

CHECKING THE DOSAGES RECEIVED BY WORKERS EXPOSED TO IONIZING RADIATION

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Presented are possibilities of evaluating the effectiveness of protection, based on the data compiled by an Institute which does filmdosimetric checking up of workers exposed to the ionizing radiation. Also presented are the findings of exposure checkups of over 2,000 workers in the Socialist Republic of Croatia, from 1962 to 1967.

In order to make the work with ionizing radiation equally safe for the worker as in the majority of other occupations, we must through safety measures assure that an operator be not exposed to ionizing radiation levels above those specified in the recommendation of the International Commission for Radiological Protection (ICRP) (1), and also accepted by our legislative regulations (2).

All safety measures are to be observed to this end. The measurement proper of the received dosages can be a direct proof of satisfactory protective measures, and that a worker has received a smaller dosage than the specified maximum (MPD). In this country, as nearly anywhere else, received dosages are measured by filmdosimeters (3). Good and bad facets of the method, and its limits of error, are described in numerous papers, and opinions differ in that respect. Opinions notwithstanding, today there is no other method of checking the dosages received by workers which would for its acceptability satisfy the three basic prerequisites (4):

- The dosage should be recorded in a manner which is admissible as a legal document.
- The dosage readout precision should be high enough that, allowing for the specified error, it can give the information whether the dosage received by a worker is higher or lower than the prescribed standard.
- The cost of checking up the dosages must not be significant as compared with the cost of operations with ionizing radiation.

There are primarily legal reasons, followed by technical and economical ones, that the organization of data distribution, processing and keeping is entrusted to a single authorized institution performing for the benefit of all other institutions which use sources of ionizing radiation, within a certain area.

The data about the dosages received by workers, compiled in such institutions make it possible to arrive, after their processing, at conclusions which can be used in labor legislation, and in measures for technical and medical protection. Intention is to present here such possibilities on the territory of the Socialist Republic of Croatia, derived from the data processed in this institute (Institute for Medical Research of the Yugoslav Academy of Sciences and Arts) which checks up about 2,000 workers for their exposure to ionizing radiation (5). All those workers carry film dosimeter badges, distributed, processed and filed by the Institute. The badges are changed twelve times yearly after each 4 or 5-week period of usage. The film dosimeter badges are worn, as a rule, upon the chest, over possible shield aprons. The films are read under a modified *Dresel* method (6) after being developed by standard procedures. The information about the received dosages is processed only for those workers who have at least four recorded dosages yearly for the entire duration of checkups, and are therefore considered as chronically exposed.

We emphasize here that this pertains exclusively to workers who operate enclosed sources and X-ray machines. In the case of workers handling open sources, because of a chance of internal contamination, there may exist a significant part of the received dosage which will not be recorded by a film dosimeter. The dosages read in this manner under accepted standards, are considered as radiation dosages received by the whole body (7, 1).

Exposure data are given in Tables 1-3.

The information in Table 1 present a general picture of worker exposure to ionizing radiation. The median dosage per person, together with the information about the number of overstepped MPDs make it possible to evaluate the existing safety measures, either prescribed by law or introduced on the job. Also, related to the results in column 4, this information can serve as guidelines in the case of possible legislative regulation changes concerning the working with the ionizing radiation. Dosages higher than the MPD and confirmed after a job has been checked up, are indicative for determining those jobs where the radiation hazards are above the norm, and additional safety measures are necessary (such as the pocket dosimeter, improved protection though more expensive, et sim.). The number of dosages recorded as higher than the MDP and after a job investigation being ascertained as the

results of crude neglect, of international or accidental irradiation of the film, or any other irradiation not caused on the job, can serve as a yardstick of discipline in the safety measure application.

Supplementing the data in Table 1, are data in Table 2 about dosages received by some numerically stronger categories of workers on identical jobs.

Table 3 shows the data about cumulative dosages received by workers. These can be used for health protection of workers. In 10–15 years, when there will be a larger number of workers which will have received a cumulative dosage of 30 R or more, the comparison of these results with the findings of medical checkups will be of significant value.

From results presented in Tables 1–3 it can be concluded that:

- Protection of labor from ionizing radiation is satisfactory.
- Legislative regulations should not be made stricter, but on the contrary, if there are indications that the utilization of ionizing radiation might be rendered easier, some regulations could be softened.
- The number of overstepped MPD dosages through neglect etc., are an indication that the regulations should more precisely define the procedures in such cases.
- Dosages received by workers are not such yet as to make us expect adverse consequences of the effects of ionizing radiation received by workers.

Records of dosages received, which are kept on file to have a source of information about the level of the exposure of individuals, can be useful for the evaluation of certain elements of protection.

Table 1
General picture of worker exposure to ionizing radiation

Year	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10 % MPD	Number of dosages exceeding MPD values	
				Total recorded	Checked up and rejected
1962	297	357	24	1	1
1963	580	216	73	4	3
1964	803	300	132	5	3
1965	1019	343	146	6	4
1966	1161	229	123	8	4
1967	1266	206	102	6	6

Table 2.
Data about dosages received by some numerically stronger categories of workers on identical jobs (1962-1967)
1962.

Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10%/o MPD
Industrial defectoscopy	16	368	1
Physicians radiologists	27	116	4
Physicians phthysiologists	77	179	6
General practitioners	9	485	3
Roentgen technicians	65	487	14
All staff engaged in Ra-226 therapy	31	590	21

1963.

Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10%/o MPD
Industrial defectoscopy	23	640	5
Physicians radiologists	39	185	1
Physicians phthysiologists	182	106	9
General practitioners	14	152	1
Roentgen technicians	132	243	17
All staff engaged in Ra-226 therapy	24	297	22

Table 2
(continued I.)

1964.		1965.	
Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10 ⁰ / ₀ MPD
Industrial defectoscopy	27	863	18
Physicians radiologists	50	357	10
Physicians phthysiologists	221	162	10
General practitioners	23	87	1
Roentgen technicians	158	337	28
All staff engaged in Ra-226 therapy	33	644	33
1965.			
Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10 ⁰ / ₀ MPD
Industrial defectoscopy	44	796	2
Physicians radiologists	65	460	18
Physicians phthysiologists	299	142	8
General practitioners	34	68	1
Roentgen technicians	193	358	29
All staff engaged in Ra-226 therapy	85	1005	42

Table 2
(continued II.)

1966.		1967.	
Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10%/o MPD
Industrial defectoscopy	22	553	20
Physicians radiologists	78	315	9
Physicians phthysiologists	347	94	8
General practitioners	41	46	0
Roentgen technicians	209	212	24
All staff engaged in Ra-226 therapy	107	943	48
Occupations	Number of workers	Median dosage per worker in mR/year	Number of workers who received dosages higher than 10%/o MPD
Industrial defectoscopy	42	335	21
Physicians radiologists	70	181	3
Physicians phthysiologists	379	70	3
General practitioners	46	54	1
Roentgen technicians	204	230	15
All staff engaged in Ra-226 therapy	128	557	44

Table 3.
Data about cumulative dosages received by workers

Dosage in R	1-5	5-10	10-15	15-20	20-25	25-30
Number of workers	303	59	7	2	1	1

References

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