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APPLICATION OF THE DOSE CONSTRAINT CONCEPT TO OPTIMIZE RADIATION PROTECTION OF MEDICAL PERSONNEL

SCIENTIFIC SESSION of the BELARUSIAN STATE MEDICAL UNIVERSITY,
25 January 2024

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Introduction

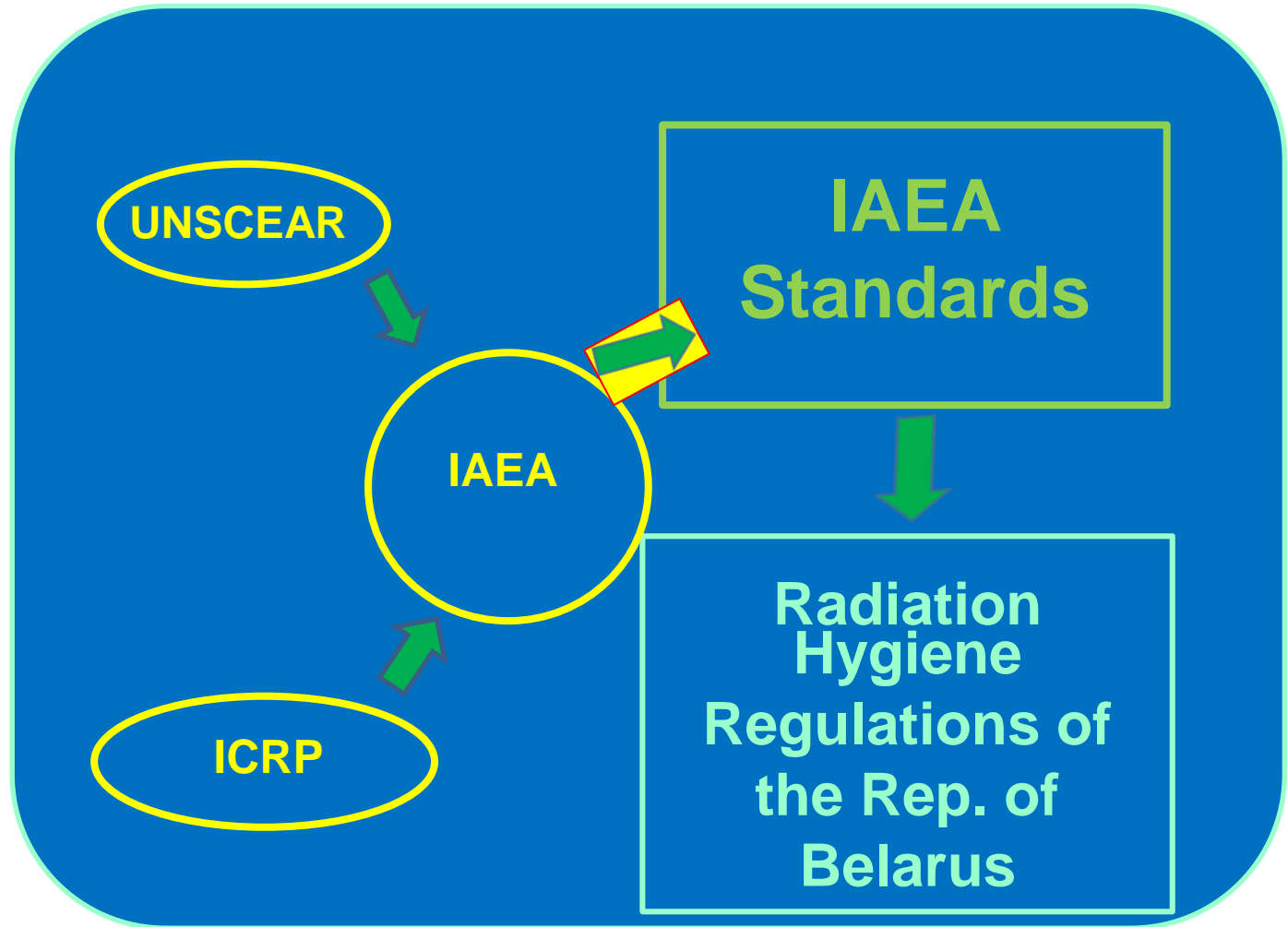
Optimization, that is ensuring that radiation facilities and technologies are operated and maintained in such a way that their impact on public and personnel health is as low as reasonably achievable has been and will continue to be a keystone of radiation safety system

