STATE OFFICE FOR NUCLEAR SAFETY

The Current System of Occupational Exposure Regulation in the Czech Republic IAEA P-S4-198

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Summary

National Central Register of Occupational Exposures (CRPO) is in operation in the Czech Republic more than 20 years. There is about 23ths active radiation workers registered in CRPO with collective dose 7.8 Sv. The average annual individual effective dose was 0.35 mSv for all workers and 0.9 mSv for those with doses above MDL in 2020 year. Dose distribution within last 10 years is stable with slight shift to lower doses. Specific control of personal doses of outside (itinerant) workers is established in accordance with European legislation. SUJB is issuing Personal Radiation Passports – up to now there was almost 10ths passports issued – currently 3 800 of them are in use. There is 7 dosimetric services in operation approved by SUJB. All requirements for this specific license are included in legislation and annual control of measurements quality and accuracy is organized by SUJB. NORM workplaces are categorized in the Czech Republic as planned exposure situation with all relevant requirements for them. Currently there is about 500 NORM workplaces registered in SUJB special database. Radon workplaces are understood as existing exposure situation and some of relevant requirements for planned exposure situation are applied. The regulation of radon workplace started in 2018 year and there is an estimation of more then 10ths of radon workplaces that could be found in radon prone areas specified by legislation. The graded approach is currently applied and the workplaces with assumed highest radon concentration are contacted and informed about new legislative requirements (see also poster Berčíková et all. "Control of Natural Radon Exposure to Workers in Schools and Educational Facilities in the Czech Republic").

Legislative Framework for Regulation of Occupational Exposures

Atomic Act (Act No. 263/2016 Coll.) defines radiation workers as workers who are exposed to radiation due to their employment within planned exposure situation and categorizes them into category A and B. Category A worker could receive – based on assessment of real and potential doses as well– more than 6mSv/y and shall have a personal dosimeter with one month period of evaluation and shall pass a preventive medical surveillance once per year.

The limit of 20 mSv/y for effective dose is established (with the possibility for regulator to approve a special limit 100 mSv/5y with maximum 50 mSv in one year if justified) and also limit for lens of the eye 100 mSv/5y (with max 50 mSv in one year) and 500 mSv/y for skin and extremities.

Derived limit 20 mSv/y for Hp(10) is also established.

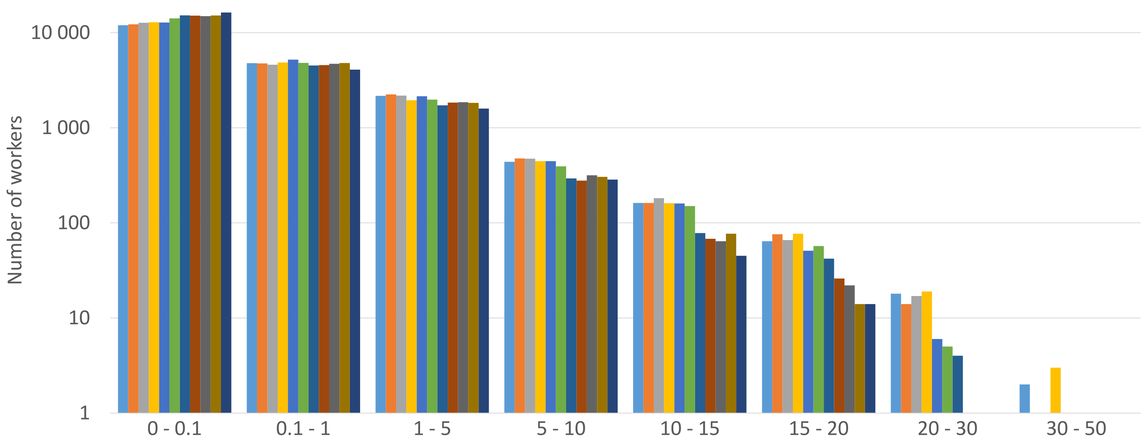
Evaluation of personal doses for category A workers shall be done only by the dosimetric service authorized by SUJB. Currently we have 7 dosimetric services with valid authorization in the Czech Republic performing evaluation of external as well as internal exposure of radiation workers. Dosimetric services use as legal dosimeters following types - film dosimeters, TLD, OSL, neutron dosimeters and also electronic personal dosimeters (mainly in NPPs).

Category B workers are workers with estimated doses lower than 6mSv/y however also for them shall be ensured a method for dose estimation – at least as an evidence that their categorization is correct.

Licensee shall described all aspects of personal doses evaluation and registration including reporting to SUJB for all radiation workers in Monitoring Program which structure is prescribed by legislation.

