

1178

### THE DIFFERENCE IN EXTERNAL RADIATION EXPOSURE DEPENDING ON THE WORKING PROCESS AMONG RADIATION DECONTAMINATION WORKERS IN FUKUSHIMA

Takeyasu Kakamu\*, Tomoo Hidaka, Tomohiro Kumagai, Yusuke Masuishi, Shota Endo, Sei Sato, Tetsuhito Fukushima. *Department of Hygiene and Preventive Medicine, Fukushima Medical University, School of Medicine, Fukushima, Japan*

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**Introduction** Since the occurrence of the Fukushima Daiichi Nuclear Power Plant Accident, radiation decontamination work has been conducted in Fukushima. In this work, several different working processes are typically performed simultaneously in a single area. However, the difference in external radiation dose rates between processes is unknown. The aim of this study was to compare external radiation exposure of decontamination workers between processes.

**Methods** The subjects were 130 radiation decontamination workers who worked at the same site from April to December 2016. We obtained the external radiation dose rates from a radiation decontamination company, whose workers wear external radiation dose monitors at all times when working. The monitors are used to calculate the external radiation dose rates every month. We used the data from April to December 2016. We divided the workers into 5 groups according to their working processes; administration, removal, collection, and transportation of contaminated soil, and filling of uncontaminated soil. We compared the total radiation dose per month and total overall dose during the period between the groups.

**Result** The median (25–75 percentile) external radiation dose rate during the period was 0.82 (0.72–0.91) mSv. The process with the highest exposure was removal of contaminated surface soil, with a median of 0.96 (0.91–0.99) mSv. The exposure rates of administration and filling of uncontaminated soil were 0.64 (0.57–0.71) and 0.71 (0.65–0.77) respectively, which were lower than those in the other processes.

**Discussion** The cumulative radiation exposure rates in a single area differed according to working process. Although the differences in radiation exposure were relatively small, cumulative exposure may increase in the long term. This radiation decontamination work is globally unprecedented and the effect of low-dose radiation exposure is unknown. Continuous monitoring of low-dose radiation, as well as surveying its effects, are necessary.

1185

### MATERNAL CUMULATIVE EXPOSURE TO EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELDS AND PREGNANCY OUTCOMES IN THE ELFE COHORT

<sup>1</sup>L Migault\*, <sup>1</sup>C Piel, <sup>1,2</sup>C Carles, <sup>1</sup>F Delva, <sup>1</sup>A Lacourt, <sup>3</sup>E Cardis, <sup>4</sup>C Zaros, <sup>5</sup>R de Seze, <sup>1,2</sup>I Baldi, <sup>1</sup>G Bouvier. <sup>1</sup>University of Bordeaux, Inserm UMR 1219 EPICENE Team, Bordeaux Population Health Research Centre, Bordeaux, France; <sup>2</sup>Bordeaux University Hospital, Service de Médecine du Travail et pathologie professionnelle, Bordeaux, France; <sup>3</sup>ISGlobal, Centre for Research in Environmental Epidemiology, Universitat Pompeu Fabra Barcelona, Spain; <sup>4</sup>Joint research unit Elfe, Ined-Inserm-EFS, France; <sup>5</sup>TOXI PERITOX UMI-01 unit, INERIS, Verneuil en Halatte, UPJV, Amiens, France

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**Objectives** To study the relations between maternal cumulative exposure to extremely low frequency electromagnetic fields (ELF MF) and the risk of moderate prematurity and small for gestational age within the birth cohort Elfe.

**Methods** The Elfe study included 18,329 infants born at 33 weeks of amenorrhea or more in France in 2011 and was designed to follow children until 20 years of age. Gestational age and anthropometric data at birth was collected in medical records and small for gestational age was defined according to a French customised growth standard. During interviews, mothers were asked to report their job status during pregnancy. If employed, their occupation was coded according to the ISCO-88 classification and the date on which they stopped their work was recorded. Cumulative exposure to ELF MF during pregnancy was assessed, for both mothers who worked and those who didn't work during pregnancy, using a recently updated job-exposure matrix (JEM). Cumulative exposure was considered as a categorical variable (<17.5, 17.5–23.8, 23.8–36.2, 36.2–61.6 or ≥61.6 μT-days), as a binary variable (<44.1 and ≥44.1 μT-days) and as a continuous variable. Associations were analysed by logistic regression, adjusting for mother's lifestyle factors, sociodemographic characteristics and some mother's medical history during and before pregnancy. Analyses were restricted to single births and to complete values for the pregnancy outcomes (n=16,733).

