When do AC magnetic fields occur?

AC or alternating current magnetic fields are the result of an alternating current flowing through a home wiring system, cables, TVs, kitchen appliances, audio systems, transformers, motors, machines, coils, chokes, lamps... high-tension power lines, substations- whenever a device is turned on, whenever a current flows.
The flux density of AC magnetic fields is measured in tesla (T) or milligauss (mG); in building biology we prefer the measuring unit nanotesla (nT). The magnetic flux density either increases or decreases, depending on e.g. the strength of the electric current; the distance between current-carrying and return current-carrying conductors; the type, layout, and quality of installations, cables, and appliances; net currents along sanitary piping or protective ground wires.

AC MAGNETIC FIELDS

Magnetische Wechelsfelder

Unter Strom

Autoren: Dipl. Med. Frank Mehlis, Bonn/ Wolfgang Maes, Neuss

Was kann die Baubiologie leisten?

Die Baubiologinnen und Baubiologen des VERBAND BAUBIOLOGIE sind Fachleute für die Erkennung und Vermeidung von Umweltrisiken in Innenräumen.
Sie messen, analysieren und begutachten neben magnetischen Wechselfeldern auch Schimmelpilze, Wohngifte und andere physikalische Feldeinflüsse wie Elektrosmog, Radioaktivität, die Luftqualität und das Raumklima und sprechen Sanierungsempfehlungen aus.

BaubiologInnen helfen, die Krankmacher, die sich oft in unseren eigenen vier Wänden verstecken, zu finden und zu reduzieren.

Wir wollen weniger diskutieren und über unsinnige Grenzwerte streiten als zum Handeln auffordern.

Es lebt sich besser mit weniger Belastung, vorsorglich und nachsorglich.

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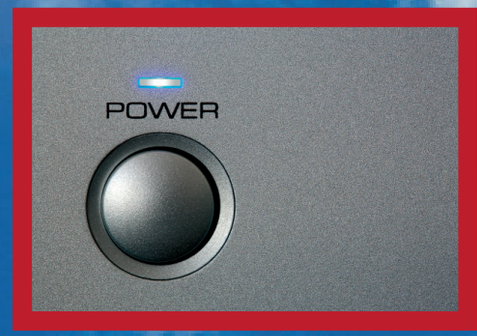
VERBAND BAUBIOLOGIE (VB)

AC MAGNETIC FIELDS

Live and Hot



Nothing works without electricity!

Without electricity, our world would stop: high-tension power lines, railroad transmission lines, underground transmission lines, not to mention the millions of kilometers of wiring in our homes as well as in our electric appliances at home and in our electronic devices at work. Electricity has its great benefits, making life ever so convenient. But electricity also has its side effects that show up as AC magnetic fields. Though there is no reason to fear every single line that carries a current or every single device that is turned on. Once again, a technically sound installation makes all the difference.

What happens in such a field?

When the human body is within the reach of an AC magnetic field, it is permeated unimpeded, it becomes "live and hot." AC magnetic fields induce unnatural voltages and eddy currents in the human body. Many other biological effects, ranging from hormone disturbances to cancer, are being confirmed, discussed, and researched.

Do AC magnetic fields make you sick?

In relation to high-tension power lines, the health risks associated with AC magnetic fields have been researched and published by scientists in many countries. Unfortunately, very little attention has been paid to home appliances even though we find the majority of magnetic field sources right at home. Numerous research results document associations with all kinds of diseases, but especially those with degenerative processes and cancer. According to Swedish and American studies, the susceptibility for leukemia is increased significantly in children living in houses close to high-tension power lines. A whole host of conditions have already been described, including manifestations of stress, behavioral problems and delayed responsiveness, immune deficiency and changes in the pulse rate, migraine headaches and allergies, cardiovascular diseases, hyperactivity and memory loss as well as sleep and eye problems. With regard to land use plans, the federal health department in Germany recommends to allow for a generous distance to high-tension power lines. What exactly is meant by the term "generous distance," is not defined by the department.

Can magnetic fields be found at home?

Most of the time, biologically relevant field strengths in the wiring of our home installations are insignificantly small. When high magnetic field exposures do occur in indoor environments, this usually has to do with technical defects or installation errors. However, if it is not about typical applications (230 V in Europe, 110 V in North America) but those with heavy current requirements, magnetic field exposures can be accordingly higher, such as in electric heating systems, furnaces, and stoves. If a current has to find its way through one thousand and one windings of a coil, e.g. through transformers, ballasts, chokes, adapters..., then there is almost always a much higher exposure level to be expected.

