For some time there has been a concern about wireless network systems like WiMax in some areas of Sweden, and quite a lot of media coverage. Some people have claimed to be sick from exposure from WiMax transmitters. Several of these people have said that they had to move from the area after the transmitters were activated. The Swedish Radiation Protection Authority, SSI, and others have made measurements in these areas and found that the exposure levels from WiMax transmitters are very low indeed. SSI has made measurements at nine different locations in the Skellefteå area in the north of Sweden; the highest contribution from WiMax transmitters was 0.00001 mW/m², one billionth of the reference value. A private company has measured in a municipality close to Gothenburg in the western part of central Sweden and registered equally low exposure levels.

The Swedish Government has decided that a new radio communication system for Public Safety authorities, RAKEL, shall be constructed in Sweden by the Swedish Emergency Management Agency (SEMA). RAKEL is based on the TETRA standard and the installation started in 2005 in the south of Sweden and according to the plans the system should cover the entire country by 2010. SSI has made measurements of installed TETRA systems in the south of Sweden. Measurements were performed at 10 locations in the Malmö area; the highest contribution from TETRA was measured to 0.2 mW/m².

In April 2007 SSI started an information campaign on precaution when using mobile phones. This precaution is primarily motivated by studies indicating a possible risk increase for acoustic neuroma for long-term users. The message from SSI is that unnecessary exposure should be avoided when using a mobile phone. First of all use of hands-free devices is recommended but SSI also gives information on other ways to reduce exposure. SSI points out that it is especially important for children and adolescents to avoid unnecessary exposure since they are potential long-term users. A small booklet with this message has been produced and has been offered free of charge to the companies selling mobile phones.

During spring 2007 SSI together with the National Board of Health and Welfare and a number of local clinics for environmental medicine has performed local one-day seminars on “EMF, new techniques like TETRA and WIMAX”. Two seminars have taken place so far, five more will follow in the autumn.

Since 1995 Sweden has had regulations for drying with microwaves (SSI FS 1995:3, SSI FS 2005:3). The regulations apply to the use of microwaves for the drying of walls and floor structures in buildings. During 2006 the surveillance working in this field has been intensified and a number of inspections have been performed. In December 2006 the new Swedish government decided that National Institute for Working Life will close down for good as of July 1, 2007. This means that a successful and important part of Swedish research on electromagnetic fields will be closed down.
Sweden

SSI has continued to regularly give the training course “Electromagnetic fields from a radiation protection view” primarily aimed at municipality employees.

The Swedish central authorities working with the EMF issue from different perspectives have a working group that meets two or three times a year to discuss common questions. The authorities also publish common information material on EMF.

For the fourth consecutive year the SSI:s independent Expert Group on Electromagnetic Fields has delivered its annual report “Recent Research on EMF and Health Risks (SSI Report 2007:04). The report covers among other research areas results from the REFLEX study, the replication of the TNO-study and studies on mobile phone use and cancer risk. The report can be found at http://www.ssi.se/ssi_rapporter/ssirapport.html.

The Swedish Work Environment Authority (SWEA) is continuing the work of implementing the directive 2004/40/EG into national legislation. A draft for general comments will be issued during autumn of 2007 and legislation will be issued in April 2008. An ongoing dialogue between SWEA and some major employers, who will be affected by the directive, is taking place. A major concern is expressed as how to asses the limit-values in the directive as there are few, if any, employers who can asses the limit-values due to the technical and computational difficulties involved. Concern has also been expressed by users of MRI-equipment as there is a concern that the limit-values in the directive will prohibit use of MRI in some clinical applications.

Design of a web-side is going on SWEA web-server. This side will provide useful information about the directive and the Swedish implementation. This side will be available during autumn 2007.

**Swedish research on EMF and health effects, 2006-2007**
*Report to the WHO International EMF Project, IAC meeting June 2007.*

The number of researchers in EMF has been diminishing the last years due to lack of funding, and if nothing is done within a few years Sweden will have no research on EMF and health. However, in the past year there has been a number of publications from the active groups, and a short summary of the findings are given below.

The results from the large Interphone project are now starting to be published. The group from the Karolinska Institute has published a paper on risk of parotid gland tumours and mobile phone use, and they did not find any increased risk. The combined data from 5 North European countries on glioma and mobile phone use showed with ipsilateral use and more than 10 years of use there was an significantly increased risk with OR = 1.39 (95%CI= 1.01-1.92). On the opposite side no increased risk was seen (OR=0.98, 95%CI 0.71-1.37).

The Hardell study group has performed two large case-control studies on use of cellular and cordless telephones and the risk for brain tumours. Cases were diagnosed during 1997-2003. The questionnaire was answered by 905 (90 %) cases with malignant brain tumour and 2,162 (89 %) population based controls (Hardell et al 2006a). Using > 10 year latency period analogue phones gave odds ratio (OR) = 2.4, 95 % confidence interval (CI) = 1.6-3.4, digital phones gave OR = 2.8, 95 % CI = 1.4-5.7 and cordless phones yielded OR = 1.8, 95 % CI = 1.1-3.0. Highest OR was calculated for ipsilateral use of wireless phones.
Sweden

Regarding benign brain tumours, 1,254 (88%) participated and 2,162 (89%) controls (Hardell et al. 2006b). Analogue phones gave OR = 1.8, 95% CI = 1.2–2.6, digital phones OR = 1.6, 95% CI = 0.8–3.5 and cordless phones OR = 1.4, 95% CI = 0.8–2.3 using > 10 year latency period. Regarding acoustic neuroma OR = 3.1, 95% CI = 1.7–5.7 was obtained. No significant association was found for meningioma in the same latency group, but the results were based on low numbers.

