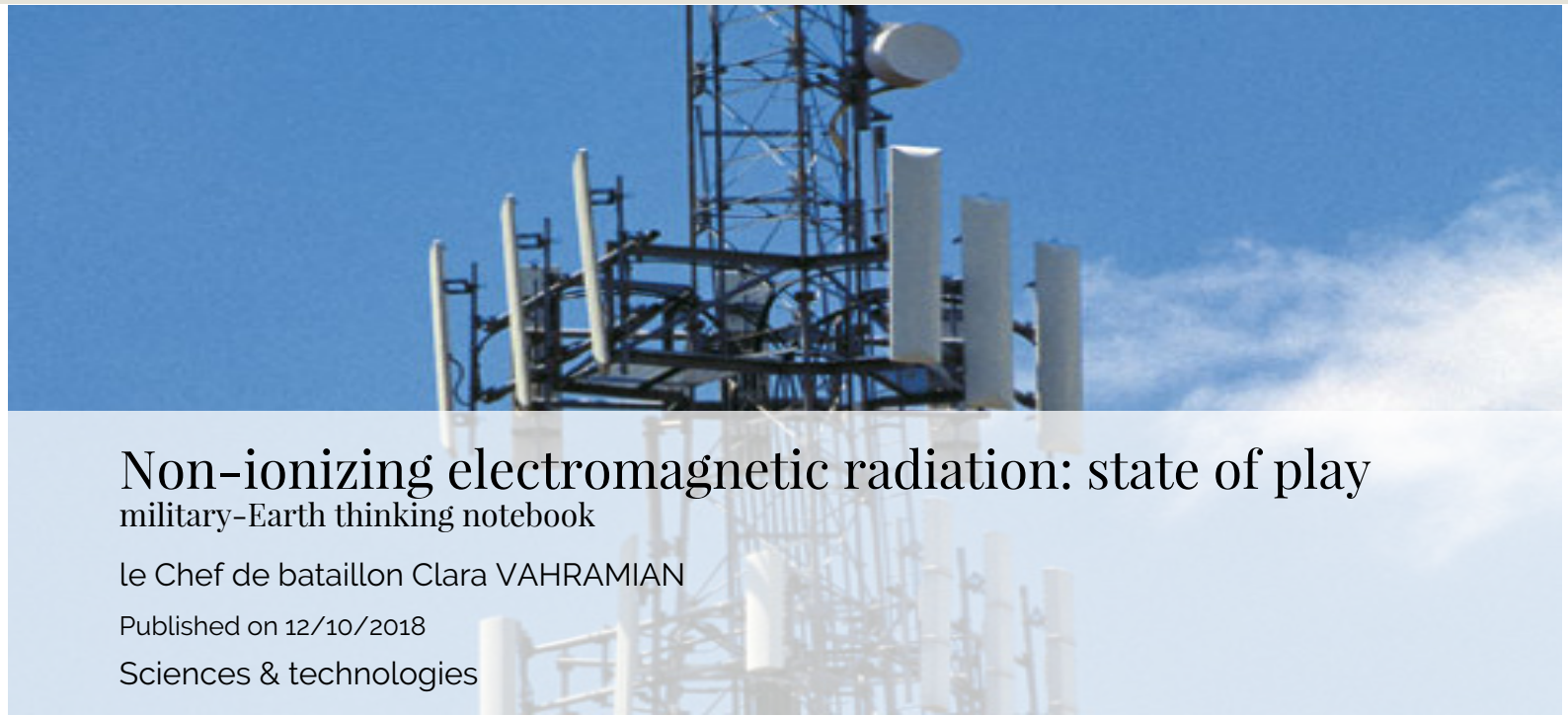




Non-ionizing electromagnetic radiation: state of play

military-Earth thinking notebook

Le Chef de bataillon Clara VAHRAMIAN

Published on 12/10/2018

Sciences & technologies

In an environment where the effects of cumulative electromagnetic radiation are unknown, and where mobile and WiFi data traffic is growing exponentially, Battalion Commander Clara Vahramian considered that the responsibility for prevention lies not only with manufacturers and telecommunications companies, but also with users, who must behave sensibly when dealing with radiating devices.