Results of personal monitoring of category A workers shall be reported to CRPO. This is prime responsibility of licensee but there is possibility that doses are reported directly by dosimetric services. Unique identification of worker is used and affiliation of worker to certain licensee and workplace is also registered. In the case of more employers for one worker, all of them must report required information and they shall co-operate to ensure control of total personal dose of worker from all employments.

Picture No. 1



Dose [mSv]	0 - 0.1	0.1 - 1	1 - 5	5 - 10	10 - 15	15 - 20	20 - 30	30 - 50
2010	11 962	4 786	2 165	439	162	64	18	2
2011	12 224	4 754	2 238	476	162	76	14	1
2012	12 712	4 606	2 177	473	182	66	17	1
2013	12 864	4 862	1 944	445	161	77	19	3
2014	12 771	5 197	2 145	446	160	51	6	0
2015	14 152	4 814	1 978	393	150	57	5	1
2016	15 177	4 512	1 720	293	78	42	4	0
2017	15 113	4 561	1 838	278	68	26	0	0
2018	14 934	4 700	1 857	316	64	22	0	1
2019	15 131	4 793	1 826	305	77	14	1	0
2020	16 286	4 080	1 590	285	45	14	0	0

NORM Workplaces

(prepared by Ivana Ženatá, SÚJB)

NORM workplaces and measurement results are registered in the specific Register of NORM workplaces operated by the SONS. A positive list included in legislation is based on the EU positive list as well as on the practical experience of SUJB. There are currently about 500 NORM workplaces registered. More than half of them are groundwater treatment plants equipped with technologies for removing iron, manganese, and uranium from water. The second most common are coal combustion workplaces, including boiler maintenance. Doses from external exposure to gamma radiation generally do not exceed 1 mSv/year at NORM workplaces. Radon exposure is more significant, values above 300 Bq/m3 occur at most groundwater treatment plants and spas. The highest effective doses are determined in underground mining activities (uranium mining is not included within NORM), which include exploration work underground, operation and maintenance of underground guided tours; here the doses from both exposure pathways (external gamma and radon) regularly exceed 6 mSv/year. Doses of flight crewmembers are also regularly assessed (calculated), the average annual effective dose for them was 0.57 mSv/year in 2020 (1.48 in 2019) (max. 2.95, in 2019 4.55 mSv/year), the annual collective dose decreased from a value of 3.18 Sv in 2019 to 0.79 Sv in 2020 – as a result of slowdown in air traffic in 2020 due to the Covid 19 pandemic.

Evaluation of Higher Personal Doses

The comprehensive system how to indicate as soon as possible higher personal doses or doses exceeding any specified limits is established.

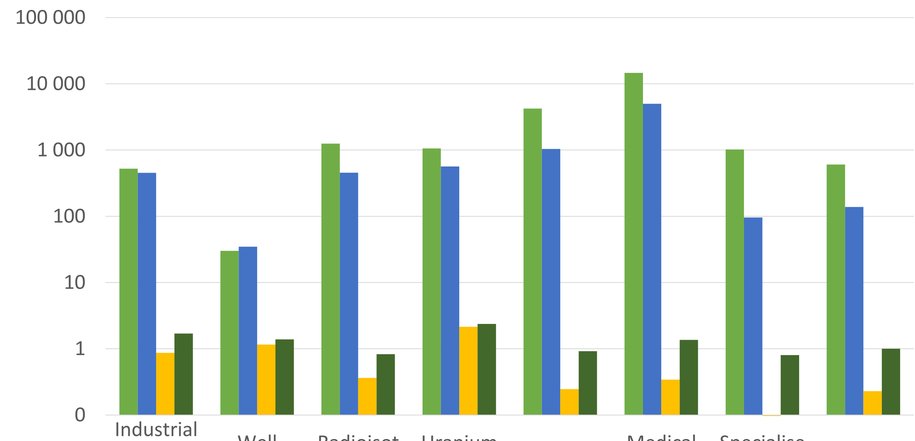
Several requirements are included in legislation. First – if there is any suspicion for higher exposure (for example because of incident or accident at the workplace occurred) – there is obligation of employer or operator immediately evaluate a personal dosimeter of workers involved. Second – there is an obligation for licensee to report any doses exceeding 10mSv immediately (despite if dose has been a result of evaluation in single period or has been reached as a sum of more periods). The same duty have also dosimetric services. Licensee has to report to regulatory body also results of evaluation of higher doses and main cause with description of measures accepted to avoid the same situation in the future.

Personal dose exceeding the limit is not an automatic reason for exclusion of certain workers from the activities with radiation sources. There is required that worker shall pass an extraordinary health check and it is up to responsible physician to decide if worker could continue working as radiation worker. This approach is specified in the legislation because in the past we have been facing a problem with very formal measure from the side of licensees when workers with doses exceeding any limits during the calendar year and despite how much were automatically excluded from the activities with radiation sources for the rest of the year – for some of them this could be a big problem – mainly highly specialized physicians such as neurosurgeons performing interventional procedures.

