THE IMPLEMENTATION OF THE RADIOLOGICAL SAFETY STANDARDS IN UKRAINE

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Introduction

Standard acts directed at the increase of nuclear enterprise personnel and public protection from ionizing radiation were adopted in Ukraine during the recent 5-7 years. While developing this laws the latest accomplishments of the world nuclear community in the area of radiation protection generalized in ICRP (46, 60, 64, 76, 77, 81) and IAEA publications were used.

The Main Content of the New Radiation Safety Standard of Ukraine (RSSU-97) and the Law of Ukraine "Protection of Man from Acting Ionizing Radiation About"

The Law of Ukraine "Protection of Man from Acting Ionizing Radiation About" was adopted on February 24, 1998. This Law defines the right of man to be protected from ionizing radiation exceeding established limits. This right is realized by means of integrated measures to protect man from ionizing radiation exceeding established limits, reimbursement for dose limits exceeding and detriment caused by ionizing radiation impact reimbursement.
Main exposure dose limits are defined.

- Public exposure shall not exceed 1 mSv of the annual effective dose.
- Newly commissioned nuclear facility occupational exposure shall not exceed 20 mSv of the annual effective dose, assuming that the dose can be increased up to 50 mSv on condition that the average annual exposure dose during 5 years does not exceed 20 mSv.
- Operating nuclear facility occupational exposure shall not exceed 50 mSv per 12 months in succession, with gradual decreasing of radiation dose limits to 20 mSv per year during the transition period.

The time of such transition period is defined by state regulatory bodies.
According to this Law protection of man from radionuclides contained in construction materials, foodstuffs, drinking water is ensured. Protection of man during medical practice is ensured.

New radiation safety standard of Ukraine RSSU-97 entered into force 01.01.98. Supplement to it RSSU-97/D2000 entered into force in the middle of 2000. This standard introduces the concept of potential exposure to ionizing radiation and regulates probability of criticality events connected with exposure. It also defines three basic principles of radiation protection with reference to potential exposure to ionizing radiation.

- Justification Principle- practical activity which can lead to exposure to ionizing radiation shall not be implemented if the benefit for people exposed and for the society in general does not exceed the harm from this activity now and in the future in connection with the potential occurrence of criticality event.
- Non-Exceeding Principle- all types of practical activity falling under sanitary surveillance shall not lead to exceeding of the dose values and probability of potential exposure to ionizing radiation regulated by this document.
- Optimisation Principle (ALARA)- criticality event probability and potential exposure dose as well as the number of persons that could be impacted by such sources shall be as low as reasonably achievable taking into account economic and societal considerations.

These principles are utilized at practical activity planning stage.

«Program of transition of nuclear power enterprises of Ukraine to operation meeting the requirements of RSSU -97» adoption and implementation.

In order to take up new dose limits the **«Program of transition of nuclear power enterprises of Ukraine to operation meeting the requirements of RSSU -97»** was developed by the Ministry of Energy of Ukraine and the State Scientific and Engineering Center of Control and Emergency Response Systems and approved by the regulatory body.

Applicability of the Program.

- Definition of radiation safety condition conformity to RSSU-97 requirements.
- Definition of the new standard general transition activity directions.
- Transitive period duration establishment.

The program defines the main directions of the activity:

- Revision of standards (instructions, radiation control regulations) at the plant level.
- Measuring procedures revision and development.
- Occupational exposure reduction measures development.
- Revision of plant radiation monitoring systems including new equipment installation.

Transition period duration is established for the nuclear enterprise or facility where operation is performed proceeding from organisational evolutions terms while taking up new standards.
The program establishes the duration of the first stage for nuclear enterprises for Ukraine's NPPs-5 years starting January 1,1998.
The following organisational evolutions have been planned and implemented in the framework of the program:

1) Training of NPP personnel in RSSU general provisions and their differences from the previous RS-72/87 was organized.

2) NNEGC "EnergoAtom" Radiation Protection Council was created.

3) NPP dose limits of occupational exposure projection groups (ALARA) were organized and Provisions for ALARA group performance were adopted.

4) Transition to monthly measuring of the occupational integral individual doses; women under 45 and critical group personnel (where exposure dose higher than 10 mSv/year is possible).

5) Dose limits exposure analysis for the personnel performing radiation dangerous activities is performed by ALARA groups; collective dose projection report is issued before the planned outage and outage performance report is issued afterwards.

6) The list of radiation dangerous activities is worked out; before the planned outage organisational evolutions to decrease the exposure are developed.