Every day 2.5 billion GB (Gigabytes) of data are generated worldwide, and nearly two-thirds of this will be transmitted via WiFi or mobile. However, the current trend in Western countries is to "hunt" for electromagnetic waves; in other words, the connected citizen would like to enjoy digital facilities without suffering from electromagnetic pollution.

We are talking here about the microwave range from 100 Mhz to 300 Ghz, the so-called non-ionising frequencies, abbreviated as NIR.

Although manufacturers and Internet service providers (ISPs) are subject to national or European health standards, no scientific body is to date able to assess the potential nuisance caused by the multiplication of emission sources, a veritable breeding ground in which we live daily.

It is therefore up to the connected citizen to adopt responsible behaviour, likely to keep him away from risks that are still difficult to define.

Reminder of health issues

- Electromagnetic wave behaviour

Up to 100 Mhz, the human body is relatively transparent, it is traversed by radiation. But above 100 Mhz, part of the radiation is absorbed, first below the epidermis, then more and more superficially, concentrated on increasingly thin layers of tissue.

The frequencies used in mobile telephony, from 700 to 3,500 Mhz, are exactly part of these so-called penetrating frequencies.

Above 300 Ghz, the (infra-red) waves no longer pass through the human body and are no longer absorbed.

- Effects on the human body
- Thermal effects (high exposure cases)

Between 100 Mhz and 300 Ghz, there is generalized heat stress of the body and excessive localized heating of the tissues.

These effects are even greater when the body or a part of the body acts as an antenna, i.e. for a length $L = \lambda/4$ with λ being a given wavelength. In this case, the body or part of the body acts as a resonator.

For example, the 700 Mhz band, gives a wavelength $\lambda = \text{speed/frequency} = 42 \text{ cm}$. Let $\lambda/4 = 11 \text{ cm}$ as the best resonator. It is for example the size of the gall bladder, an organ particularly sensitive to NIR because it is poorly irrigated and therefore unsuitable for thermoregulation.

Thermal effects become deleterious if the body temperature rises by one to two degrees. The effects are numerous; among them are severe alterations in neurological, hematological and reproductive functions.

At 43°C, the body suffers irreversible damage. This corresponds to an exposure of 150 W/kg.

- Athermal effects

These effects occur at low levels of exposure, that is, at the levels to which we are continually exposed. They are difficult to study and there is not enough hindsight to assess their consequences over a human lifetime. Yet some studies have shown a change in blood formulation in rats exposed to low levels of emissions over a prolonged period of time. More generally, the WHO classifies microwaves as "possibly carcinogenic".

Actions taken by manufacturers and public authorities

- Manufacturers motivated by economic interests

Motivated by substantial energy savings, telephone operators are seeking to limit the transmission power of their cell phones and GSM antennas as much as possible. The less the device emits, the less energy it consumes, the greater its autonomy will be.

The Specific Absorption Rate (SAR) is the energy absorbed by an individual in the immediate vicinity of a radiating device. It is limited by the European Community to 2 W/kg head/trunk, but it is becoming a selling point for certain brands of smartphones, which are able to restrict it to 0.25 W/kg.

Moreover, some uninformed citizens wrongly complain about the multiplication of GSM antennas. Instead of a GSM bubble with a high-power beacon, a mosaic of small bubbles with low transmission and better reception quality is created. In other words, the electric field measured at one centimetre from a mobile phone is greater than that measured at one metre from a GSM antenna. (90 V/m versus 50 V/m).

- The NIR regulations of the Ministry of the Armed Forces. (IM 302143) The adverse effects of NIRs are estimated at 4 W/kg whole body and 100 W/kg head-trunk (modification of animal behaviour and 1°C increase in body temperature).

The exposure threshold for authorised personnel, i.e. for personnel working on radiating materials, is 10% of the above-mentioned threshold, i.e. 0.4 W/kg whole body and 10 W/kg head/trunk.

