



# MAGNET- FÄLT

och eventuella  
hälsorisker  
utifrån vad vi  
vet i maj 1994.

May 31, 1994

English translation of the Swedish brochure "MAGNETFÄLT och eventuella hälsorisker utifrån vad vi vet i maj 1994".

## **MAGNETIC FIELDS**

**and possible health risks based on what we know, May 1994.**

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More and more people are asking questions on power frequency magnetic fields. In this brochure, we - that is, all the authorities listed on the back of this brochure - give you the answers we think can be given at present.

Unfortunately, we cannot give precise answers to all your questions. We still know relatively little about how magnetic fields from ordinary electric currents affect humans. It was not until 1979 that the issue started to be taken seriously, and scientists still have a long way to go. We suspect that magnetic fields may pose certain risks to health, but we are not certain.

Intensive research is now being carried out, and we hope that we will learn a lot more about the health risks of magnetic fields over the next few years.

While we are waiting for the results of this research, there is good reason to exercise a certain amount of caution.

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### **Where do you find magnetic fields?**

We are surrounded by magnetic fields all the time - the most widespread magnetic field being that which encircles the Earth, geomagnetism, which makes the needle of your compass point to the north.

Electric currents also give rise to magnetic fields. Therefore, magnetic fields are found around electric cables, transformers, machines and around anything else through which electricity is flowing.

Magnetic fields are strongest nearest to their sources, e.g. a cable or an appliance, and diminish quickly with distance. The higher the current, the stronger the magnetic field. These fields are difficult to screen off and often pass right through walls and ceilings.

**Magnetic fields with frequencies of up to 300 Hertz (Hz) are known as power frequency magnetic fields. The Hertz measurement denotes the number of oscillations per second. The current we get from our wall sockets is at a frequency of 50 Hz. This means that the current changes direction 100 times a second. Direct current from batteries (for example) does not change direction and therefore has a frequency of 0 Hz.**

**Magnetic fields are measured in Tesla units. A Tesla unit is very large, and in practice is used in millionths of Tesla, i.e.  $\mu\text{T}$  (microtesla).**

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### **Is health affected by magnetic fields?**

Humans are able to live with the Earth's magnetic field. This is a static field. Such fields are also formed around anything which is operated using direct current. As far as we know, humans suffer no ill effects from static fields at the same level as those of the Earth - 50  $\mu\text{T}$ .

On the other hand, we do know that alternating magnetic fields create weak electrical currents in the body. Alternating magnetic fields are formed around alternating current cables and appliances, i.e. around all power lines and anything which is operated using current from wall sockets.

It is suspected that magnetic fields from alternating current may cause cancer. Scientists have studied the number of cases of cancer among people who have been exposed to magnetic fields at work and at home in the vicinity of high voltage power lines. The results have been compared with the number of cases among people who were exposed to magnetic fields to an insignificant extent<sup>1</sup>. This revealed that there were a few more cases of leukaemia (cancer of the blood) among people who had been exposed to magnetic fields.

However, the number of cases that were found is so small that it is impossible to say from these studies whether there is a link between magnetic fields and cancer. Scientists still do not know whether magnetic fields are really to blame, and, if so, how. If more certainty is to be achieved, extensive research must be carried out, including experiments on everything from individual cells to entire animals in order to find evidence of the biological links.

It is probable that a number of factors all work together in quite complex processes. Therefore, it may be a few years yet before we have more concrete answers.

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### **Can high voltage power lines cause cancer if you live close to them?**

We do not really know. If there is a risk, children are the ones most likely to suffer, but any risk is relatively small.

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<sup>1</sup> In the study by Feychting and Ahlbom - Cancer och magnetfält hos bosatta nära högspänningsledningarna i Sverige [Magnetic fields and cancer in people residing near Swedish high voltage power lines], people who were exposed to less than 0.1  $\mu\text{T}$  (yearly average), i.e. people who were exposed to an insignificant extent, formed a reference group.

The normal annual risk of leukaemia in children is four cases in 100 000, or, in other words, around 70 cases in Sweden every year. Seven out of ten children survive<sup>2</sup>.

Some research results show that this risk is almost doubled for children who live in the vicinity of high voltage power lines - the number has been estimated at around 50 000<sup>3</sup>. If this is so, this would mean that two children every year in Sweden would contract leukaemia as a result of magnetic fields from high voltage power lines.

Compare this with other risks. For example, we know that around 400 children are severely injured in road traffic accidents every year. The risk is therefore thirteen seriously injured children in every 50 000.

The majority of investigations have shown no increased risk for adults. However, more research is required before we know for sure.

