Journal of Radiological Protection

Official journal of the Society for Radiological Protection

NEWS AND INFORMATION

ARCH—Agenda for Research on Chernobyl Health New ICNIRP exposure guidelines Scale of UK exposure to x-rays revealed

To cite this article: 2011 *J. Radiol. Prot.* **31** 151

J. Radiol. Prot. **31** (2011) 151–154 doi:10.1088/0952-4746/31/1/M03

News and information

ARCH—Agenda for Research on Chernobyl Health

26 April 2011 is the 25th anniversary of the Chernobyl accident, which led to the exposure of many millions of the general population to radiation from fallout, and exposure of over half a million liquidators (clean-up workers) to a variable mixture of external and internal radiation. The accident took place in the Ukraine; the radionuclides released from the damaged reactor contaminated vast territories in the neighbouring countries and fallout affected virtually the whole of Europe. Studies to date have mainly concentrated on the thyroid after the very early observations of a dramatic increase in thyroid carcinoma incidence in children. These studies have clarified our understanding of radiation induced thyroid carcinogenesis, but the emphasis on thyroid consequences has taken attention away from the need for internationally supported comprehensive studies of other possible health effects. These should have been undertaken as soon as the magnitude of the exposure was recognised: Chernobyl is comparable only to atomic bomb exposure in its importance to understanding the effects of radiation on human health.

With the support of the European Commission, an international group of experts and advisors[1] has carried out the project 'ARCH: Agenda for Research on Chernobyl Health'. ARCH has reviewed the current knowledge about the health consequences of radiation exposure from the accident and provided advice on the studies that need to be carried out in the future. ARCH's proposal for a strategic research agenda (http://arch.iarc.fr/documents/ARCH_SRA.pdf), outlining a long-term plan for research into the health consequences of radiation from the Chernobyl accident has recently been submitted to the European Commission.

The ARCH report concludes that there are many reasons why even now, 25 years after the accident, it is important that a long-term coordinated research programme on the health effects of the Chernobyl accident be supported. Health effects from the accident continue and future effects are uncertain; past knowledge of radiation effects is largely based on atomic bomb studies, but Chernobyl involved a different type and pattern of exposure; assumptions on the risk of low dose exposure have been challenged by recent advances in radiobiology; estimates of deaths due to the Chernobyl accident vary widely.

[1] ARCH experts and advisors: Keith Baverstock, Finland; Dmitryi Bazyka, Ukraine; Andre Bouville, USA; David Brenner, USA; Elisabeth Cardis, Spain; Zhanat Carr, WHO, Switzerland; Vadim Chumak, Ukraine; Malcolm Crick, UNSCEAR, Austria; June Crown, UK; Scott Davis, USA; Yuri Demidchik, Belarus; Vladimir Drozdovitch, Belarus, (currently USA); Yuri Dubrova, UK; Ian Fairlie, UK; Bernd Grosche, Germany; Maureen Hatch, USA; Viktor Ivanov, Russian Federation; Ausrele Kesminiene, IARC/WHO, France; Christoph Reiners, Germany; Sisko Salomaa, Finland; Margot Tirmarche, France; Klaus Trott, UK; Richard Wakeford, UK; Dillwyn Williams, UK; Shunichi Yamashita, Japan.

Items for inclusion in this section are welcomed and should be sent to the Deputy Editor, Jim Gray, at the address given at the front of this issue.

The ARCH group of experts and advisors therefore recommended international support for the long-term funding of a Chernobyl Health Effects Research Foundation (CHERF), for reasons similar to those that led to the creation of the Radiation Effects Research Foundation (RERF) some years after the atomic bomb exposures in Japan. The proposal is not to create a centre with dedicated research staff similar to the RERF, but to set up a mechanism to coordinate and fund studies that will enable assessment of the overall long-term health effects of this disaster. A key to the success of the ARCH recommendations is the creation, maintenance and follow-up of life-span cohorts. These include already existing cohorts exposed to fallout as children in Belarus and Ukraine with detailed thyroid dose measurements as well as cohorts of liquidators. CHERF could be a virtual institute consisting of a management board with representatives of the funding organisation(s) and the countries most involved, both inside and outside the EU, and a scientific advisory board which would help determine priorities for funding and advise the management board on projects that should be supported. Particular attention should be paid to long-term maintenance of the life-span cohorts needed to support a range of studies.

