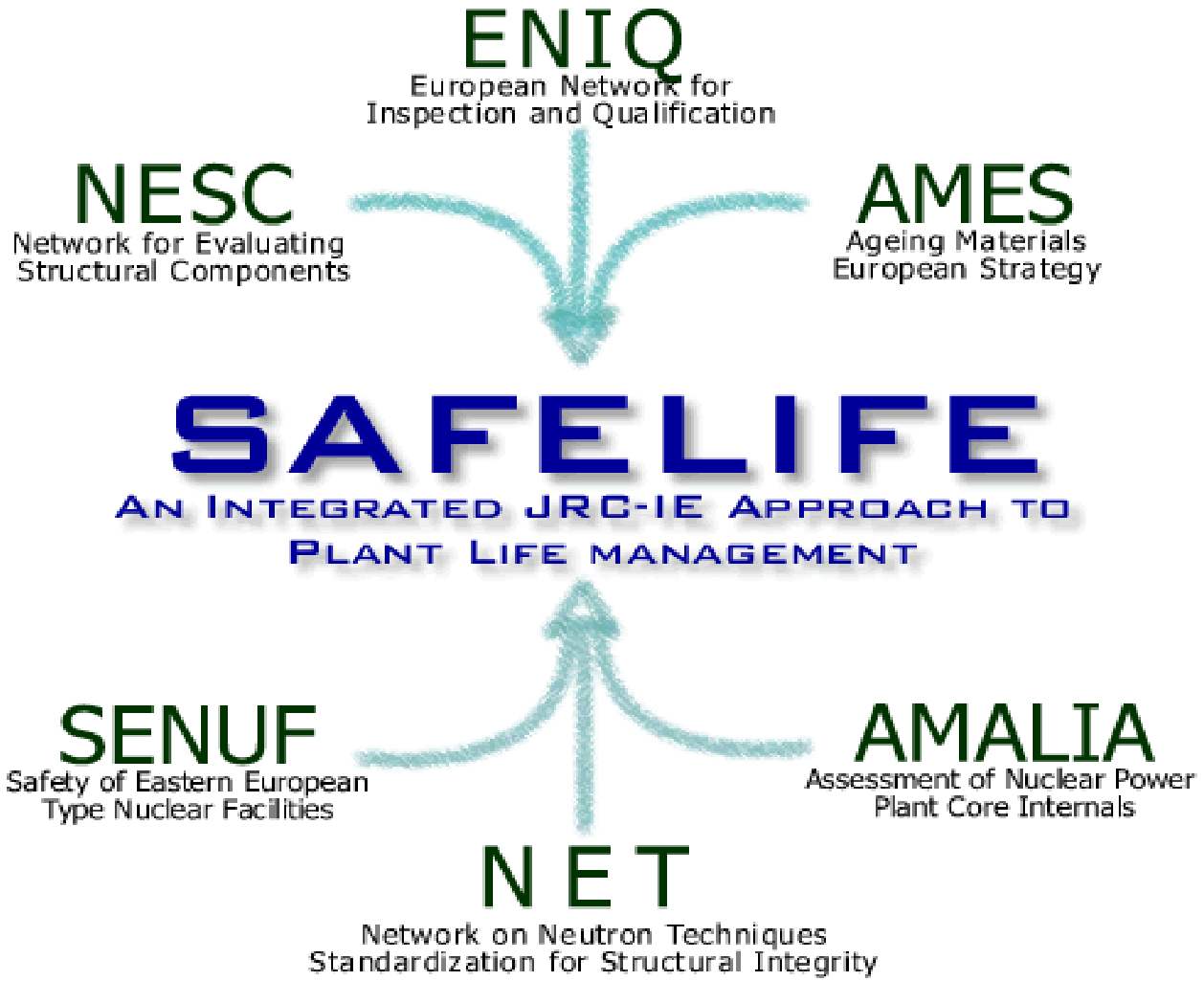
EU Research in Reactor Safety (1)

