EVALUATION OF OCCUPATIONAL EXPOSURES IN THE CZECH REPUBLIC

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ABSTRACT - The recent situation in the Czech Republic (CZ) concerning the evaluation and recording of occupational radiation exposures is described. The individual monitoring is based on the interpretation of the personal dosemeters responses and the evaluation of the other special dosimetric methods (measurement of excreta, whole body counting, etc.). The evaluation of occupational radiation exposures is carried out by five approved dosimetric services, which control about 20,000 workers. Record keeping of overexposures is based on two systems, which principles are explained. Based on long time analysis of occupational radiation exposures in CZ it can be present that the average values and trends of individual and collective effective dose equivalents are comparable with those in developed countries. The distributions of the radiation exposures for the important occupational groups of workers are presented.

INTRODUCTION

The individual monitoring of workers with sources of ionizing radiation (SIR) in CZ is based on measurement, evaluation and registration of occupational radiation exposures (ORE) using personal dosimeters or the other special methods (measurements of organ doses, of excreta, the whole body counting, etc.). The licensee's duty, covered by law in CZ[1], is to secure the control, monitoring and recording of ORE of its workers.

Recent legislation in CZ, in accordance with political and economical changes in the country, is going through an extensive reconstruction. A proposal of the Law on Peaceful Use of Nuclear Energy and Ionizing Radiation (new "Atomic Act") [2] has been already elaborated (it is assumed to come into force during 1996). The Atomic Act and related regulations are based on ICRP Report 60 [3] and New International Basic Safety Standards [4], i.e. licensees will be responsible not only to designate controlled areas where specific protective measures are required for:

* control of ORE and prevention of the spread of contamination during normal working conditions,
* prevention and limitation of the extent of potential exposures,

but shall maintain exposure records for each worker for whom an assessment of ORE is required. Simultaneously, licensees will be responsible for the communication with the Central Registry of Occupational Exposures (CROE). CROE is created [5] by the State Office for Nuclear Safety (SONS) for the registration and evaluation of ORE on the national level.

The evaluation of ORE is carried out by five approved dosimetric services in CZ - National Personal Dosimetric Service, two Dosimetric Services of NPP at Dukovany and Temelin, Dosimetric Service of Uranium Industry and Dosimetric Service of Nuclear Research Institute in REZ. Recently these services control about 20,000 workers (Table 1).

METHODOLOGY

The film dosemeter is a basic type of dosimeter for the evaluation of ORE from external irradiation. All services proceed from filtration analysis for the estimation of dosimetric quantities. A qualitative estimate of contamination of worker and of individual (surface and penetrating) dose equivalents (with recording level 0.2 mSv for one month period of control)

are made by the evaluation of dosemeter. The estimated value of individual penetrating dose equivalent H_p is considered to be an acceptable (usually overestimating) estimate of the effective dose equivalent from external irradiation. Further dosimetric investigations (from H_p > 1.25 mSv) are carried out, considering the presumed geometry of irradiation , if an overexposure is suspected.

Since 1976 personal neutron dosemeters (based on plastic track detectors Malyar with the couple of fission foils, enriched uranium and natural thorium [6]) are used (recording level H_p > 1.25 mSv for month as well as for year control periods is used at the selected workplaces (about 600 workers) with significant neutron sources (industrial radiographers, well-loggers, etc.).

Some workplaces, especially NPP's, are equipped with additional, operational dosimeters (mostly TLD, now different types of electronic detectors) for evaluation of ORE in the course of special tasks, somewhere finger TLD are used.

As far as the internal contamination is concerned, the licensees are responsible for securing of monitoring of workers or workplaces and recording of the results. When individual monitoring is inappropriate, inadequate or not feasible, ORE are assessed on the base of the monitoring of the workplaces, information about given location and duration of exposure. CROE registers ORE from internal contamination exceeding the recording level (0.1 of annual limit of intake).