As well as suggesting the creation of a Chernobyl Health Effects Research Foundation, the ARCH group has highlighted the importance and prioritised a series of individual studies covering the main health consequences. These include, as a high priority, monitoring of cancer rates to determine whether there has been or will be measurable increases of various types of malignancy. Taking into account that the latency period to develop radiation-induced tumours is potentially long, and that radiation related risk of solid cancers appears to remain elevated for decades, it is important to ensure long-term monitoring of cancer incidence trends among populations exposed to fall-out from the accident. Tumours where registry data suggests a possible radiation related increase will then require specific well-designed analytical studies. The ongoing thyroid cancer problem requires continued study to determine, amongst other endpoints, the extent to which the risk to those exposed in infancy will continue into the future, the risk to adults at exposure, and the continuing change in the molecular findings. The reported rise in breast cancer clearly needs confirmation, and it too will need long-term epidemiological and molecular study. Radiation related increases in non-cancer diseases after atomic bomb exposure were in general not observed until many decades later, and reports of increased risks after Chernobyl require long-term study. The finding of inherited molecular-genetic alterations in the unexposed children of exposed fathers has major implications; do the findings continue into subsequent generations, and do they have implications for health effects, or are they scientifically interesting but of no real clinical importance? It is clearly important that these questions are answered.

Long-term studies after Chernobyl of already existing groups with known radiation doses, both those exposed to fallout as children and those exposed as young adults to both external radiation and to fallout, would provide invaluable information on the lifetime risks of both external and internal exposures. Comprehensive studies of the Chernobyl accident are of great importance to the study of long-term low-dose rate effects, for the improvement of the bases for radiation protection, and importantly, to adequately inform the exposed population by providing properly researched studies that give reliable rather than speculative estimates of the consequences. This is particularly important at a time when it seems likely that there will be an expansion in nuclear power.

Unless careful, coordinated studies of those exposed to the Chernobyl accident are set up, together with a mechanism to ensure long-term funding, the long-term consequences of a nuclear accident involving the exposure of many millions of people to radiation will not be properly studied, speculation will flourish, and knowledge essential to assessing the risks of radiation exposure will be lost.

Acknowledgements
The ARCH project was supported by the European Union under FP7 Euratom contract FP7-212737.

Dillwyn Williams, Ausrele Kesminiene, Elisabeth Cardis and Keith Baverstock (members of the ARCH core group)

New ICNIRP exposure guidelines

ICNIRP, the International Commission on Non-Ionizing Radiation Protection, have published new exposure guidelines for electric and magnetic fields (EMFs) in the frequency range 1 Hz–100 kHz, thus including the 50 or 60 Hz frequencies produced by electric power systems. These replace the low-frequency part of the previous ICNIRP guidelines, which were published in 1998 and cover the range 0–300 GHz. Those 1998 guidelines are the origin of the exposure limits currently in place in the UK. The mechanism for this is that for public exposure, the 1998 ICNIRP exposure guidelines were incorporated into a 1999 EU recommendation, which was adopted in the UK by the government in 2004 and reaffirmed in 2009. For occupational exposure, the Health and Safety Executive have used ICNIRP as a guide to whether employers have complied with general health and safety duties.

The new guidelines are not intended to represent any fundamental change. They are still based on avoiding established, acute effects (primarily induced currents in the body causing interference with nerves), and they still say that for possible chronic effects (e.g. childhood leukaemia), the evidence is not strong enough to warrant setting exposure limits.