The exposure threshold for non-authorised personnel, i.e. the public, is 50 times lower than the above-mentioned threshold, i.e. 0.08 W/kg whole body and 2 W/kg head/trunk.

The SAR head-stem of 2 W/kg head-stem, which is the EU standard for the public sector, applied in mobile phones, is used here.

In concrete terms, this translates into the implementation of Red-Orange-Yellow-Green zones, initially defined by the person responsible for the prevention of electromagnetic risks (PCPRE) using a field meter.

It is clear that standardization and prevention actions, in both the military and civilian world, only apply to a specific system and not to a given environment shared by several radiating systems. Over-multiplication of means

radiant emissions is a recent phenomenon, for which regulation is still deficient. The precautionary principle, usually prevalent in France, is muzzled in this case by individual and institutional dependence on our means of communication.

The user must therefore adopt a preventive behaviour to protect himself and his family from risks that are still unknown.

While waiting for a public policy of prevention against RNI, adopt individual hygiene?

It is possible to imagine that a behavioural prevention policy for radiating devices could emerge in the coming decades. But before that, certain elementary gestures, in the family circle or in our daily military life, can be adopted.

- Mobile telephony

The exposure threshold for the public is 2 W/kg head/trunk. However, in frequent situations, the citizen is exposed to much more. At rush hour in a moving subway train, we observe a configuration where all mobile phones, in search of a beacon, emit at their maximum power. This example can be modelled by imagining ten terminals within a radius of less than one metre, at 1.7 W/kg, which gives a SAR of 17 W/kg, a power much higher than that tolerated for NIR workers.

This is the worst-case scenario and is based on theoretical data, but these results should encourage health authorities to carry out tests in these risk environments.

Ideally, you should not use your phone while travelling, or even put it in airplane mode, and do not carry it with you at all times.

- WiFi

WiFi home boxes are RNI's second home of production in the civilian sector. A simple search for wireless networks in apartment buildings reveals an average of five to six available networks. Knowing that a box emits at 100 mW and that amplifiers up to 10 W are available over the counter, one can easily reproduce the same calculations as for mobile telephony and prove its potential harmfulness.

Domestic WiFi boxes emit at high power to allow the signal to pass through the walls of a house. Regulations prohibit users from transmitting more than 100 mW indoors and 10 mW outdoors on certain channels.

This limitation of outdoor transmission is explained by the very high and completely useless elongation of the signal outdoors: more than 50 km observed, with risks of interference on the overexploited 2.4 GHz band.

Users wishing to limit their exposure to NIRs could cut off their WiFi transmission at night, which is easily programmable on commercial boxes.

- In the armed forces

In the defence sector, in a projection situation, prevention imperatives quickly fade into the background. Certain reflexes should not be neglected. The platoon leader must take into account the clearance zone of the satellite dish of his VAB ML, especially in site, if he decides to emboss it.

In the Navy, the risks of radiation due to the enslavement of antennas in negative sites in heavy seas must be taken into account. Protective suits can be used.

For convenience or by accident, helicopters sometimes use antenna clearance zones to land. Not only do they cut the beam, but if the doors are open, they will potentially be exposed to strong radiation.

These safety reflexes must be observed first by the element leader.

These reflex acts must be adopted immediately in civilian as well as in theatres of operation, as it is a matter of having the right behaviour to The dawn of the advent of connected objects, which will end up bathing the whole of our environment in a density of NIR never seen until now.

In short, it is clear that in the face of an obvious government under-regulation of NRT, it is necessary to adopt individual actions to prevent overexposure.

When will NRT be used as a non-lethal weapon?

It is already the case: the United States has deployed its riot ray gun in Afghanistan. It is called ADS, Active Denial System, which operates at 92 Ghz and inflicts an immediate and unbearable heat on anyone within a radius of one kilometre, known as "the goodbye effect". The effects of this device on the human body remain classified.

Battalion Commander Clara VAHRAMIAN is particularly interested in the effects of electromagnetic radiation during lectures given by speakers from the DGA and the DGA.Orange Business Service on radio and satellite propagation, during her technical diploma course "Networks and Telecommunications" at the École des transmissions.

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Release date	08/10/2018
