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General Summaries

Summaries of articles in this issue

REVIEW

Childhood leukaemia risks: from unexplained findings near nuclear installations to recommendations for future research

D Laurier, B Grosche, A Auvinen, J Clavel, C Cobaleda, A Dehos, S Hornhardt, S Jacob, P Kaatsch, O Kost, C Kuehni, T Lightfoot, B Spycher, A Van Nieuwenhuysse, R Wakeford and G Ziegelberger (R53–R68)

Recent findings on childhood leukaemia incidence near nuclear installations have raised questions which cannot be answered by current knowledge. This review summarises the conclusions of an international multidisciplinary workshop on this topic, considering both epidemiological and aetiological aspects. Regarding epidemiology, the creation of collaborative working groups was recommended, to verify consistency in methodologies and allow combination of data for future analyses. Regarding aetiology, the interest of epigenetic approaches was underlined, as well as the need for multidisciplinary collaboration, especially regarding potential predisposition markers and the infectious hypothesis. This should be paralleled by suitable animal studies.

PAPERS

Comparison between *in situ* and *ex situ* gamma measurements on land areas within a decommissioning nuclear site: a case study at Dounreay

Peter D Rostron, John A Heathcote and Michael H Ramsey (495–508)

Radioactively contaminated land can be characterised using *in situ* measurements of gamma-emitting radionuclides as well as by *ex situ* analyses of extracted soil samples. Both methods have logistical advantages and limitations and the results are also subject to different levels of measurement uncertainty. This study compares the results of both kinds of measurement on an area of land at a decommissioning nuclear site. The sources of uncertainty are found to differ between *in situ* and *ex situ* measurements. This knowledge of uncertainty allows best use to be made of the much cheaper *in situ* measurement technique.

Efficiency of radiation protection equipment in interventional radiology: a systematic Monte Carlo study of eye lens and whole body doses

C Koukorava, J Farah, L Struelens, I Clairand, L Donadille, F Vanhavere and P Dimitriou (509–528)

Monte Carlo calculations were used to investigate the efficiency of several eyewear models and ceiling-suspended shields in reducing eye and whole body doses during fluoroscopically guided interventional procedures. Rounded and well fitting lead glasses that leave the minimum possible gaps between the face and the eyewear were found to provide the optimal protection.

Moreover, ceiling-suspended screens are more efficient when positioned close to the patient's skin and to the x-ray field. Finally, eye and whole body doses are also significantly affected by the beam projection, the position and head orientation of the operator, as well as the distance between the image detector and the patient.

MaMP and FeMP: computational mesh phantoms applied for studying the variation of WBC efficiency using a NaI(Tl) detector

T C Ferreira Fonseca, R Bogaerts, A L Lebacqz, R M Ribeiro and F Vanhavere (529–543)

A whole body counter (WBC) is a facility to routinely assess the internal contamination of exposed workers. The calibration of the counting system is usually done by calculating the counting efficiency (CE) using anthropomorphic physical phantoms representing the human body. In this study, the CE calibration was calculated for a series of computational mesh phantoms called MaMP and FeMP, which span variation in height, weight and gender. The deviation on the CE due to the detector position related to the phantom was studied and the CE as functions of trunk volume, waist–hips ratio and waist–chest ratio for different mesh phantoms were established.

An investigation into the upward transport of uranium-series radionuclides in soils and uptake by plants

D Pérez-Sánchez and M C Thorne (545–573)

Upward transport of ^{238}U -series radionuclides through soil exhibited a wide variety of behaviour, even when the source was limited to being a constant flux of either ^{238}U or ^{226}Ra . Hydrological conditions control the rate of upward migration from depth, and seasonally changing flow directions closer to the soil surface can result in accumulation at specific depths irrespective of changes in sorption between the oxic and anoxic regions of the soil. However, such changes in sorption can also be significant in controlling the degree of accumulation that occurs. With a seasonally fluctuating water table, timing in relation to the period of plant growth was found to have a major impact on the degree of uptake by plant roots.

Remediation of TENORM residues: risk communication in practice

C König, C Drögemüller, B Riebe and C Walther (575–593)

Risk management of radioactive materials remains a challenging issue. This is also true for wastes containing technologically enhanced naturally occurring radioactive materials. The present work investigates the underlying reasons for communication problems between experts and affected members of the public. Exploring the case of a German remediation site with residual radioactive contamination in a residential area, the experts' as well as the residents' perspectives were studied by conducting qualitative interviews. The results indicate that coordination of different health and environment protection disciplines—in this case radiation protection relating to soil protection—is possible and urgently needed.