Optimization concept is included in the Law of the Republic of Belarus “On Radiation Safety” and is one of the requirements of the national regulations

In order to limit radiation doses within frame of the optimization process, the ICRP introduced the concept of dose constraints (hereinafter referred to as DC), which is the most important optimization tool

This work discusses aspects of introducing the DC concept into the practice of radiation protection of personnel in medical institutions of the Republic of Belarus

How the system is working?

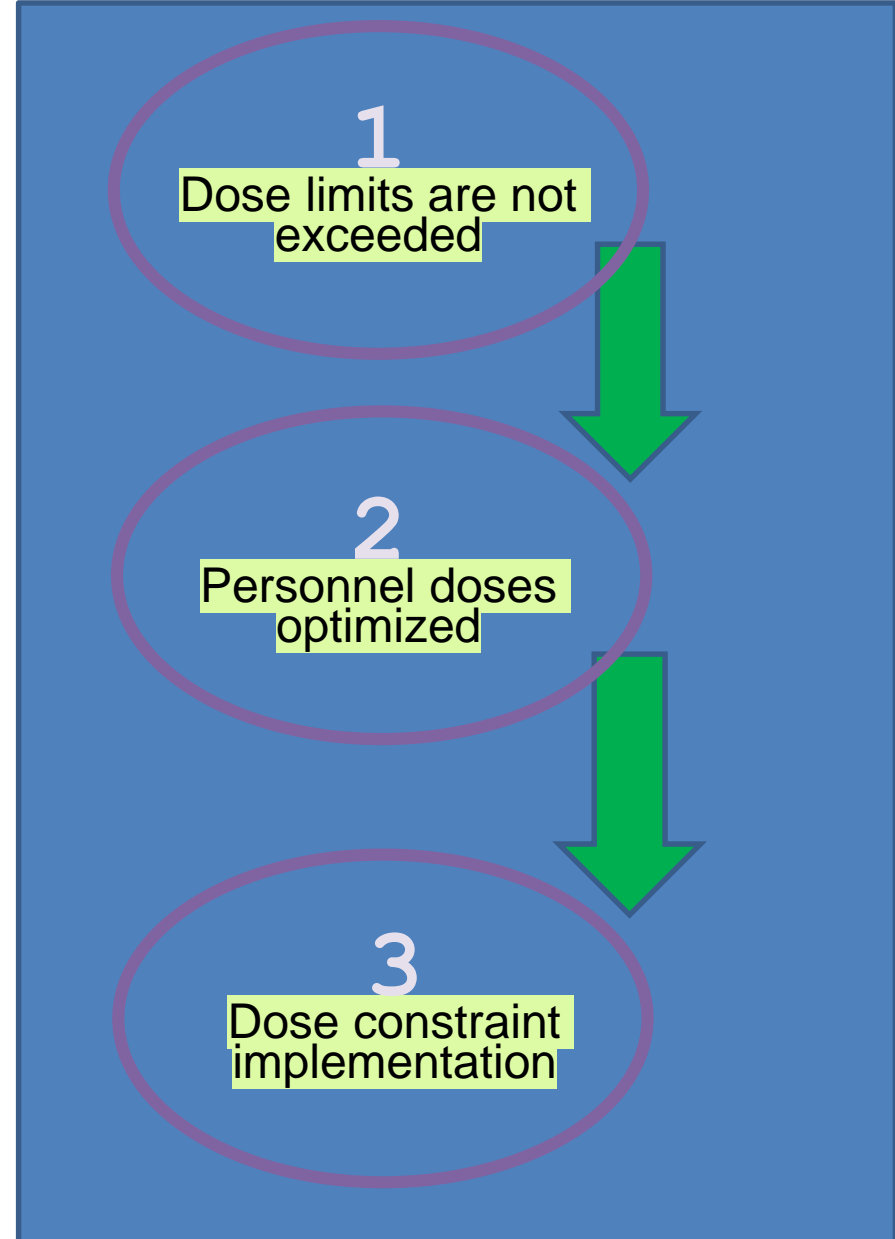


Optimization of occupational doses

At the first stage the system ensures that internationally accepted occupational dose limits are not exceeded

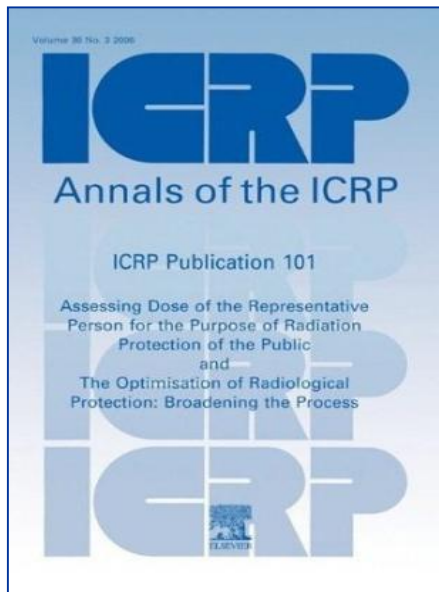
At the second stage, the aim is to optimize personnel doses to reasonably achievable limits, i.e. setting standards, corresponding to working conditions and possible radiation effects on the worker if the work is properly organized and the radiation safety instructions are followed

