HAL
open science

ELFSTAT Project: Assessment of infant exposure to extremely low frequency magnetic fields (ELF- MF, 40-800 Hz) and possible impact on health of new technologies

Marta Parazzini, Serena Fiocchi, Emma Chiaramello, Laurent Le Brusquet, Hanany Tolba, Martin Röösli, Isabelle Magne, Martine Souques, Paolo Ravazzani

To cite this version:

Marta Parazzini, Serena Fiocchi, Emma Chiaramello, Laurent Le Brusquet, Hanany Tolba, et al.. ELFSTAT Project: Assessment of infant exposure to extremely low frequency magnetic fields (ELF-MF, 40-800 Hz) and possible impact on health of new technologies. 11ème Congrès National de Radioprotection, Société Française de Radioprotection (SFRP), Jun 2017, Lille, France. hal-01475084

HAL Id: hal-01475084

https://hal.science/hal-01475084

Submitted on 1 Mar 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

ELFSTAT PROJECT : ASSESSMENT OF INFANT EXPOSURE TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS (ELF-MF, 40-800 HZ) AND POSSIBLE IMPACT ON HEALTH OF NEW TECHNOLOGIES

Parazzini M[1], Fiocchi S[1], Chiaramello E[1], Le Brusquet L[2], Tolba H[2], Röösli M[3,4], Magne I[5], Souques M[5], and Ravazzani P[1]

[1]CNR Consiglio Nazionale delle Ricerche, Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni IEIIT, Milano, Italy
[2]Laboratoire des Signaux et Systèmes (UMR CentraleSupélec, CNRS, Université Paris-Sud), Gif-sur-Yvette, France
[3]Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland
[4]University of Basel, Basel, Switzerland
[5]EDF, Electricite de France, France

Extremely low frequency magnetic fields (ELF-MF) have been classified as possibly carcinogenic to humans based on reasonably consistent epidemiological data for childhood leukaemia [1]. Despite the classification and consequent implementation of numerous health risk assessment processes to evaluate possible risk of ELF exposure of children, the real everyday exposure to ELF-MF in Europe is not well known. Indeed, only a few studies analysed children exposure to ELF-MF by collecting personal measurements, correlating the daily exposure patterns to children's movement and behaviour [2-7]. Furthermore, the exposure assessment to MF sources other than power lines has been not yet addressed. Therefore, an improved knowledge of these exposure contributions is needed to better understand biological mechanisms and to interpret previous epidemiological studies as well. A correct assessment of the induced fields in tissues should also be carried out. Indeed, so far, the estimation of induced fields are limited to exposure of a few children's anatomies [8-9] and on foetal exposure [9-13]. Personal exposure measurements and computational dosimetry contribute to provide the picture of the impact of exposure on health. However, due to the high variability of real exposure scenarios, the exposure assessment by means of those tools turns in high time-consuming processes.

ELFSTAT project started in November 2015 and is founded by the French ANSES (2015-2019, Grant agreement n. 2015/1/202). The main purpose of ELFSTAT is to characterize children's exposure to low frequency magnetic fields (MF, from 40 to 800 Hz) in real exposure scenarios using stochastic approaches. Both the global exposure at personal level and tissue dosimetry due to far- and near-field sources will be investigated. Finally, prediction of the impact of new technologies (e.g. smart grids, electric vehicles) on children's exposure will be carry out, enlarging the frequency range to the intermediate frequencies (IF).

ELFSTAT project aims to develop stochastic models able to provide exposure assessment of children in several exposure conditions and hence considering the high variability of real exposure scenarios, on the base of a relatively few experimental and/or computational data.
The project is divided in three Work Packages (WP):
WP1-Stochastic Models: the aim is to develop stochastic models to model personal exposure and tissue dosimetry. The exposure will be characterize in terms of magnetic field amplitude at personal level and induced electric field for tissue dosimetry.
WP2- Children exposure assessment to ELF-MF: the aim is to characterize children's exposure to low frequency magnetic fields (MF) from 40 to 800 Hz using stochastic models developed in WP1. Furthermore, appropriate indicators to represent children's exposure based on the stochastic exposure assessments will be developed.
WP3- Exposure to new technologies ELF devices: the aim is to evaluate the impact of new technologies for energy on children exposure. A systematic literature review will be conducted about research papers on the ELF-MF exposure of new technologies. An estimation of the change of exposure due to these new sources will be done to evaluate the impact on children's exposure of these new technologies.
Ongoing work is about: i) modelling of extremely low frequency magnetic field time series obtained from the EU project ARIMMORA [3] and EXPERS database [6-7] by segmenting them into blocks modelled by locally stationary processes [14]; ii) the development of stochastic models of induced electric field in foetal tissues and in the children exposed to MF by means of the polynomial chaos theory; iii) identification of the new technologies that could change the ELF EMF exposure scenario for the young population.