7) Planned action implementation control is performed during the planned outage.

8) Radiation monitoring of permanent and temporary residence of personnel into stringent operating condition zone was performed.

9) Dose limits of NPP personnel occupational exposure projection and analysis techniques are being developed.

Lack of electronic dosimeters at NPPs is a still great problem.
It makes radiation monitoring more complicated and decreases its efficiency.
Measures to develop the internal exposure dose calculations according to the results of body counter measurement techniques for NPPs are not yet implemented, such techniques are developed only for " The Shelter" facility.

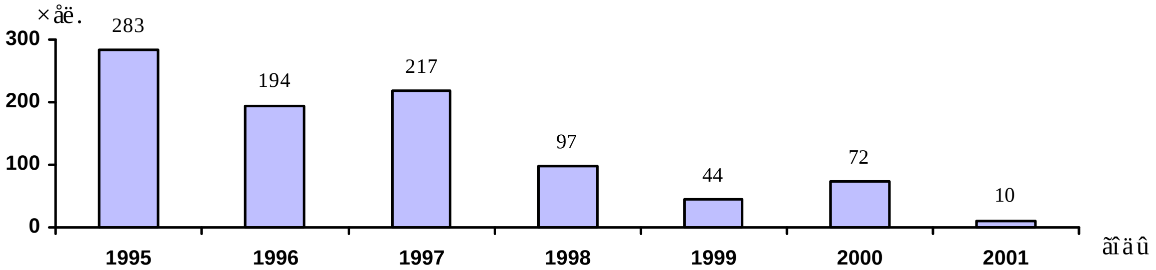
Current reduction of occupational exposure doses at Ukrainian nuclear power plants as a result of optimization of the radiological protection (ALARA)

The main measure of activity associated with the radiation protection quality is the collective and average doses.
Occupational exposure dose reduction trend is one of the indicators while following the ALARA principles.

Table 1. Individual occupational exposure dose distribution on January 1,2002; collective and average annual individual doses for 2001.

NPP	number person under control	Number personnel intook dose exposure on January 1, 2002, man,(mSv/year)									Dose exposure for 2001 year, mSv	
		<2	2-5	5-10	10-15	15-20	20-30	30-40	40-50	>50	Collective dose	Average annual individ. dose
Zap.NPP	4789	4204	322	169	70	24	0	0	0	0	4324.1	0.900
incl. outside personnel	477	443	15	15	3	1	0	0	0	0	247.2	0.520
Rivne NPP	3247	2370	431	166	38	32	10	0	0	0	5173.2	1.590
incl. outside personnel	415	198	10	7	0	0	0	0	0	0	450.5	1.090
Khmel.NPP	2072	1899	132	39	2	0	0	0	0	0	1377.1	0.665
incl. outside personnel	420	390	27	3	0	0	0	0	0	0	212.5	0.506
SU NPP	2846	2074	394	217	130	31	0	0	0	0	5872.0	2.063
incl. outside personnel	517	492	76	45	43	14	0	0	0	0	1273.4	1.901
NNEGC	**12954**	**10547**	**1279**	**591**	**240**	**87**	**10**	**0**	**0**	**0**	16746.4	1.293

Graph 1 shows NNEGC personnel quantity changes with external individual doses exceeding 20 mSv per year during the recent 7 years.



Graph 1.The number of WWER- reactor NPP personnel having intaken the external dose more than 20 mSv per year during 1995-2001.

Graph 1 shows that the number of such personnel has gradually decreased and in 2001 only 10 people intook the doses higher than 20 mSv (approx. 30 mSv) and what's more this decision was approved by Chief Sanitary Doctor on condition that in 5 years to come the collective dose of these people could not exceed 100 mSv.

Table 2 represents the WWER-reactor NPP personnel and outside personnel collective exposure dose change dynamics for NPP in general and data for the recent 5 years for one unit.