At the third stage the most important optimization tool is Dose Constraint

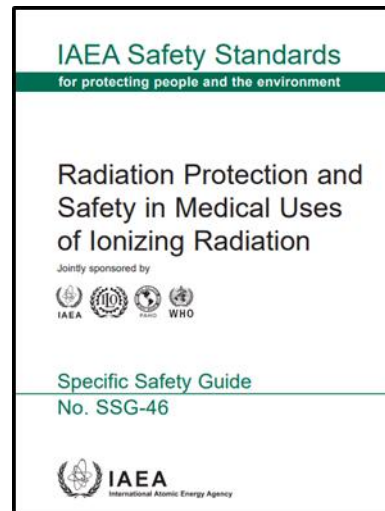
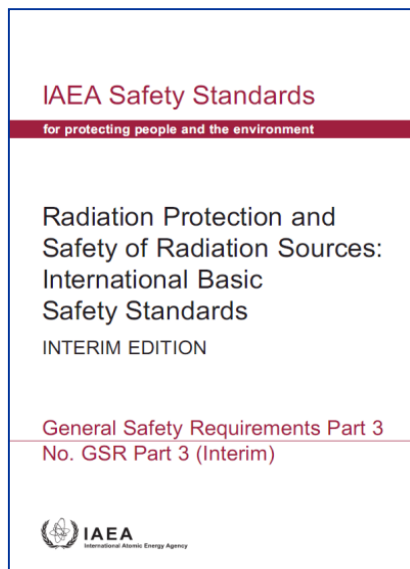




International recommendations



Dose constraints are used to optimize protection and safety and aim to ensure that, through control, the level of all exposures is kept as low as reasonably achievable, taking into account economic, social and environmental factors





Main provisions of the recommendations of the ICRP and the IAEA

Dose Constraint (DC):

the upper limit of dose predicted for a worker performing a specific job with a specific irradiation source (or set of irradiation sources used in a facility or group of operations in a specific practice) in a situation with specific radiation characteristics, which should be achievable in a well-controlled practice.

