

OPTIMIZATION OF OCCUPATION EXPOSURE AT THE ARMENIAN NPP

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The Armenian Nuclear Power Plant (ANPP), the only nuclear power plant in the region, consists of two VVER/440/270 units (that is a modified, seismic design VVER/440/230). Unit 1 started its commercial operation in 1976 and Unit 2 in 1980. Both units were shutdown shortly after the 1988 Spitak earthquake. Re-commissioning works were performed from 1993 to 1995 and in November 1995 Unit 2 restarted operation. At this moment the ANPP Unit N1 is in conservation regime (long-term shut down).

The Radiation Safety Norm and the Radiation Protection Rules for the regulation of safety and control of employees, public, medical exposure and the environment were putted in force in 2006.

These regulations are stated the dose limits for the staff (category A and B), for the public and for the medical exposure (guidance levels). The limits are in line with the IAEA Safety Standards.

For the implementation of the limits, as well as for the fulfilments of the principles of optimization of the doses and the related radiation risks, the radiation safety rules (Chapter XIV) stipulates the requirements on Radiation protection of the workers and the safety of the sources. The more detail radiation protection and safety requirements are stated in the special regulations for the nuclear facilities including NPP's.

ANPP has more than 873 staff under the radiation safety control. Most of them (excluding the shift staff) are not permanently work at controlled area and could be involved during the outages or maintenance or refuelling activities at ANPP.

For the ALARA implementation proposes by the special order of management the ALARA committee has been established and the program for its implementation has been adopted.

This plan includes the technical and organizational measures as well as dose planning approach, which periodically reviewed by the radiation Protection Department and Management of ANPP.

In accordance with ALARA program the following organizational and technical actions for dose reduction are established:

- when performing activities on equipment repair maximum use of mechanization facilities and reduction of manual work should be provided for;
- before starting the maintenance activities decontamination of rooms, equipment under repair shall be performed, if necessary;
- during performance of activities only the personnel whose presence is required should be at work places;
- the tools used when performing maintenance activities shall have special labelling and shall be placed on special trays or in boxes made of easily decontaminated material. The tools contaminated during maintenance activities are to be decontaminated. The use of these tools for maintenance of non contaminated equipment must be ruled out;
- when performing electric welding and gas welding activities it is necessary to take actions on preventing radioactive aerosol inhalation; the welding of small parts and equipment must be performed on special stands equipped with local exhaust ventilation;

- the personnel involved in the maintenance activities must be provided with radiation monitoring means (electronic digital radiation monitors, if possible);
- after completing the maintenance activities overall decontamination of rooms with subsequent radiation monitoring shall be performed.

During the maintenance activities personnel protection equipment is used:

- Isolating protection equipment (pneumatic suit, pneumatic helmet and in particular cases self-contained isolating equipment) should be used during activities when the room air radioactive contamination exceeds the allowable levels more than 200 times. In common cases respirators are used.
- For hand protection rubber gloves resistant to chemical agents specific for this production site are used combined with cotton gloves.

The additional PPE is taken off in such a manner so that not to contaminate the main protective clothing and protective shoes. First, it should be the plastic protective clothing and protective shoes, then the gloves and the last - the respirators.

The following ALARA forms for the dose planning are developed and implemented at the ANPP;

The form of planning the works according ALARA

Work place:						
Description of work:						
ALARA arrangements	Yes	No		Protective actions	Yes	No
1. Depressurization of system	<input type="checkbox"/>	<input type="checkbox"/>		Decontamination of work area	<input type="checkbox"/>	<input type="checkbox"/>
2. Equipment movement possibility to less contaminated premises	<input type="checkbox"/>	<input type="checkbox"/>				
3. Availability of approved program/ procedures	<input type="checkbox"/>	<input type="checkbox"/>		Decontamination of equipments	<input type="checkbox"/>	<input type="checkbox"/>
4. Availability of special marked tools list	<input type="checkbox"/>	<input type="checkbox"/>		Temporary shillings	<input type="checkbox"/>	<input type="checkbox"/>
5. Is Monitored the working area	<input type="checkbox"/>	<input type="checkbox"/>				
6. Is it needed the special tools? If yes, specify!	<input type="checkbox"/>	<input type="checkbox"/>		Ventilations	<input type="checkbox"/>	<input type="checkbox"/>
7. Accurance of Radwaste	<input type="checkbox"/>	<input type="checkbox"/>		Air for special protective clothes	<input type="checkbox"/>	<input type="checkbox"/>
8. Designated place for Radwaste	<input type="checkbox"/>	<input type="checkbox"/>		Drainage of system	<input type="checkbox"/>	<input type="checkbox"/>
9. Written order for access to working area	<input type="checkbox"/>	<input type="checkbox"/>		Washout of system	<input type="checkbox"/>	<input type="checkbox"/>
10. Training of personnel	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
11. Other requirements if needed					<input type="checkbox"/>	<input type="checkbox"/>
What kind of other special ALARA arrangements are included?						
The Controller of the works				Date:		

Equipment /safety system:						
Description of work:						
The planning manpower allocation, man/hour	In fact man/hour	Differences, %	The planning dose, man*Sv	In fact dose, man*Sv	Differences, %	In fact dose rate, μ Sv/h
Designate the works which could be impact on manpower allocation or in dose:						
The volume of work (man/h) has changed:				Increase on%		
				Decrease on.....%		
The radiation situation has changed in relation to planned:				Improved.....		
				Worsened.....		
If the radiation situation has worsened, mention the causes:						
a) Insufficient of shielding.....						<input type="checkbox"/>
b) Inconsistence of shielding to radiation situation.....						<input type="checkbox"/>
c) Incorrect definition of radiation situation.....						<input type="checkbox"/>
d) Insufficient ventilation.....						<input type="checkbox"/>
e) Accordance a new un planned situation (mention what situation).....						<input type="checkbox"/>
Other causes.....						
Insufficient knowledge's of personnel on Radiation Safety						<input type="checkbox"/>
Incompliance with rules of Radiation protection						<input type="checkbox"/>
If the radiation situation turned out to be more severe than planned one, mention the causes.....						
The chairman of ALARA Committee (signature).....						
Date.....						

As far as in 2008 at ANPP were planed and performed a general repair and maintenance activities (chemical cleaning of reactor vessel, non destructive testing of reactor vessel and eddy current control of SG tubes with cutting damaged tubes) the doses for 2008 were increased slightly and had influence on dosimetric trends.

The planned exposure doses for repair and outage were agreed with regulatory body.

The planned collective dose before outage for 2008 was **1.58 Sv*man**. The real collective doses during the outage were **0.78 Sv*man**.

Distribution of main doses within different departments of ANPP was as follows:

- For the repair works – 61.8%
- For the decontamination work – 16.1%
- For the works for non destructive testing – 6.2%

The rest of percentages are distributed within other departments of ANPP.