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NUCLEAR AND RADIATION SAFETY CENTER

Overview of Equipment qualification Program development for ANPP

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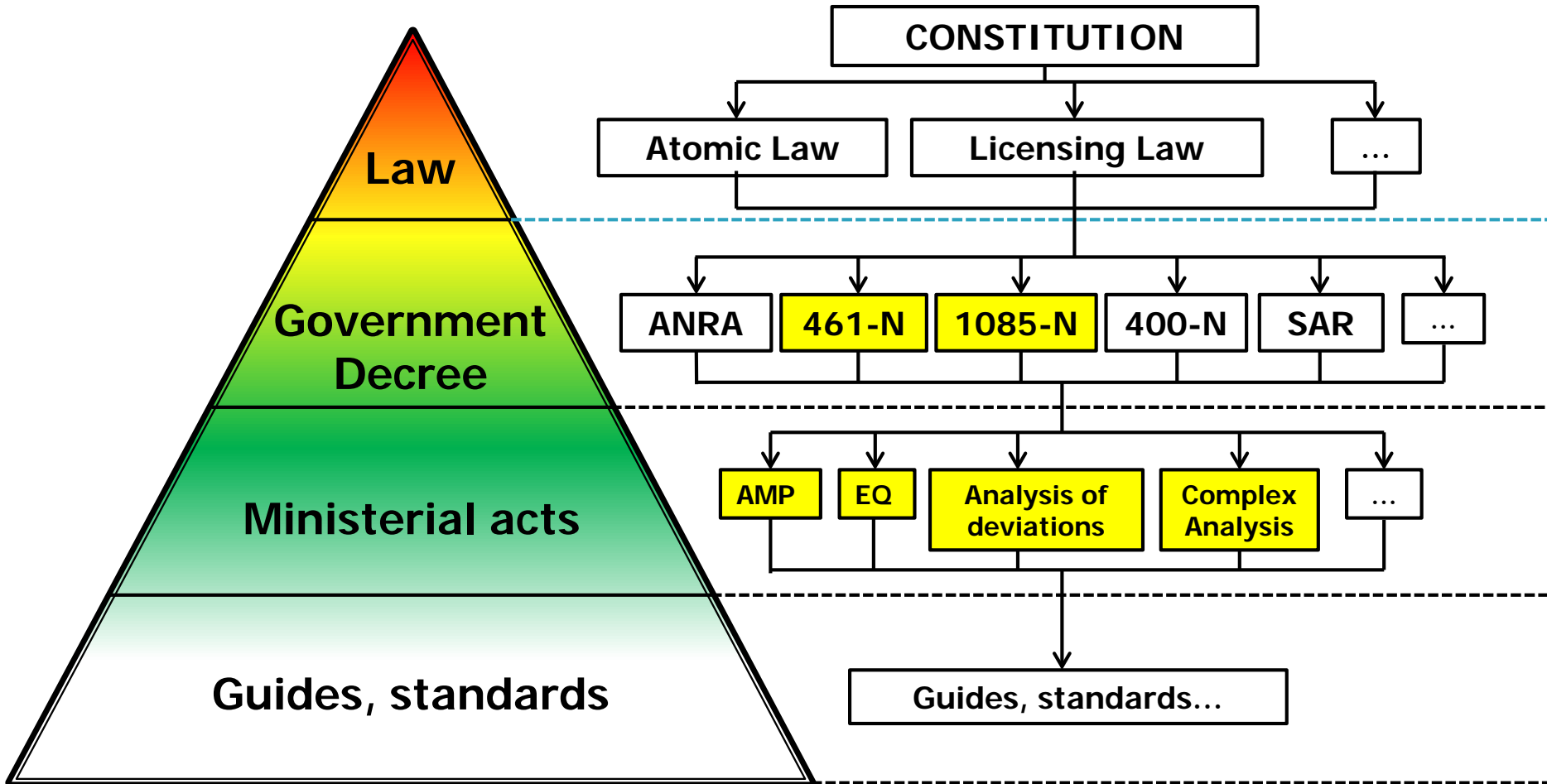
Introduction

