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The Dutch Exposimeter Study: Developing an Activity Exposure Matrix

Author(s): Bolte, J FB*; Pruppers, M JM*; Kamer, J†; Van der Zande, G†; Schipper, C MA*; Fleurke, S R†; Kluwer, T†; Van Kamp, I*; Kromhout, J‡

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Institution(s): *National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands; †Radio Communications Agency (AT-EZ), Groningen, Netherlands; and ‡Institute for Risk Assessment Sciences, Utrecht University, Utrecht, Netherlands.

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Abstract:

The main goal of the study is to find a proper measure of exposure, characterizing the exposure to extremely low frequency (ELF) and radiofrequency (RF) electromagnetic fields (EMF), for usage in epidemiological studies to define highly vs. lowly exposed persons. The study aims to build an Activity Exposure Matrix (AEM), describing for about 30 common, everyday activities in 1 ELF and 12 RF frequency bands the estimate of the exposure level. In this way the exposure to EMF can be estimated based on the AEM and a questionnaire on activity patterns without the need to actually measure. In the Dutch Electromagnetic Fields and Health (EMF&H) Research Programme the “EMF exposure characterisation using personal exposimeters and an Activity Exposure Matrix (EMF-AEM)” is one of the five first granted studies. The project started in 2007 and will finish by the end of 2009. The outcomes of the EMF-AEM study will be made available for the follow up studies in the EMF&H Research Programme.

In the first stage we have prepared all tools such as questionnaires, time-activity patterns, a diary format and a list of initial everyday activities to be measured. The main criteria for the activities are: contrasting in exposure, common under a substantial part of the population and distinguishable from the recorded time series. Since the power transmitted by the sources depends on the time of day and the surroundings, the activities will be layered, for example “Traveling by bike–Morning rush hour–City”. For the ELF band we purchased 8 Emdex Lite exposimeters measuring in a frequency range 40–1000 Hz. For the RF bands we purchased 11 EME Spy 121, measuring 12 frequency bands: FM, TV3, TV4/5, uplink bands and downlink bands for GSM, DCS and UMTS, DECT, Tetra and WiFi. The EME Spy exposimeters have been tested in a GTEM to determine the measurement uncertainty per exposimeter and per frequency band. To estimate the measurement errors we tested for a.o. the isotropy, responses at different input field strengths and out of band responses.

In the second stage we have hired temporary workers and commissioned them to perform the preliminary identified list of activities included in AEM, while carrying the EME Spy 121 RF-exposimeter, the Emdex Lite ELF-exposimeter, and a GPS. Based on these measurements and the characteristics of the exposure during the activities an exposure classification scale will be constructed. In the AEM per frequency band the relevant activity will be classified. Also spot and exposimeter measurements will be performed to characterize certain (indoor) activities. The GPS data will be used as a tool to point out locations with exceptionally high or low field strengths. At these locations spot measurements with more sensitive, exact measurement devices with a broader measurement range of frequencies can be performed. To validate the developed tools, in the last stage we will test the AEM and questionnaire on volunteers.

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