These results have been further displayed regarding e.g., risk increase per 100 hours use of mobile and cordless phones as well as per one year of use (Hansson Mild et al. 2007).

In a case-control study of testicular cancer encompassing 542 (92%) cases and 870 (89%) controls no association was found for use of wireless phones (Hardell et al. 2007). There was no increased risk for place of keeping the mobile phone during stand by. An overview of the investigations on brain tumours, salivary gland tumours, non-Hodgkin lymphoma and testicular cancer by the Hardell group has been published (Hardell et al. 2006c).

Recently summary results from 16 case-control studies on mobile phone use and the risk of brain tumours were published (Hardell et al. 2007). In a meta-analysis ipsilateral cellular phone use gave for acoustic neuroma OR = 2.4, 95% CI = 1.1–5.3 and for glioma OR = 2.0, 95% CI = 1.2–3.4 using ≥ 10 years latency period.

Wilén et al. (2006) investigated in a provocation study the effect of mobile-phone like RF exposure on subjects with symptoms related to mobile phone. Subjects with mobile phone related symptoms (N=20), and matched controls (N=20) were exposed for 30 min. to a 900 MHz GSM signal (1 W/kg), and the effects on neurophysiological (HR, HRV, EDA, blood flow, critical flicker fusion threshold) and cognitive (working memory, reaction time) variables and symptom experience were examined. No effects of RF exposure were encountered. However, the subjects with mobile phone related symptoms displayed an enhanced sympathetic activation during functional tests (independent of exposure).

On occupational exposure a follow up paper has been published by Wilén et al. (2007) on heart rate variability in RF sealer workers. In this follow up study of operators of RF plastic sealers (N=35), it was found that they had a significant increased heart rate variability nighttime compared to a control group (N=37). This could be an indication of an adaptation of the thermoregulatory system caused by a long-term RF exposure, but further studies are needed to confirm this rather speculative hypothesis.

Hillert et al. (2006) investigated how different factors may influence the output power of mobile phones. The evaluation was made by local switch logging of calls (1, 1.5 or 5 min long) made indoors and outdoors, in moving and stationary mode, and in rural as well as in urban areas. The results showed that high mobile phone output power is more frequent in rural areas whereas the other factors (length of call, moving/stationary, indoor/outdoor) were of less importance. Urban and rural area should be considered in an exposure index for classification of the exposure to RF from mobile phones.

The influence of recruitment strategy for the electric current perception threshold was studied by Schröttner et al. (2007) in subjects reporting electromagnetic hypersensitivity (EHS). Self-declared EHS subjects were selected from members of a self aid group, from responders to a
newspaper call and from persons actively asking for investigations in their search for help. The electric current perception threshold was quite different among the three groups. Pooled together it could be shown that EHS subjects as a group differ significantly from the general population sample, however with a pronounced overlap with the normal range. The EHS groups are very inhomogeneous and contain numerous persons with no increased ability to perceive low frequency electric or magnetic fields.

Thorlin et al (2006) investigated whether 900 MHz radiation could affect these two different glial cell types in culture by studying markers for damage-related processes in the cells. Primary cultures were exposed to 900 MHz microwave radiation in a temperature-controlled exposure system at SARs of 3 W/kg GSM modulated wave for 4, 8 and 24 h or 27 W/kg continuous wave for 24 h. No significant differences could be detected for any of the parameters studied at any time and for any of the radiation characteristics. The morphology of the cultured astroglial cells and microglia was studied and appeared to be unaffected by microwave irradiation. Thus this study does not provide evidence for any effect of the microwave radiation used on damage-related factors in glial cells in culture.

Two studies focused on possible effects of 1,800 MHz EMF on human immune cells. Cells were exposed to continuous wave of different GSM-modulations at various SAR-values (up to 2 W/kg) and exposure times (30 min – 1 h). No effects on release of reactive oxygen species or expression levels of the stress protein HSP70 could be seen in primary human monocytes and lymphocytes due to RF-exposure, although the cells responded to the positive controls heat treatment and the phorbol ester PMA (Lantow et al., 2006). When exposing the human monocyte cell line Mono Mac 6 to these fields, alone or in combination with ultrafine particles (UFP), no effect due to EMF was seen. This was irrespective of if the exposure was to EMF alone or to various combinations of EMF and UFP (Simkó et al., 2006). However, the UFP themselves caused phagocytosis, increased oxygen radical release, and HSP70 increases.

**Publications by Swedish researchers 2006-2007**


Sweden


Schrötter J, Leitgeb N, Hillert L. Investigation of Electric Current Perception Thresholds of
Sweden