Caption:

**The magnetic field at varying distances from high voltage power lines.**

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**Can I move to a house near a high voltage power line?**

Should I move if I live in a house near a high voltage power line?

We do not really know for certain whether there is an increased risk of cancer. So we cannot give you a straight answer.

If you are thinking of moving to or out of a house close to a high voltage power line, you yourself must weigh up the advantages against the disadvantages and try to sum up the various risks. For example, if there is less traffic around the new house than at your old house, there is less risk of your children being injured in a road traffic accident. Moving from a town to the country can also mean a reduction in risks.

**Are there magnetic fields around transformer sub-stations?**

Magnetic fields do form around sub-stations, but the strength of these fields is reduced greatly by distance. Therefore, people are seldom affected by sub-stations. However, in some blocks of flats or offices such sub-stations can be found within the building. Magnetic fields can then be found in the rooms next to and above the sub-station.

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<sup>2</sup> Report by the Swedish Child Leukaemia Group: *Läkartidningen* 1993, 35: 2883-86.

<sup>3</sup> *Elsäkerhetsverket - Magnetfält och cancer [Magnetic fields and cancer]*, 1993

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### **What are stray currents?**

Sometimes, the current which should really go back to the power station via power cables goes by a different route, such as through the water system. We usually say that the currents are "on the loose" - going astray. These currents *per se* are not dangerous, but they generate magnetic fields which may be of the same strength as the fields around high voltage power lines.

### **Would it be possible to get rid of high voltage power lines, sub-stations and stray currents?**

From a purely technical point of view, it would be possible to replace high voltage power lines with underground cables. This would radically reduce the strength of the magnetic field. However, this would be very expensive. One cheaper alternative would be to set up the lines in the shape of a triangle - this would reduce the magnetic field, but not as effectively as underground cables.

Sub-stations could be moved and partially screened off. However, this would also be costly.

Stray currents could be reduced by changing the supply mains to a five-wire system between customers and the sub-station. The extra cost involved is low if this is done when installing a system.

There is at present no legislation which forces the electricity companies to implement measures to reduce magnetic fields.

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### **Do domestic appliances form magnetic fields?**

Yes. Magnetic fields are formed as soon as you switch on a light or an electrical appliance. These magnetic fields are strong only very close to their source and decrease very quickly when you are a short distance away from them.

Strong magnetic fields can be found close to domestic appliances, cookers, electric radiators and all the transformers which can be found in items such as televisions, computers, radios and some low-voltage lamps.

On the other hand, power frequency magnetic fields are not formed around battery-operated items such as radios, Walkmans, alarm clocks and watches. Power frequency magnetic fields are not given off by mobile telephones or other radio transmitters either, but they do give off R F magnetic fields for which limits do exist.

Measurements have shown that the total exposure to magnetic fields in the home is usually small. This is partly because people often keep at a certain distance from appliances, wires and transformers, and partly because most appliances are used only for a short period.

Caption:

**Magnetic fields diminish extremely quickly the greater the distance from their source.**

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### **Can electrical and magnetic fields cause hypersensitivity to electricity?**

Hypersensitivity to electricity - an allergy to electricity or "monitor sickness" - has often been described as flushing, a pricking sensation, itching, dizziness, headaches and palpitations. These symptoms primarily affect people who work with monitors.

We do not yet know the cause of these symptoms. Scientists believe that they are a combination of a number of different factors; it is unclear whether electrical and magnetic fields are among these factors. Extensive research is now under way. It will probably be a few years before we know more.

### **Simple things you can do to exercise caution:**

- **Switch off any electrical appliances you are not using. No current passes through appliances which are switched off, so no magnetic fields are generated.**
- **Unless necessary, avoid remaining close to any electrical appliances which are switched on. For example, keep your clock-radio 0.5 - 1 metre away from you if it is run on electricity from the mains.**

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### **Are magnetic fields present at work?**

Yes. You can be exposed to magnetic fields if you work with or close to electrical appliances and equipment or if there is a high voltage power line or sub-station close to where you work. However, again there is no real proof that this would increase your risk of contracting cancer.

It is true that scientists have discovered a link between cancer and exposure to magnetic fields in an industrial environment. However, they are not entirely certain that magnetic fields are to blame. Other factors in the working environment may play a part.

### **Are there any limits for magnetic fields?**

No. Current knowledge is not sufficient for us to tell how magnetic fields may affect us. So we do not have a basis on which to set limits.

However, suspicions regarding the link between magnetic fields and cancer mean that we do recommend you exercise a certain degree of caution. Therefore, the following points should be taken into account when towns and villages are being planned and built if this is possible at reasonable cost:

- Attempt to design/locate new high voltage power lines and electricity facilities so that magnetic fields are limited.
- Avoid locating new homes, schools, day nurseries, etc. close to existing electricity facilities which generate significant magnetic fields if alternative locations are possible.
- Attempt to limit fields of significant strength in existing homes, schools and workplaces.