- *Goal*
  - *Ensure safe nuclear power generation*
- *Research priorities*
  - *How to enhance operational safety of existing reactors*
  - *How to further optimise plant performance and safety*

EU Research in Reactor Safety (2)

- ***Results of the research conducted on operational safety of existing installations***
  - ***Number of multipartner projects structured in three clusters:***
    - ***PLEM (Plant Life Extension and Management)***
    - ***SAM (Severe Accident Management)***
    - ***EVOL (Evolutionary Safety Concepts)***
  - ***Project cost shared by the EC (approx. 50%) and other project partners***
  - ***Project results regularly presented at FISA (international symposium on "EU Research in reactor safety"***
  - ***Some project results available on web-sites***

EU Research in Reactor Safety (3)



EU Research in Reactor Safety (3)

- ***Specific EU research activity related to I&C***
  - ***Cost Effective Modernisation of Systems Important to Safety (CEMSIS)***

What is CEMSIS?

- *The CEMSIS project seeks to:*
  - *Maximise safety and Minimise costs by developing common approaches within the EU to the development and approval of Systems important to safety (SIS) refurbishments that use modern commercial technology*
- *Project focused on I&C systems that re considered as "Systems Important to Safety"*
- *A 36-month cost shared contract commenced in January 2001*
- *Project public web-site www.cemsis.org available*
- *Main results presented at FISA 2003 (Luxemburg 10-13 November)*
- *Final public synthesis report published in April 2004*

Why this project?

- ***Past***
  - *I&C systems developed for the nuclear industry in particular country*
  - *I&C systems used simple analogue relay or discrete logic relatively easy to analyze*
  - *I&C systems tended to be developed to comply with requirement of single regulatory body*
- ***Present***
  - *Maintenance and modernization of obsolete I&C is required in number of nuclear installations*
  - *Recent development shows increasing reliance on computer based systems in I&C*
  - *A common approach is therefore required within the EU*

