Ionizing radiation: what does it mean for workers' health?

The European Union's ionizing radiation watchdogs linked together in the Esorex network[1] estimate that in 2000, a million workers were being monitored for exposure to ionizing radiation. Thirty-five percent were receiving measurable doses. They work in various sectors of activity, mainly the medical and veterinary sector, but also the nuclear industry and general industry where sources of ionizing radiation are used. In EU countries with a reliance on nuclear-generated electricity[2], workers may be employed by nuclear power plant or nuclear fuel cycle facility operators, or so-called "outside" workers working for firms that provide services to nuclear power plants, especially during unit outages. Significantly, these workers may also come from countries that have no nuclear industry.

Community-level standards of protection against ionizing radiation were brought in under the Euratom Treaty to cover all exposed workers, because repeated exposure to doses of ionizing radiation can cause cancers and leukaemias. Directive 96/29, which consolidates several previous directives, sets the standards of protection for the general public and workers. Directive 90/641, which relates only to the "operational protection of outside workers", enjoins Member States to ensure that this category of workers receive the same protection as that provided to the permanent workers employed by operators. The basic standards lay down a set of provisions to ensure that "all exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account".

Dose limitation values are set for the general public and workers. For the latter, the dose is set at 100 mSv (see box) over five years[3]. The requirement for pregnant women is that the conditions to which they are subject in the context of their employment must be such that the equivalent dose received by the child to be born does not exceed 1mSv between the time the pregnancy is notified and childbirth. The allowed dose for the general public is 1 mSv a year.

The Euratom Treaty (article 31), which is incorporated in the Treaty on Union, places specific consultation requirements on the European Commission. So, when putting forward proposals on health and safety matters, the treaty requires the Commission to consult only the European Economic and Social Committee and a group of experts appointed by the Member States. Regrettably, the Commission's proposal to give the Luxembourg Advisory Committee responsibilities in radiation protection was not adopted by Council[4]. As things stand, therefore, there is no obligation at Community level to consult the trade unions on either proposals or the implementation of Community basic standards.

The International Agency for Research on Cancer's (IARC) recently published study on a population of more than 400 000 nuclear power industry workers in 15 countries[5] followed-up over an average period of 12.7 years is important in this connection. This retrospective cohort study set out to estimate the risk of cancer mortality, including leukaemia, from exposure to low levels of high energy photon radiation (gamma rays). Real time measurements of individual doses of radiation from external sources were available for all the workers. The study was limited to workers who were wearing personal

Current measuring units for ionizing radiation

Bq: In order to measure the quantity of radioactivity, the unit becquerel (Bq) has been defined in the international system of units. One becquerel is the number of radionuclides per second on search of more stability. The Becquerel replaces a former unit, the curie (Ci), which was the amount of radioactivity of 1 gram of Radium. 1 curie = 3.7 x 10^{10} Bq.

Gy: The Gray (Gy is the unit of absorbed dose, indicating the quantity of energy absorbed per unit mass of material such as tissue. 1 Gy = 1 joule of radiation energy absorbed per kilogram of tissue. 1 mGy = 1/1000. A whole-body dose of more than 4.5 Gy to a group of people would be fatal for 50% of them if not treated adequatlely.

Sv: The radiation effect varies according to the type of radiation (alpha, Beta, X or gamma rays) and with the different radiosensitivity of each organ. The Sievert is the unit of equivalent dose where the absorbed dose (gray) is multiplied by correcting factors accounting for those differences. This indicates the risk of ionising radiation exposure to an organ or tissue and can be summed for the whole body as an indicator of health effect. It is then called the effective dose.

The millisievert (mSv) is commonly used to measure the effective dose at the work place and in diagnostic medical procedures (e.g. X-rays, nuclear medicine).

[1] See: www.esorex.cz.
[2] Finland, Sweden, Lithuania, Germany, Belgium, Netherlands, Great Britain, Spain, France, Czech Republic, Slovakia, Slovenia, Hungary.
[3] The directive permits Member States to set a maximum annual dose, an option seemingly taken up by the old Member States.
[4] Council Decision of 22 July 2003.
[5] Analysing exposure data from workers wearing dosimeters in Australia, Belgium, Canada, South Korea, Spain, the United States, Finland, France, Hungary, Japan, Lithuania, the United Kingdom, Slovakia, Sweden and Switzerland.

dosimeters and had worked for at least a year in a nuclear power plant, research, nuclear waste treatment, or nuclear fuel, isotope or weapons production facility. The situation of workers covered by the Outside Workers Directive was therefore not considered in the IARC study. Who these workers are, what dose they receive, and whether they benefit from the same protection as workers employed by nuclear power plant operators are all unanswered questions (see article, p. 26).

We asked the Belgian partners in the study to present their results and the surrounding debate to us, with special emphasis on aspects related to the protection of workers, pregnant woman, and unborn children.

Carrying out an epidemiological study on this scale, covering a huge number of workers, shows the importance of collecting data on long-term individual exposures. As the authors of the following article emphasize, the study findings raise urgent questions about estimating the scale of exposure levels and the effects of combined exposure to multiple carcinogens.

We believe these findings are essential to inform the forthcoming European debate around the adoption of exposure limits for carcinogens[6]. Making sure that employers fulfill their safety obligation, which is that "the level of exposure is reduced to as low a level as is technically possible", is the second strand of that debate. In pointing out the limitations of its study coverage, the IARC also raises the issue of the practical implementation of the Carcinogens Directive for all exposed workers, regardless of their employer or type of employment contract. ■

Marc Sapir, Director of the Health and Safety Department, ETUI-REHS, msapir@etui-rehs.org

6 See directive 2004/37/EC.