The evaluation of annual ORE and their recording in dependence on different factors (occupational group, working time, sex, age, etc.) are introduced into practice of dosimetric services a fter a revision of their methodology of ORE evaluation (implementation of the new ICRP and ICRU recommendation) during 1990-91 years.

OVEREXPOSURES RECORDING

Record keeping of overexposures is based on two systems:

- if there is suspicion on overexposure at a workplace, licensee is obligated to estimate of the severity of given event; an investigation shall be conducted with the aim to identify the circumstances and assess and record the relevant doses and their distribution in the body. In the case that the annual limit of the effective dose equivalent $H_{E,L}$ (for internal contamination - 1/10 of ALI), the event must be reported to CROE. For serious incident (with possible medical consequences) National Radiation Protection Institute in Prague is involved in evaluation of incident consequences;
- the second system is based on co-operation of CROE with dosimetric services; these services report directly to CROE immediately after the evaluation of dosimeters for given control period any excess of the $H_{E,L}$ (or determined investigation levels). Identified events are then investigated by inspectors of SONS directly at the workplace where the event occurred.

183 persons were involved in 65 minor accidents and in indicated events detected in CZ (and former CSSR) during the 1954 - 1994 years. 102 of them were exposed by external and 81 by internal radiation. Only 15 from these events have led into health consequences (dermatitis with skin defects, cataracts). In some events surgical interventions - amputation of fingers, removal of a local deposit were used. In the period 1975-94 years 107 dosemeter readings were reported by the second system as exceeding the value 50 mSv ($H_{E,L}$). Following reinvestigation it appeared that in most cases the primary evaluation was falsely positive; it was concluded that only in 45 of indicated findings, the values of $H_{E,L}$ were exceeded.

DISTRIBUTIONS OF ORE, CONCLUSIONS

The long term evaluation of ORE in CZ covering period 1975-1990 has undertaken in 1993 year [6]. Several basic characteristics are illustrated in Table 1.

Based on mentioned analysis and recent results of ORE evaluation, we can present that:

- the average values and trends of individual effective dose equivalent (H_E) are comparable with those in developed countries (only 20-30 % of values ORE were higher than 0.2 mSv, the recording level),
- the significant part of the annual collective dose equivalent (S) arises form operations in the nuclear industry, when values of H_E from radon, its daughters and from ore dust constituted about (60-80)% of its total value in the uranium industry (UI);
- average individual values of H_E in NPP Dukovany are lower or comparable with those in the other NPP s PWR - type. In period 1985-94 (operational time of NPP Dukovany) the H_E values have been registered in the interval (0.55 - 0.82) mSv.

Table 1: The numbers, sex and age distributions of monitored workers in the Czech Republic.

NUMBER OF WORKERS (THS)	YEAR				
	1 975	1 980	1 985	1 990	1 993
NPP				1.5	2.6
URANIUM INDUSTRY	11.2	10.3	10.3	7.9	3.3
INDUSTRY	3.5	5.4	6.8	7.8	5.7
MEDICINE	3.7	5.6	7.1	8.2	11.1

	AGE DISTRIBUTION [YEAR]					
	< 25	25 - 30	30 - 40	40 - 50	50 - 60	> 60
NUMBER OF WORKERS (N) [THS] [1)]	1.3	1.6	4,4	5.7	2.8	0.9
COLL. EFF. DOSE EQUIVALENT (S)[1)][Sv]	0.5	1	3.2	4.4	2.3	0.5
S/N[1)] [mSv]	0.4	0.6	0.7	0.8	0.8	0.6

	DOSE EQUIVALENT DISTRIBUTION H_E [mSv]						
	< 0.2	0.2-1.0	1.0-2.0	2.0-10	10-20	20-40	> 40
NUMBER OF WORKERS N(THS)[1)]	9,66	3,93	1,61	1,37	0,09	0,02	0,01

GROUP	SEX DISTRIBUTION [RATIO M/W]
INDUSTRY	5,13
MEDICINE	0,54
RESEARCH	1,17

[1)]Data from National Dosimetric Service,Ltd.

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