However it must be noted that there were only few cases in the past ten years when dose on the personal dosimeter of radiation worker exceeded dose limit and has been confirmed as really personal dose. Sometimes the evaluated dose is not personal because only dosimeter was exposed (from different reasons) or the most frequent case is that dose is evaluated above the shielding apron (in health care) and it is re-calculated. This is done for doses exceeding 10mSv above the apron. For workers wearing shielding apron and performing procedures under the control of radiation source, it is required to use two personal dosimeters one above and one under the apron – this helps better estimation of real personal dose when necessary.

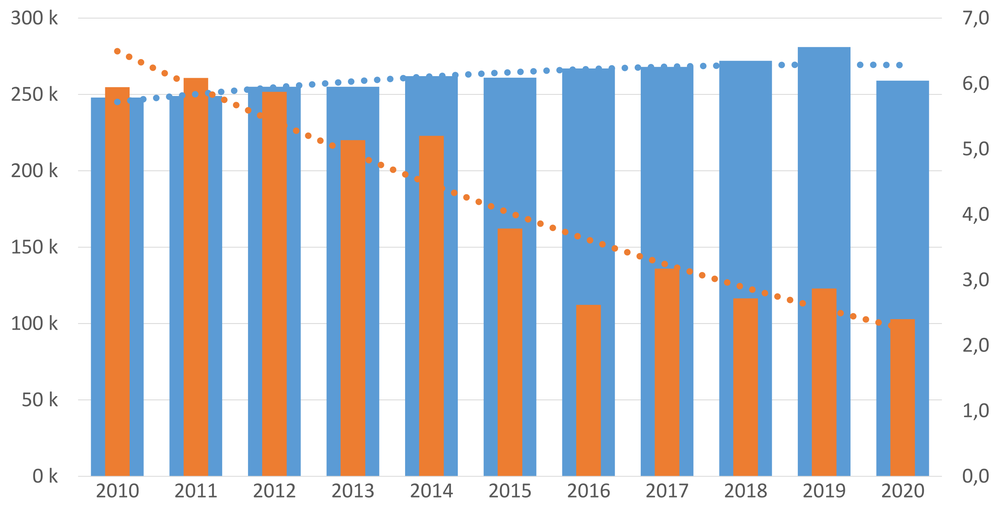
Industrial radiographers and Interventional radiologists are usually workers with the highest personal doses per year.

Picture No. 2



	Industrial radio-graphy	Well logging	Radioisotopes	Uranium industry	NPP	Medical uses	Specialised workers	Others
Number of workers	524	30	1 250	1 057	4 228	14 602	1 020	603
Collective doce [mSv]	453,29	34,78	453,74	565,00	1 040,03	4 990,09	95,80	138,05
Average effective dose [mSv]	0,87	1,16	0,36	2,15	0,25	0,34	0,09	0,23
Average effective dose > MDL [mSv]	1,70	1,38	0,83	2,37	0,92	1,36	0,80	1,00

Picture No. 3



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Count of Exams (thou.)	248	249	255	255	262	261	267	268	272	281	259
Avg Dose [mSv]	5,94	6,09	5,87	5,14	5,20	3,79	2,62	3,17	2,72	2,87	2,40

Data Evaluation, Results, Trends

Data registered in CRPO are primarily used by inspectors of SUJB during their routine controls at workplaces. CRPO also enable regulatory body to check compliance personal doses with limits or dose constraints, which are established by licensees.

Based on CRPO data we are able also to evaluate dose distributions for different professions, assess long-term trends and based on them determine priorities for regulation (see **Picture No. 1**)

Number of workers, collective dose and annual average dose for main professional groups in 2020 for all workers and for those with doses above MDL are presented in **Picture No. 2**.

There is visible that the most numerous are radiation workers in medicine creating also the biggest part of annual collective dose. It is also clear that most of them have doses lower than MDL (registered as zero) and only part of them (app. 25%) have measurable dose. Those workers are mostly interventional radiologists with annual average dose …mSv.

Picture No. 3 compares trends in number of interventional procedures performed during last ten years (https://www.sujb.cz/fileadmin/sujb/docs/radiacni-ochrana/lekarske_ozareni/Bulletinlo2021.pdf) and trends in personal doses of personnel performing these procedures. It could be positively evaluated that despite of slightly increasing numbers of procedures (except of 2020 "covid" year) doses of personnel are app. on the same level.

The year 2020 is strongly influenced by pandemic situation caused by covid 19 – for interventional radiologists the structure of procedures changed (there were patients with complications related to the covid -19 disease and needed interventions) and the numbers and collective doses slightly increased. We assumed that although the numbers of procedures decreased, they were more complicated – this assumption will be analyzed further on in the future.