- Armenian NPP is 2 Unit VVER-440/V-270 type reactor, seismically enhanced VVER-440/230
- Commissioned: Unit 1 in 1976, Unit 2 in 1980
- Shut down at 1989
- Extensive modernizations 1993-1995
- Restarted in 1995 (only Unit 2)
- In the process of lifetime extension



Regulatory requirements

Legislative pyramid

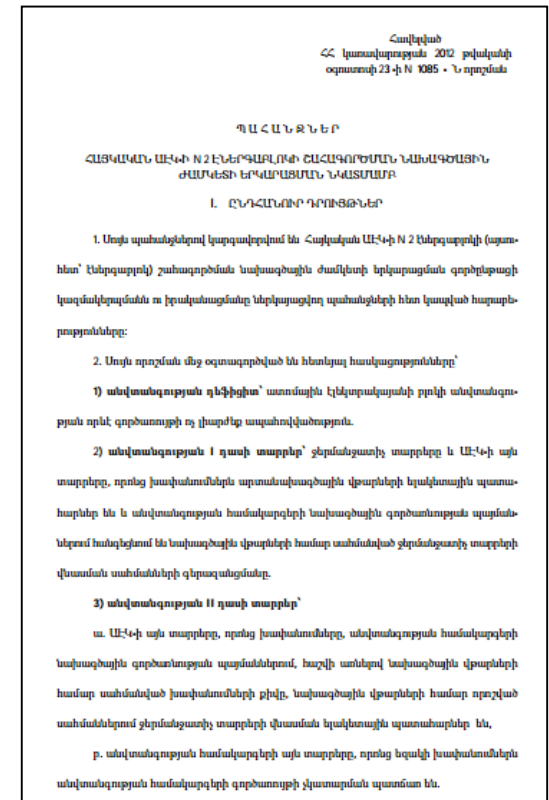


Regulatory requirements

REQUIREMENTS FOR EXTENSION OF THE DESIGN LIFETIME FOR ARMENIAN NPP UNIT 2 OPERATION, Government Decree #1085-N, 2012

The stages of LTE process:

- **STAGE 1 - Feasibility analysis** of lifetime extension and SSC assessment:
 - ✓ Plant comprehensive assessment with conclusion on each component
 - ✓ **Safety assessment (safety issues and classification of issues)**
 - ✓ Development of the Program for preparation to Long-term operation
- **STAGE 2 - Implementation of the Program for preparation to Long-term operation** (additional investigations, replacement of equipment, safety-related measures, equipment tests, updated SAR)



Regulatory requirements

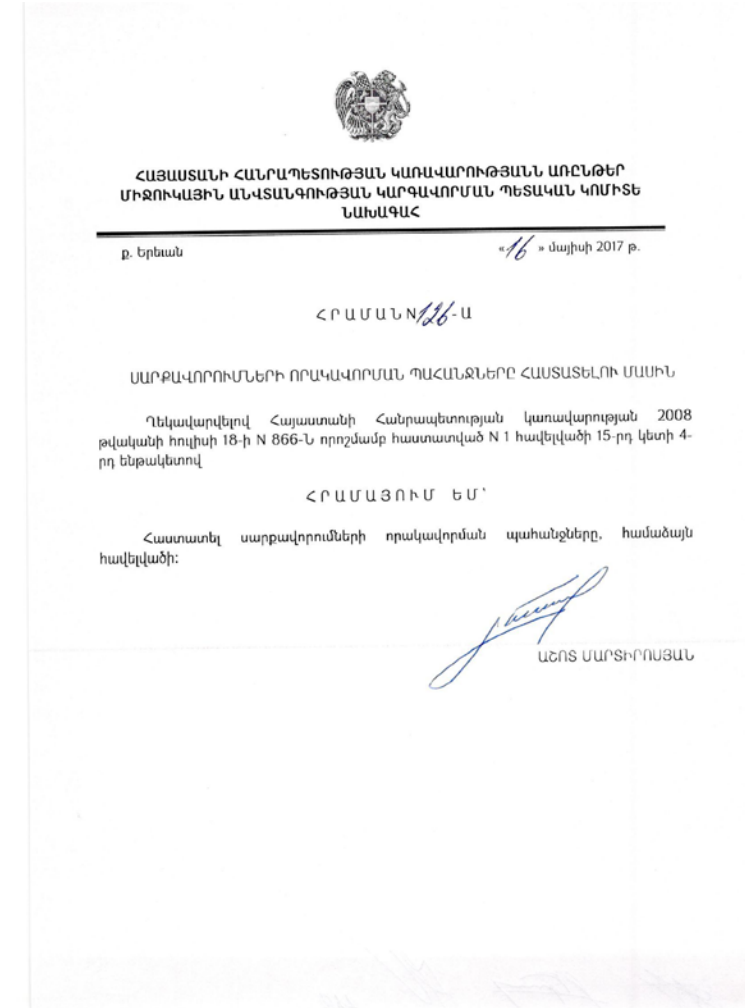
The 12th point of RA Government Decree #1085-N, 2012 REQUIREMENTS FOR EXTENSION OF THE DESIGN LIFETIME FOR ARMENIAN NPP UNIT 2 OPERATION establishes requirement for the equipment qualification.