Aknowledgement
The ELFSTAT Project is supported by The French National Program for Environmental and Occupational Health of Anses (2015/1/202). The French data come from the EXPERS study database, subsidized by the French Ministry of Health, EDF and RTE, and carried out by Supélec, EDF and RTE.

References
[1] IARC Monographs on the evaluation risks to humans. 2002. Volume 80. Non-Ionizing Radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields. IARC Press, Lyon, France.
[2] Forssén UM, Ahlbom A, Feytching M. 2002. Relative contribution of residential and occupational magnetic field exposure over twenty-four hours among people living close to and far from a power line. Bioelectromagnetics, 23(3): 239-44.
[3] Struchen B, Liorni I, Parazzini M, Gaengler S, Ravazzani P, Röösli M. 2015. Analysis of children's personal and bedroom exposure to ELF-MF in Italy and Switzerland. J Expo Sci Environ Epidemiol. doi:10.1038/jes.2015.80.
[4] Magne I, Souques M, Lambrozo J, Bedja M, Fleury G, Le Brusquet L, Carlsberg A. 2011. Exposure of the french population to 50 Hz magnetic field: general results and impact of high voltage power line. Proceedings of the 10th International Congress of EBEA, Rome, Italy, 21-24 February.
[5] Magne I, Deschamps F, Lambrozo J, Le Lay M, Richard JL, Bedja M, Fleury G, Le Brusquet L, Souques M, Lambrozo J, Carlsberg A. 2011. Analysis of high voltage network and train network in the EXPERS study. Proceedings of the 10th International Congress of EBEA, Rome, Italy, 21-24 February.
[6] Bedja M., Magne I., Souques M., Lambrozo J., Le Brusquet L., Fleury G., Azoulay A., Deschamps F. and Carlsberg A. 2010. Methodology of a study on the French population exposure to 50 Hz magnetic fields, Radiat Prot Dosimetry 142(2-4), 146-152.
[7] Magne I, Souques M, Bureau I, Duburcq A, Remy E and Lambrozo J. 2016. Exposure of children to extremely low frequency magnetic fields in France: Results of the EXPERS study, J Expo Sci Environ Epidemiol.

[8] Dimbylow P. Development of pregnant female, hybrid voxel-mathematical models and their application to the dosimetry of applied magnetic and electric fields at 50 Hz. 2006. Phys Med Biol, 51, 2383-2394.
[9] Bakker JF, Paulides MM, Neufeld E, Christ A, Chen XL, Kuster N, van Rhoon GC. 2012. Chidlren and adults exposed to low frequency magnetic fields at the ICNIRP reference levels: Theoretical assessment of the induced electric fields. Phys Med Biol, 57, 1815-1829.
[10] Dimbylow P, Findlay R. 2010. The effects of body posture, anatomy, age and pregnancy on the calculation of induced current densities at 50 Hz. 2010. Radiation Protection Dosimetry, 139, 532-535.
[11] Cech R, Leitgeb N, Pediaditis M. Fetal exposure to low frequency electric and magnetic fields. 2007. Phys Med Biol, 52, 879–888.
[12] Zupanic A, Valic B, Miklavcic D. 2007. Numerical Assessment of Induced Current Densities for Pregnant Women Exposed to 50 Hz Electromagnetic Field. International Federation for Medical and Biological Engineering Proceedings, 16(7), 226-229.
[13] Liorni I, Parazzini M, Fiocchi S, Douglas M, Capstick M, Gosselin MC, Kuster N and Ravazzani P. 2014. Dosimetric study of fetal exposure to uniform magnetic fields at 50 Hz. Bioelectromagnetics, 35(8): 580-597.
[14] Killick R, Fearnhead P and Eckley I. 2012. Optimal detection of changepoints with a linear computational cost. J of the American Statistical Association, 107(500):1590–1598.