The cancer mortality and incidence experience of workers at British Nuclear Fuels plc, 1946–2005

Michael Gillies and Richard Haylock (595–623)

This study examined the cancer mortality and incidence risk associated with external radiation exposure in the BNFL cohort of nuclear workers. The BNFL workers show the expected 'healthy worker' effect and this analysis has provided evidence within the BNFL cohort of an increased cancer risk associated with occupational external radiation exposure. The cancer risk estimates for the cohort are consistent with values used by national and international bodies

in setting radiation protection standards with significant risks noted between all cancers, solid cancers, digestive cancers, leukaemia excluding chronic lymphatic leukaemia and cumulative external radiation exposure.

An assessment of the reliability of dose coefficients for intakes of radionuclides by members of the public

M Puncher (625–643)

This paper quantifies uncertainties resulting from internal exposures to a number of radionuclides considered significant because of their anthropogenic origin. Uncertainties in the mathematical models that predict the retention of radionuclides in the body are derived to calculate distributions of effective dose per unit intake following inhalation or ingestion by members of the UK public. The distributions are used to inform the derivation of uncertainty factors (UF) for the dose coefficients, which can be used to assess their reliability as protection quantities. The inferred UF values are typically around 2–3 for ingestion and 2–6 for inhalation for all age groups.

BABYSCAN: a whole body counter for small children in Fukushima

Ryugo S Hayano, Shunji Yamanaka, Frazier L Bronson, Babatunde Oginni and Isamu Muramatsu (645–653)

BABYSCAN, a whole body counter for small children with a detection limit for Cs-137 of better than 50 Bq/body, was developed, and the first unit has been installed at a hospital in Fukushima at the end of 2013, to help families with small children who are very much concerned about internal exposures. Even with this low detection limit, radiocaesium was not detected in any of the first 100 Fukushima children.

Effects of ambient temperature on the performance of CCD array spectroradiometers and practical implications for field measurements

Luke L A Price, Rebecca J Hooke and Marina Khazova (655–673)

The performance of miniature CCD array spectroradiometers, which are widely used for the assessment of personal and environmental exposures, may be affected by variations in ambient temperature. The dark signal, spectral sensitivity and wavelength position of six different array spectroradiometer models, produced by two different manufacturers, were assessed in ambient temperatures ranging from 5 °C to 40 °C. The results are presented with a discussion of the practical implications for field measurements when the instruments are used outside of a temperature controlled environment.

Comprehensive data on ionising radiation from Fukushima Daiichi nuclear power plant in the town of Miharu, Fukushima prefecture: The Misho Project

T Koike, Y Suzuki, S Genyu, I Kobayashi, H Komori, H Otsu, H Sakuma, K Sakuma, E M Sarausad, K Shimada, T Shinozuka, H Tamura, K Tsukada, M Ukai, T O Yamamoto and for The Misho Project (675–698)

A grass-roots movement by residents of Miharu in Fukushima prefecture, Japan for protecting themselves against radiation released by the nuclear accident in March 2011 is documented. A set of data was collected through this movement later organized as the Misho Project. Timing of an advisory by the Miharu local government for ingesting distributed iodine tablets on 15 March to people under 40 years of age is evaluated. Furthermore, an estimate of cumulative external exposure to the radiation including a contribution from short-lived ^{132}Te is given based on individual measurements of more than 1400 schoolchildren in the town.

NOTE

Fundamental study of a real-time occupational dosimetry system for interventional radiology staff*Yohei Inaba, Koichi Chida, Ryota Kobayashi, Yuji Kaga and Masayuki Zuguchi (N65–N71)*

Recently, the i2 system by RaySafe™ has been introduced to measure occupational exposure in real-time. In this study, we evaluated the fundamental performance aspects of the i2 system. The dose linearity of the i2 was excellent. The i2 exhibited slight dose-rate dependence at very high dose rates. Little angular dependence was observed for the i2 system. We also found that the personal dosimeter was highly sensitive at angles positioned behind it. However, this backscattered radiation is not a problem, in general, due to the placement of the i2 sensor on the lead apron. We conclude that the i2 system facilitates accurate real-time monitoring of occupational doses.

PRACTICAL MATTER

Design of patient rooms and automatic radioiodine-131 waste water management system for a thyroid cancer treatment ward: ‘Suandok model’*N Vilasdechanon, S Ua-apisitwong, K Chatnampet, M Ekmahachai and J Vilasdechanon (699–708)*

The ‘Suandok model’ is a design of radioiodine treatment ward and an automatic system of radioactive waste water management. The dose limit of 5 mSv yr^{-1} for radiation workers, 1 mSv yr^{-1} for the public, and the clearance level of radioactive waste water of 40 Bq L^{-1} are applied for local regulation in the hospital. Conformal practices under the radiation safety standard criteria have been continuously observed since the system was established in 2009. The practical points that lead to the success of radiation protection and safety management are the consciousness of radiation workers and the public’s understanding of radiation control. Therefore, with the regular inspections of efficiency and practices by the national regulator the ‘Suandok model’ was rewarded for a very good radiation practice in development of safe working conditions and environment in 2011 by the Organization of Atomic Energy for Peace (OAP), Thailand.