- ▶ 12. While implementing assessment of technical state and justification of residual life, the following should be fulfilled in relation to the Unit's items:
 1. Analysis of the operation regimes;
 2. Analysis of the repairing and maintenance results;
 3. **Analysis of qualification results under environmental conditions;**
 4. Metal testing results analysis;
 5. Implementation of calculations verifying reliability and strength;
 6. Implementation of additional testing.

Regulatory requirements

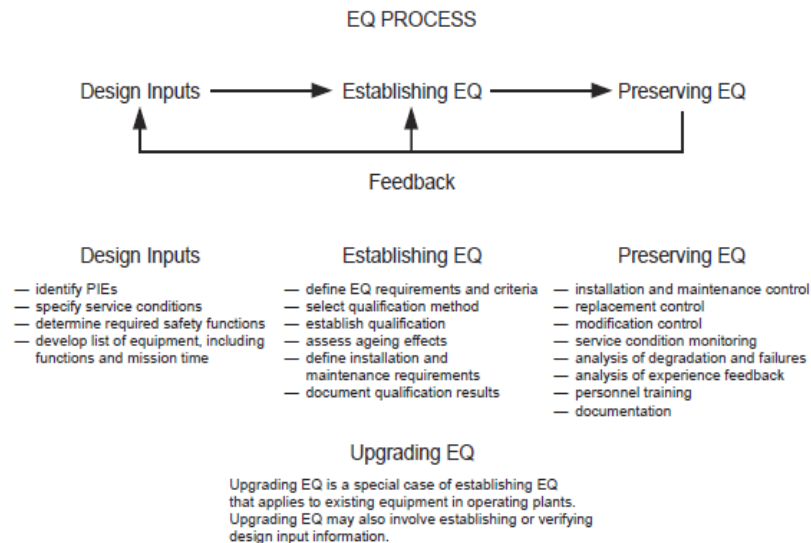
► Requirements to Equipment Qualification:

- Developed – ANRA/NRSC
- Support – EU Expert, (INSC project)
- Approved – ANRA chairman in 2017



Regulatory requirements

- ▶ According to regulatory requirements the qualification program shall include:
 - Objective of qualification,
 - Identification of items for qualification,
 - Identification of safety function for which item should be qualify,
 - Normal and accident service condition,
 - EQ methods,



History of EQ at ANPP

- ▶ Up to now ANPP developed following documents for the equipment qualification:
 - Equipment qualification program;
 - Qualification status of equipment.
- ▶ In frame of IAEA mission which took place in October 2017 both documents were reviewed. And following points were identified that were not present in those documents:
 - Methodology for selection of the equipment which needs to be qualified for the harsh environment conditions;
 - Methodology for safety function identification which will be used during qualification.
 - Continued on next slide...