**Results** Cumulative exposure was obtained for 96.0% of the mothers. Among them, 37.5% were classified in the 23.8–36.2 μT-days category, but high exposures were rare: 1.3% in the ≥61.6 μT-days category and 5.5% in the ≥44.1 μT-days category. No significant association was observed between maternal cumulative exposure and moderate prematurity and small for gestational age.

**Conclusion** This large population-based study does not suggest that maternal exposure to ELF MF during pregnancy is highly associated with risk of moderate prematurity or small for gestational age.

137

### THE ROLE OF NEAR INFRARED WITH REGARD TO POTENTIAL LONG-TERM ADVERSE EFFECTS IN OUTDOOR WORKERS EXPOSED TO SOLAR RADIATION

C Grandi\*, A Militello, M Borra. *INAIL – Dept. of Occupational and Environmental Medicine, Epidemiology and Hygiene, Monte Porzio Catone (RM), Italy*

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**Introduction** The near infrared (IRA, 780–1.400 nm) represents a primary component of the solar spectrum, accounting for about 30% of the total solar energy reaching the soil. IRA is highly penetrating, being able to reach the subcutaneous tissues. Moreover, significant amounts of IRA may reach retinal tissue. Outdoor workers are occupationally exposed to solar radiation. However, until now the attention was primarily focused on the acute and long-term adverse effects (especially skin cancer) involving both skin and eyes due to UVB and UVA bands.

**Methods** A literature search was conducted to assess the current knowledge about the biological effects of IRA, analysing implications in terms of occurrence of long term adverse effects in people working outdoor.

**Results** Experimental studies show that IRA may affect gene expression profile and the redox balance of the cell, especially fibroblasts, causing a direct or an indirect increase in ROS production, primarily interfering with mitochondrial activity. Until now there is no epidemiological evidence regarding long-term adverse effects due to solar IRA, by alone or in combination with other bands of solar radiation.

**Discussion** The available data suggest that IRA may have biological effects regardless of the potential temperature increase of tissues. Moreover, a synergistic action between IRA, visible radiation, UVB or UVA, may not be excluded, for instance regarding ROS production, modulation of cell signalling, induction of mutations and/or epigenetic changes, especially for prolonged and repeated exposures of skin and eye tissues. Waiting for new experimental and epidemiological data (including those obtained applying 'omics' technologies) protection of workers exposed to solar radiation should ideally include the shielding of IRA (although effective sunscreens are not yet available in this regard), while health surveillance should not ignore the possibility of synergistic effects. Finally, preventive pathways have to include, among others, education to healthy lifestyles.

146 **MAIN PRINCIPLES OF ELECTROMAGNETIC FIELD OCCUPATIONAL EXPOSURE RISKS MANAGEMENT IN RUSSIA**

N Rubtsova\*, Yu Paltsev, L Pokhodzey, S Perov, A Tokarskiy. *Federal State Budgetary Scientific Institution 'Izmerov Research Institute of Occupational Health'*

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Electromagnetic field (EMF) of power transmission, broadcasting systems, etc. are health risk factor. In case of occupational exposure EMF are purposeful risk factor; for other workers and general public EMF are enforces risk factor, and in case of different emitters (mobile phones, laptops, etc.) use EMF are voluntary risk factor.