There are several detailed changes. They now use induced electric field rather than induced current density as the basic restriction; they consider peripheral as well as central nervous stimulation; they use numerical dosimetry (rather than the previous simple analytical models of the body as an ellipsoid) to derive the external fields that correspond to the induced quantities; and they are (slightly) more explicit about safety factors. The consequence is that, even though the overall intent has not changed, most of the actual numbers have.

At power frequencies, for magnetic fields, the ‘reference levels’—the quantity expressed in terms of the external field—have doubled (to 200 μT for public and 1 mT for occupational exposure). For electric fields, the reference levels are unchanged (5 kV m^{-1} and 10 kV m^{-1}). The actual limit, the *in-situ* induced field, is called the ‘basic restriction’; the reference levels include a further margin. To derive the external field actually corresponding to the basic restriction, several assumptions have to be made, about tissue conductivities, relevant part of the body, and which version of the dosimetry to use (and there is uncertainty about whether the dosimetry actually exists to model satisfactorily the peripheral nervous system effects that ICNIRP has introduced). Making similar assumptions to those used for the 1998 version suggests that the actual impact of these new guidelines may not be greatly different, consistent with the intent that these guidelines are not a major new departure. But alternative assumptions could see the effective limits change by a few tens of percent. Such sensitivity to the assumptions reflects fairly the uncertainties in the underlying science. But in a situation where, in most countries with high-voltage transmission systems, exposures to the public can already push up against the limits, even relatively small changes to the limits like these could have big practical consequences.

The previous 1998 ICNIRP guidelines have been influential, at least in those countries that have adopted any form of EMF controls at all. It is hard to predict whether, or how quickly, countries will now switch to the new guidelines. For occupational exposure, national practice in EU member states will eventually be dictated by a European Directive. That directive was already being revised and is now taking some account of the new ICNIRP guidelines. For public exposure, in the UK at least, existing government policy—based on the previous 1998 ICNIRP guidelines—continues in force until government change it; the new ICNIRP guidelines do not automatically take effect, although this may be the public expectation. Likewise, the 1999 EU recommendation will need to go through a formal revision process if it is to incorporate the new guidelines.

The guidelines were published in *Health Physics* and are available from www.icnirp.de.

John Swanson

Scale of UK exposure to x-rays revealed

Greater use of x-rays over the last 10 years, including a 140 per cent increase in CT examinations, has raised the annual radiation dose the UK public receives, HPA research has found.

Radiation scientists at the agency have estimated that about 46 million medical and dental x-ray examinations were carried out across the UK in 2008, an increase of 10 per cent since 1997. About two-thirds, 67 per cent, of the procedures were carried out in NHS hospitals while 26 per cent were performed by dentists.

The new HPA study reveals that the average annual radiation dose to each member of the public from all diagnostic x-rays has increased from 0.33 millisieverts (mSv) in 1997, the last time a detailed frequency survey was completed, to 0.4 mSv. Most of the increase is due to the growth in the number of higher dose CT examinations. Medical x-rays remain the largest single artificial source of radiation exposure for the UK population. The average radiation dose from all sources of ionising radiation remains about 2.7 mSv per person year and medical x-rays contribute 15 per cent of this total.

The survey also reveals that;

- CT scanning now accounts for around 68 per cent of the dose to the UK public from all x-ray procedures. About 1.4 million CT scans were performed in 1997 and 3.4 million in 2008—a rise of 140 per cent. Around 20 000 of these CT scans were performed on asymptomatic individuals as part of self-initiated health assessment.
- The NHS breast screening programme accounted for 2.03 million x-ray examinations in 2008, an increase of 45 per cent since 1997 when 1.4 million examinations were carried out. This increase is due to the widening of the age range for screening to cover women aged 50–70, instead of those aged 50–64.
- Dentists in the NHS and private practice carried out about 12 million diagnostic x-ray examinations in 2008, although their contribution to the UK radiation dose remains negligible since they are low dose procedures.
- About 1.2 million x-ray examinations were taken in independent hospitals in 2008, a rise of 40 per cent since 1997.

The Health Protection Agency