History of EQ at ANPP

- Zoning of ANPP compartments based on environment parameters.
- Selection of equipment qualification methods:
 - Analysis method;
 - Tests method.
- Requirements for EQ preservation;
- Definition of ageing and qualified life;
- Selection of conservative margins for environment parameters;
- Performance of EQ;
- Preservation of EQ.

Development of EQ program for ANPP

- ▶ To solve problematic points identified by IAEA mission ANPP contracted NRSC for EQ program development;
- ▶ NRSC based on existing documents developed in frame of EQ, and IAEA mission comments suggested to improve the EQ program which will include following points:
 - Aim of EQ;
 - EQ methodology;
 - Selection of equipment for qualification;
 - Determination of equipment safety functions with indication of compartment where it is installed;
 - Assessment of compartments for exposure to changes in environmental parameters during emergency conditions;
 - Development of master table for EQ;
 - Continued on next slide...

Development of EQ program for ANPP

- Analysis of existing calculations for determination of environment parameters. Based on analysis determination of initiating events which need additional calculations. Performance of additional calculations;
- Zoning of ANPP compartments based on parameters of environment;
- Development of enveloping curves for environment parameters in selected zones;
- Selection of qualification methods for each equipment:
 - Analysis of qualification data from other VVER-440 plants to determine applicability for similar equipment;
 - Selection of equipment for which qualification is possible based on calculation results;
 - Selection of equipment for which qualification it is necessary to perform tests.

Development of EQ program for ANPP

- ▶ Based on list of initiating events presented in SAR were selected initiating events which may create harsh conditions in ANPP compartments Selected initial event including transient and accident condition
- ▶ On base of analysis of abovementioned initiating events were determined functional assignments of safety systems which are need to control and bring plant to safe condition.

Система/Защита/Блокировка	Функция систем/сигнала	Время	Пост аварийный мониторинг
Срабатывания АЗ-1 по снижению давления в ГПК	АЗ-1, Контроль реактивности и снижение мощности	≤16сек	-
Срабатывания АЗ-1 по снижению уровня в ПГ			
Сигнал «Разрыв паропровода» и соответствующие сигналы на отключение ГЦН и закрытие БЗОК и закрытия арматур питательной	Ограничение потери теплоносителя второго контура/ Контроль	≤5сек	-

EQ program at ANPP

- NRSC started review of existing list of equipment selected for EQ and developed Master table

Пор. №	Система	Технол. Позиция	Описание	Элемент	Тип	Помещение №/ Направление кабельных линий	Изготовитель	Класс безоп. по ПНАЭ Г -01-011-97	SF
1	СПСП до ГПЗ	21М-721	Давление пара в полуколлекторе ГПК п/к (Iк)	-	-	-	-	2У	SF-1
2	СПСП до ГПЗ	21М-721	Давление пара в полуколлекторе ГПК п/к (Iк)	Преобразователь измерительный	Rosemount 100кгс/см ²	Э-401	EMERSON США	2У	SF-1
3	СПСП до ГПЗ	21М-721	Давление пара в полуколлекторе ГПК п/к (Iк)	Кабель	Connector	Э-401 (до СК)	EMERSON США	2У	SF-1

Пор. №	Функциональное назначение и продолжительность выполнения функции при аварии							
	Течь из первого контура		Течь во втором контуре		Прочие аварии		ПАМ / ПАУ	
	Функция	Время	Функция	Время	Функция	Время	Функция	Время
1	-	-	Сигнал на срабатывание АЗ-1 и блокировок по падению давления в ГПК до 30 кгс/см ²	АЗ-1 - 16сек. Падение давления в ГПК -58сек.	-	-	-	-
2	-	-	Измерение давления в диапазоне 0÷100 кгс/см ²	58сек.	-	-	-	-
3	-	-	I=4÷20мА U=12÷45В	58сек.	-	-	-	-

Thank you

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NRSC actively participated in emergency exercise together with ANRA staff

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