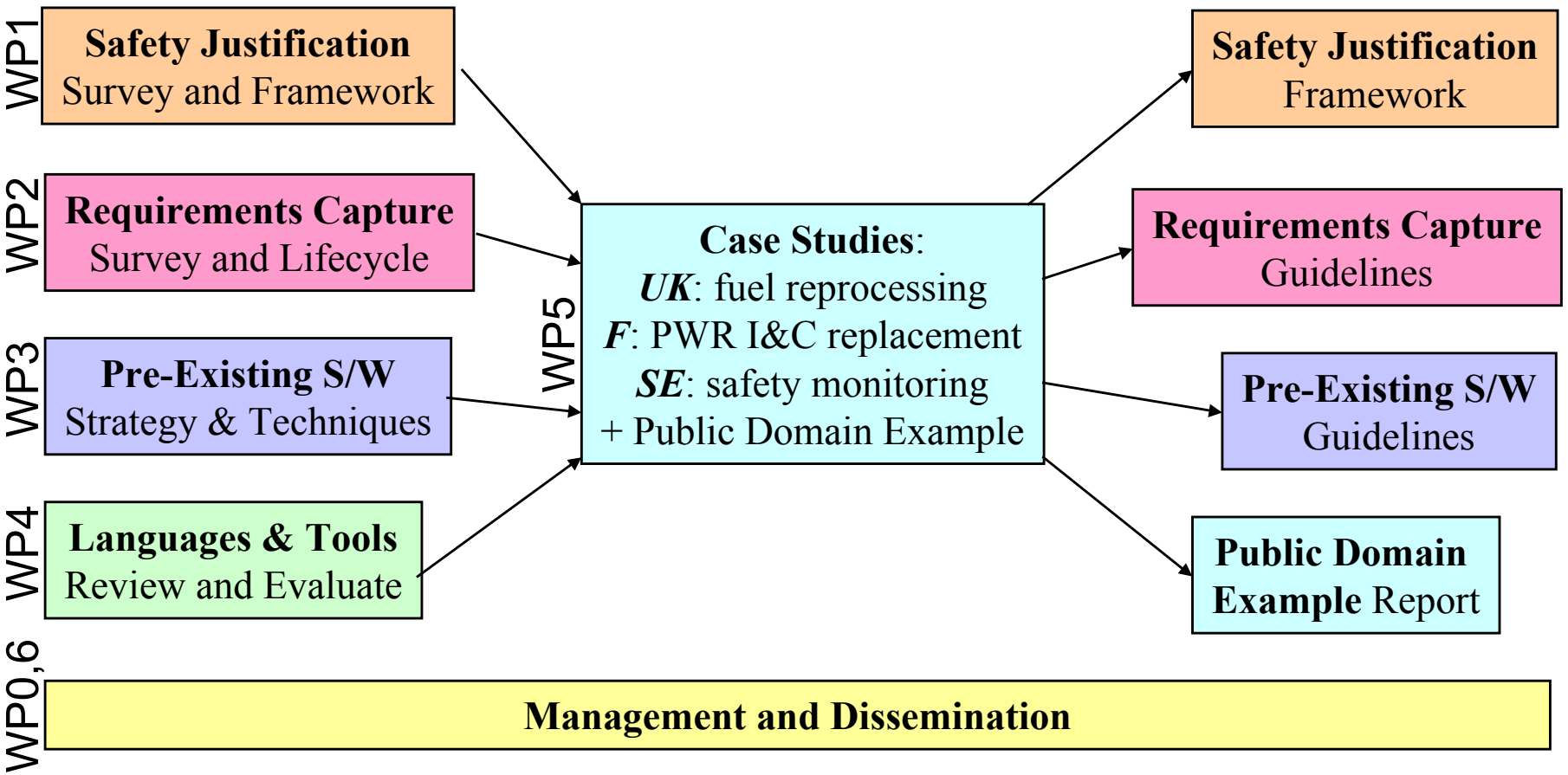
Specific technical objectives

- *Develop safety justification framework for the refurbishment of SIS that is acceptable to different stakeholders (licensing bodies, utilities) within the EU*
- *Develop approaches for establishing the safety requirements for I&C refurbishment together with an associated engineering process*
- *Develop justification approaches for widely used modern technologies*
- *Evaluate these developments on realistic examples taken from actual projects*
- *Disseminate project results to plant operators and regulators within the EU*

Work programme

- ***Main innovative aspects of CEMSIS are in addressing the following key issues in the refurbishment of nuclear I&C systems:***
  - *Harmonisation of safety justification approaches across Member States*
  - *Definition of safety requirements for the replacement SIS*
  - *Use of pre-developed software products in SIS, potentially even for Class A systems*
  - *Application of existing published standards and guidance considered*
  - *Incorporation of input from regulators on licensing issues and draws on existing experience of nuclear regulators within the EU on acceptable approaches*
  - *Incorporation of input from wide range of "stakeholders" in the industry: operators, I&C suppliers, system integrators and software specialists to identify acceptable and economic approaches to refurbishment*

Work Package Tasks



WP 1 - Safety Justification

- ***Objective:***
  - *To develop the overall technical, market and regulatory context for the project*
- ***Description:***
  - *Analysis of process of approving software-based equipment for executing safety critical functions*
    - *is far from being trivial*
    - *not yet properly and efficiently mastered by regulators, licensees and suppliers*
  - *The review of licensing approaches clearly revealed:*
    - *No systematic method is defined or in use in CEMSIS member countries for demonstrating the safety of a software-based system*
    - *Lincensing costs in resources and delays may be more important than benefits expected from the upgrade or the modernisation if a systematic and well-planned approach is not followed*
    - *Cost reeducation at the expense of safety is then great temptation*

WP 2 – Requirements Capture

- ***Objective:***
  - *To investigate methods for establishing the requirements for the refurbishment of control systems that are important to safety*
  - *To develop an associated engineering process that adequately supports the definition of these requirements*

Description:

- *requirements engineering process*
  - *describes the activities and aims of the phases of the requirements process for modernisation*
- *claim-based view*
  - *describes the properties we would like to see the requirements and their specification possess, and provides a clear link to the safety justification framework*
- *set of stakeholders or viewpoints*
  - *guide the activities of the requirements process to increase the likelihood of achieving a complete requirements specification*

WP 3 – Pre-existing SW

- ***Objective:***
  - *To develop cost effective techniques and strategies to demonstrate that the software and architectural design of "Off The Shelf Products" (OTSP) are suitable for performing functions important to safety*
- ***Description:***
  - *WP3 proposes strategies and recommendations for the two main activities of the pre-qualification*
    - *the functional assessment*
    - *dependability assessment.*
  - *WP3 addresses the matching of the OTSP with the requirements of the SIS and the overall safety justification of OTSP-based SIS.*

WP 4 – Graphical Language

- ***Objective:***
  - *To develop justification approaches for graphical specification languages*
- ***Description***
  - *Graphical languages provide a valuable interface between the plant specialist, the I&C engineer and the software developer. To justify the applicability and reliability of such languages one must consider the following:*
    - *justification of the graphical specification. i.e. Does it perform the task that the user requires in a way that is quickly and easily interpreted, and modelled to guarantee safe behaviour?*
    - *availability and justification of verification and validation techniques.*
    - *justification of the means for transfer of the graphically specified function into the underlying "engine“*
  - *There will be no public deliverable for Work Package 4*

WP 5 – Case Studies

- ***Objective:***
  - *To evaluate the developments on real life working examples*
- ***Description:***
  - *Case studies were undertaken to evaluate the results of the initial guidance documents on realistic examples taken from actual projects. To focus the effort, different aspects of the concepts outlined above were applied to three industrial case studies (led by BNFL, Carl Bro, and EDF):*
    - *replacement of PDP11-based control software on nuclear fuel reprocessing plant*
    - *justification of typical safety claims for I&C based on a specific COTS platform in the context of the French Fundamental Safety Rule, and of UK licensing experience*
    - *replacement of a safety monitoring system in a Swedish Nuclear plant*

WP 6 – Dissemination

- ***Objective:***
  - *To, as appropriate, disseminate the results of WP 1-4 and liase with regulators within the EU*
- ***Description:***
  - *The feedback given through dissemination of the results provides valuable input into making the deliverables more generally acceptable.*
  - *The public workshop on 13 November 2003 was designed to help achieve this objective.*
  - *Other dissemination and liaison activities include:*
    - *Liason with the BE-SECBS project through mutual project member, Framatome ANP, involving exchange of project information.*
    - *Liason with the European Commission's Nuclear regulators Experts Working group.*
    - *Involvement in the ongoing development of international standards in the field of I&C systems important to safety, including the generic IEC 61508, and the nuclear sector standards IEC 60880 and IEC 62138.*
    - *Project website*

Conclusions

- *practical benefit to the nuclear industry*
- *results in the form of guidance documents*
- *realistic examples that can be easily applied to practical refurbishment situations*

References related to I&C refurbishment

1. *"Four Party Regulatory Consensus Report on The Safety Case for Computer-Based Systems in Nuclear Power Plants" AECB Canada, DSIN/IPSN France, NII UK, USNRC USA*
2. *Fundamental Safety Rule II.4.1.A on Software for Safety Systems, DSIN/IPSN, France*
3. *EUR 19265 EN – "Common position of European nuclear regulators for the licensing of safety critical software for nuclear reactors". European Commission, Nuclear safety and the environment. ISBN 92_828_8178_4, 2000-IV, 81pp.*
4. *"Justifying the use of software of uncertain pedigree (SOUP) in safety-related applications" CRR336 HSE Books 2001 ISBN 0 7176 2010 7*
5. *"The use of computers in safety-critical applications", Final report of the study group on the safety of operational computer systems, HSE Books 1998 ISBN 0 7176 1620 7*