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### **How do the decision makers decide?**

In our society, we constantly have to consider how much money should be invested in health and the environment, and where this money would best be put to use. In such cases, it is natural that we should give priority to actions against illnesses and accidents that affect a large number of people.

As far as we know at present, magnetic fields from high voltage power lines could cause around two cases of leukaemia in children each year. The cost of eliminating these possible cases would be extremely high.

As things stand at present, it may be more important to invest money in reducing the number of cases of cancer caused by radon - approximately 900 each year<sup>4</sup> - or in reducing the number of road traffic accidents, which kill 800 and disable 10 000 in Sweden each year.

### **What are the authorities doing?**

In Sweden, there are several authorities responsible for health issues regarding magnetic fields: the National Board of Occupational Safety and Health; the National Board of Housing, Building and Planning; the National Electrical Safety Board; the National Board of Health and Welfare; and the Swedish Radiation Protection Institute. We work together in order to gain knowledge in the most expedient way possible and to take any action which may be necessary.

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<sup>4</sup> The SSI [National Radiation Protection Institute] estimates the number of deaths as a result of this at between 300 and 1 500; 900 is an average number. Förslag till förstärkta åtgärder mot radon i bostäder och vissa arbetslokaler [Proposals for improved action against radon in homes and some workplaces], 14 May 1993.



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When suspicions were first aroused with respect to magnetic fields, Sweden - like a number of other countries - invested a huge amount of money in research. However, it was not until the beginning of the 1990s that the suspicion of a link between magnetic fields and cancer appeared to be plausible.

On the basis of this, we decided to recommend that a certain amount of caution be exercised (see page 12). We also decided to continue supporting research.

Should this research prove that magnetic fields really do cause cancer, we will suggest reasonable actions which can be taken to reduce the risk.

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**Where can I go for more information?**

For more information on conditions in your area, your home or at your work, consult the following authorities:

**YOUR ELECTRICITY SUPPLIER** *The address and telephone number can be found on your electricity bill.*

**LOCAL BUILDING AUTHORITIES AND AUTHORITIES FOR ENVIRONMENTAL AND HEALTH PROTECTION** *See the green pages in your telephone directory.*

**YOUR COMPANY HEALTH CENTRE.**

**THE LABOUR INSPECTORATE** *See your telephone directory.*

Further information may be given by the central authorities responsible:

**NATIONAL BOARD OF OCCUPATIONAL SAFETY AND HEALTH**

*S-171 84 Solna. Tel.: +46 8 730 90 00 Fax: +46 8 730 19 67.*

**NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING**

*Box 534, S-371 23 Karlskrona. Tel.: +46 455 53 000 Fax: +46 455 53 100.*

**NATIONAL ELECTRICAL SAFETY BOARD**

*Box 1371, S-111 93 Stockholm. Tel.: +46 8 453 97 00 Fax: +46 8 453 97 40.*

**NATIONAL BOARD OF HEALTH AND WELFARE**

*S-106 30 Stockholm. Tel.: +46 8 783 30 00 Fax: +46 8 783 32 52.*

**SWEDISH RADIATION PROTECTION INSTITUTE**

*S-171 16 Stockholm. Tel.: +46 8 729 71 00 Fax: +46 8 729 71 08, +46 8 31 17 14.*

**The objective of the NATIONAL BOARD OF OCCUPATIONAL SAFETY AND HEALTH is to ensure a working environment which does not expose employees to ill-health or accidents.**

**The NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING is the central authority for planning and building. The Board is responsible for ensuring that building regulations contain criteria for health and safety.**

**The NATIONAL ELECTRICAL SAFETY BOARD is the Government authority which bears the chief responsibility for electrical safety. The objective of the Board is to maintain current electrical safety levels and to improve them if possible.**

**The NATIONAL BOARD OF HEALTH AND WELFARE is a central authority for hygiene and medical treatment, social services and health protection. One of its jobs is to make medical assessments of the link between health and the environment.**

**The SWEDISH RADIATION PROTECTION INSTITUTE protects people, animals and the environment against the harmful effects of radiation. This is done through supervision, research and information.**

Back-cover:

**This brochure has been compiled by:**

**BOVERKET**

[National Board of Housing, Building and Planning]

**ELSÄKERHETSVERKET**

[National Electrical Safety Board]

**SOCIALSTYRELSEN**

[National Board of Health and Welfare]

**STATENS STRÅLSKYDDSinSTITUT**

[Swedish Radiation Protection Institute]