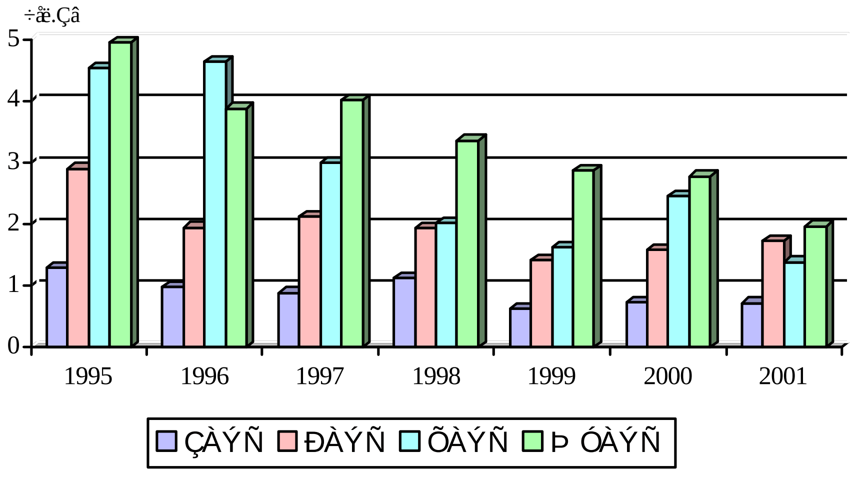
Table 2. WWER-reactor NPP personnel and outside personnel collective exposure dose in 1997-2001.

Year/ NPP	**1997**			**1998**			**1999**			**2000**			**2001**		
	Num man	Dose, m.Sv	unit/ m.Sv	Num man	Dose m.Sv	unit/ m.Sv	Num man	Dose m.Sv	unit/ m.Sv	Num man	Dose m.Sv	unit/ m.Sv	Num man	Dose m.Sv	unit/ m.Sv
Zap.NPP	4561	5.26	0.88	4634	6.74	1.12	4660	3.78	0.63	4779	4.37	0.73	4789	4.32	0.72
Rivne NPP	3745	6.36	2.12	3289	5.78	1.93	3198	4.24	1.41	3589	4.78	1.59	3247	5.17	1.72
Khmel.NPP	2061	3.01	3.01	2012	2.02	2.02	2024	1.63	1.63	2070	2.46	2.46	2072	1.38	1.38
SU NPP	2641	12.0	4.00	2721	10.1	3.36	2689	8.61	2.87	2689	8.31	2.77	2846	5.87	1.96

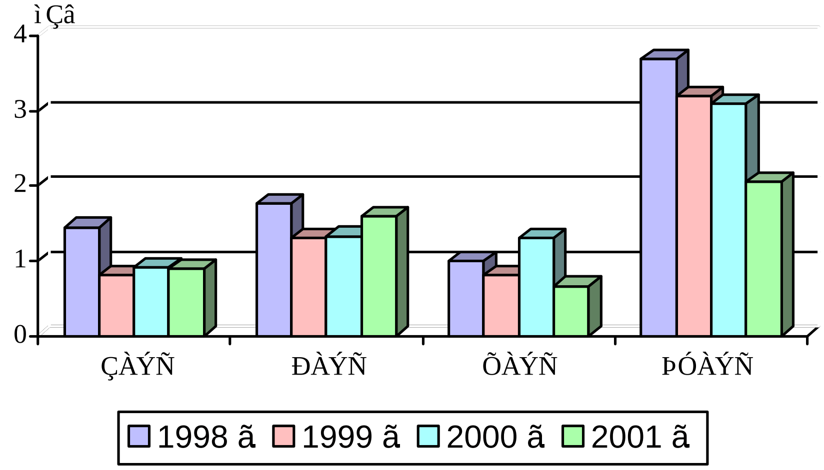
Total collective occupational exposure dose for NPP personnel in 2001 was 16,7man.Sv, for 2000 it was 17,92man.Sv ,average collective dose for the unit was 1,38 man.Sv, in 2001 - 1,29 man.Sv.

Sister-unit group data for comparison:
Hungary-0,76 man.Sv/unit, Slovakia-0,81 man.Sv/unit, Finland-1,132 man.Sv/unit, Slovenia-2,59 man.Sv/unit.

The following graphs represent WWER- reactor NPP personnel collective exposure doses and average individual exposure doses for the recent years.



Graph 2. WWER-reactor NPP personnel and outside personnel collective exposure dose in 1997-2001, 1 unit.



Graph 3. WWER-reactor NPP personnel average individual exposure dose in 1998-2001.

New More Stringent Limits Adoption

In January 2002 a joint meeting of Regulatory bodies (Ministry of Health Protection and State Committee on Nuclear Regulation) and NNEGC "EnergoAtom" took place, where the implementation of the **«Program of transition of nuclear power enterprises of Ukraine to operation meeting the requirements of RSSU -97»** was analyzed. The main objective of the **«Program...»** transition to new NPP personnel occupational exposure dose standards (20 mSv/year), revision of regulations and requirements to meet the new standards, introduction of exposure dose planning during the planned outage etc. **was accomplished.**