Are there "invisible" magnetic field sources?

Many devices that look rather inconspicuous on the outside have transformers or ballasts invisibly installed on the inside, causing considerable magnetic field exposures within up to a one meter radius: clocks, kitchen appliances, portable tape recorders, battery chargers, answering machines, wall plug transformers, baby monitors, dimmers, antenna amplifiers, fluorescent lamps, energy saving lamps, low-voltage lamps.

The same also applies to motors in refrigerators, electric razors, vacuum cleaners, and fans as well as in sewing machines, electric drills, hair dryers, blenders, and other kitchen appliances. Watch out for low-voltage lamps whose transformer in the wall plug at the other end of the power cord silently and continuously consumes power (which you have to pay for)—even when the lamp is turned off, producing strong magnetic fields (which you have to endure). Devices with rechargeable batteries also hide such invisible transformers, constantly consuming electricity during charging: electric toothbrushes, electric razors, timers, tape recorders, cordless phones, mobile phone chargers...

Spatial configuration of current-carrying and return current-carrying conductors

In each single cable and electric device, there are one or several conductors carrying the current: the current-carrying conductor, is also called phase, and the return current-carrying conductor, is also called neutral or grounded conductor. The current-carrying conductor takes the current to the consumer and the return one takes it back to the public power distribution grid. Both conductors carry a current, each generating a magnetic field in relation to the strength of its current. Normally, both conductors run directly next to each, thereby canceling out each other's magnetic field.

In order to maximize this canceling effect, in special cables the conductors are twisted, coiled, intertwined. When the distance between current-carrying and return current-carrying conductor is increased ever so slightly or both are run separately—as is often the case in low-voltage halogen lamps or electric heating pads—,then the magnetic fields of the two opposite fields do not cancel each other out as much but increase considerably.

Net Currents

Another widespread cause of sometimes rather high AC magnetic field levels has to do with net currents, so-called stray currents. In this case, the electric current does not return anymore along its dedicated wire but along sanitary pipes for gas, heating, or water as well as across the grounding system. Reasons include: grounding problems, malfunctioning devices, and poor equipotential bonding. As a result, entire houses (or entire streets) can be plagued by rather high AC magnetic field levels.

What about external sources of AC magnetic fields?

Any field source from the outside is critical because mitigation is difficult or next to impossible: from high-tension or secondary distribution power lines, from underground cables in the soil or from overhead power lines connected to the roof of a house, but also transformer stations or substations located nearby. In contrast to electric fields, it is close to impossible to shield against magnetic fields from an external source. In most cases, only sufficient distance will do the trick.

Local power distribution networks come in different configurations. When a network forms a so-called loop, the currents will be particularly unbalanced, resulting in elevated magnetic field exposures across large areas of a given subdivision.

Since transformer stations and their supply power lines are known for high field emissions, they do not belong directly next to or even inside houses.

The railway current with its typical frequency of 16.7 Hz is less well known, but it can also cause high exposure levels across large areas. The current strengths are very high because the distance between current-carrying (overhead cable) and return current-carrying (railway track) conductor is especially large.

Currents from railway systems can spread across residential areas—under unfavorable conditions—even as far as several hundred meters away from the electric railway track, and that at rather high exposure levels. In urban centers with electric railways, many houses are affected by those fields.

What can I do?

Keep your distance! No lamps with transformers or similar electronic controllers in sensitive sleeping areas. Also no electric devices (stereo systems, clock radios—even if just in stand-by mode—, and no low-voltage halogen lamps with transformers) near the bed. Keep a minimum distance of 1.50 m, which also includes the space behind the wall of the adjoining room or in the room below, or at the desk. It requires a great deal of effort to shield AC magnetic fields; they permeate all matter. Magnetic fields can fluctuate considerably; they are—among other things—affected by the consumption of electricity (also in the neighborhood). The exact exposure levels for the night (which the building biology guideline values are designed for) can only be determined by 24-h data logging.

Can one shield against AC magnetic fields?

A complete shielding with special metal alloys is challenging, but not impossible. However, the large-area magnetic-field shielding of entire living spaces in residences is not really practical or financially feasible.