May be expressed as a single dose or as a dose over a given period of time

- ✓ ESTABLISHED AT THE DESIGN OR PLANNING PHASE
- ✓ ALL RESPONSIBILITY FOR ESTABLISHING DC RESTS WITH THOSE WHO ARE RESPONSIBLE FOR WORKER EXPOSURE
- ✓ THE PROCESS OF DETERMINING DC SHOULD BE BASED ON EXPERIENCE IN OPERATING A SIMILAR SOURCE UNDER SIMILAR CONDITIONS AND CONSIDER ECONOMIC, SOCIAL AND TECHNICAL FACTORS.
- ✓ DOSE CONSTRAINTS SHOULD NOT BE USED RETROSPECTIVELY TO CHECK COMPLIANCE WITH PROTECTION AND SAFETY REQUIREMENTS



Application of the DC concept in European countries

Most European countries apply the Dc concept to optimize radiation protection of medical personnel

Greece, Ireland, Switzerland - to optimize the protection of all radiation workers

Belgium and Norway - not applicable

UK - in case the predicted dose may be several mSv/year

Sweden - in relation to personnel of all medical institutions


DC IN NUCLEAR MEDICAL DEPARTMENTS

Personnel	Proposed DC, mSv/year		
	Poland [1]	Greece [2]	Korea (PET-CT) [3]
Nurses	2,50	2,2	
Technical staff	2,50	2,2	5,5
Doctors	1,0	1,7	

Sources:

1. The practical considerations of dose constraints in diagnostic medical departments using ionizing radiation/ B. Birkenfeld // Radioprotection. -2014.-№ 49(1).– C. 23-25.
2. Proposed Dose Constraints in the Duties of Radiation Workers at the Department of Nuclear Medicine/ Woon-Kwan Chung [и др.]// Radiation Protection Dosimetry.-2019.- № 189 (4).).– C. 535-539 <https://doi.org/10.1093/rpd/ncz249>
3. Occupational dose constraints for the lens of the eye for interventional radiologists and interventional cardiologists in the UK/ Mairs WD// Br J Radiol. -2016.-№ 89: 20150551

Introduction of IAEA requirements into the radiation-hygienic regulations of the Belarus



The Law on
Radiation Safety
Entered into
force
27.06.2020

Radiation dose limits in the form of occupational radiation dose values, public radiation dose or radiation risk should be established in accordance with legislation in the field of sanitary and epidemiological welfare of the population to optimize the radiation safety of the population and personnel in a situation of planned exposure

The Ministry of Health establishes the procedure for establishing and applying radiation dose limits and reference levels



DCs are established for the individual effective exposure dose of a worker during design, commissioning or operation of:

- radiation facilities handling open radiation sources in work classes I and II or sealed radiation sources in categories I and II according to the degree of radiation hazard
- other radiation facilities if it is necessary to optimize the radiation protection of personnel, if during normal operation of the radiation source the annual radiation dose to personnel may exceed the effective dose to the whole body of 6 mSv/year



Regulation on the procedure for establishing and applying dose constraints and reference levels - Order of the Belarusian Ministry of Health dated August 31, 2021

DC is established:

- at the design stage or before the facility is put into operation – by design organization together with the user of the radiation source
- if the facility is already in operation – by user of the radiation source

The justification of DC is the responsibility of the user of the radiation source, who is obliged to provide it to the state sanitary inspection institutions for approval

DC is entered in the sanitary passport

State sanitary inspection institutions make supervision of compliance with the established DC



CONCLUSION

The completed study shows that most European countries apply the concept of DC to optimize the radiation protection of medical personnel, and applying DC brings real benefits in terms of reducing radiation doses to workers

In the Republic of Belarus, the application of the DC concept is approved at the level of the Law, and the procedure for establishing the DC for occupational exposure is determined by the radiation hygiene regulations and the Order

This ensures regulatory system functioning that not only enforces the dose limits, but also keeps workers' exposure doses as low as reasonably achievable