The main principle of EMF occupational exposure risks management in Russia is based in concept of EMF 'cumulative' effects. Hygienic norms are time dependent, comprising a principle 'protection by time'. EMF hygienic standardisation in Russia is based on the results of hygienic, clinical-physiological, epidemiological and experimental studies (directed to long-term exposure threshold effects determination), as well as the data of peer reviewed scientific publications. Hygienic norms are developed for discrete frequency ranges in account of hygienic safety factor. Today EMF occupational exposure hygienic standards include: hypo-geomagnetic conditions, static electric and magnetic fields, 50 Hz electric and magnetic field, radiofrequency EMF (from 10 kHz to 300 GHz, and special EMF case (ultra broadband pulses). Dose (time-dependence) approach allowed to specify value of EMF permissible levels depending on exposure duration. This approach in radiofrequency range is realised by introduction of 'power exposition' (PE) and 'maximal permissible level' values.

The progress in EMF hygienic safety problem solving is time dependent norms for frequencies from 3 Hz up to 10 kHz development, as well as attempt of near zone EMF adequate evaluation (for >300 MHz frequency range) principles.

EMF risks management is based in realisation of protection by distance and protection by protective measures and means too. There are developed new methods of overhead and cable extremely high voltage transmission lines 50 Hz magnetic field decrease as well as new regulatory documents on requirements and testing of 50 Hz electric field and radiofrequency EMF individual protective means.

484 **RADON AND RISK OF LUNG CANCER IN APULIA REGION SOUTHERN ITALY**

GM Ferri\*, D Cavone, G Intranuovo, F Birtolo, P Tricase, R Fuso, L Vimercati. *University of Bari, Italy, Interdisciplinary Department of Medicine (DIM), Section 'B. Ramazzini', University Regional Hospital 'Policlinico - Giovanni XXIIIth', Unit of Occupational Medicine*

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**Introduction** Radon is a naturally occurring radioactive gas and a level 1 carcinogen by IARC. It acts synergistically with cigarette smoke to cause lung cancer. The limit of 300 Bq/m<sup>3</sup> is envisaged, both for working environments and for living environments, from the new European Directive on the Protection of Ionising Radiant ('Basic Safety Standards' – Council Directive 2013/59/Euratom, published in OJ L –13 of 17/1/2014), which will be transposed by Member States of the European Union by the deadline of 06 February 2018.

**Method** we studied the association between different building, occupational and geologic characteristics and high levels of radon concentrations (above the 75% percentile). Also the lung cancer death rates for the exposure to Radon was assessed by means of the REID method (Nezahat Hunter, 2015) related to different smoking habits groups. The data collection was carried out using Apulia observed radon data collected by regional environmental protection agency (Arpa), in the provinces of Bari and Lecce and other sources.

**Results** The preliminary data showed an increase of risk to observe Radon mean values above the 75th percentile (100 Bq·m<sup>-3</sup>) associated to years of building above 1972 (OR=2.28 to OR=4.70), elevated number of rooms (OR=2.16), Non cement walls (OR=2.6). The risk rate due to residential radon will be calculated and differentiated for Continuing smokers, Ex-smokers and Never smokers. The calculations of specific lung cancer rates will be based on the REID method.

**Discussion** Radon exposure is the second cause of lung cancer. Many lung cancer cases could be prevented in Apulia by reducing indoor radon and smoking habits. The regional and provincial health authorities would be benefited by improved testing for radon and subsequent home remediation rates. Safety structural building procedures could be useful for lung cancer prevention.

1649 **ELECTROMAGNETIC FIELDS: OCCUPATIONAL EXPOSURE AND PREVENTION IN WORKERS. AN UPDATE**

Fabriziomaria Gobba. *University of Modena and Reggio Emilia, Modena, Italy*

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**Aim of special session** Electromagnetic Fields (EMFs) are virtually ubiquitous, and the large part/almost all workers are virtually exposed. Consequently, an adequate prevention of the occupational risk related to EMFs exposure is important, as recognised by authoritative Institutions as ILO and WHO. In Europe a specific Directive, the 2013/35/EU, recently implemented in European Countries, introduced occupational limits, and the legal requirement of health surveillance of EMF exposed workers. Aim of this Special Session is to give an update on activities currently ongoing for the prevention of the occupational EMF risk, and on the problems of the