

Electrical Hypersensitivity, a Modern Illness

By Alasdair and Jean Philips

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This book attempts to paint a picture that represents current thinking we believe to be correct at the time of production. It does not pretend to be, nor can it be, comprehensive. We update the book every so often as a result of new or revised information.

Comments, corrections, and information about additions and omissions are welcome. Please post them to us at 2, Tower Road, Sutton, Ely CB6 2QA info@powerwatch.org.uk

We especially welcome feedback from EHS sufferers who have found ways of improving their situation so that we can pass this information on to other people with EHS.

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1. What is electrical & microwave sensitivity?

The density of electromagnetic fields around us is now many hundreds of millions of times the natural level reaching us from the sun and other sources. The sun's radiation levels *and the natural earth energies* are what the human being has evolved with, adapted to and depends on. We have not had the time even to begin to adapt to the radiation from our use of electricity, mobile phones and telecommunications masts. We are also beginning to lose touch with natural sources of radiation (e.g. Schumann waves) which are beneficial to human homeostasis, because they are now swamped by man-made radiation; our systems are no longer able to detect or resonate with them.

People living one hundred years ago would not have been bathed in the many unnatural forms of electromagnetic energy that we now live in. Marconi had just managed to send the first radio signal across the Atlantic and man-made EMF pollution was almost non-existent. In 1920 the Marconi Company began the first public speech transmissions from their Chelmsford (UK) factory, amplitude modulated on the long wavelength of 2750 metres (109 kHz). Most of Great Britain still did not have electricity and some areas that did were supplied with Direct Current that did not vibrate 50 or 60 times every second. The large Cambridgeshire village where we live did not receive mains electricity until the autumn of 1939. Alasdair's grandmother chose not to have mains electricity in her London house until the mid-1970s.

The real growth of commercial radio broadcasting started in the early 1930s. In 1932 the **Wireless Constructor** magazine was reporting: *"Every week one reads of some station planning to radiate enormous power, some fiddling little continental (station) will suddenly develop into an overpowering giant"*. It warned *"you may find yourself in the position of a paralysed man watching the rising of a tide which will ultimately drown him."* Prophetic words?

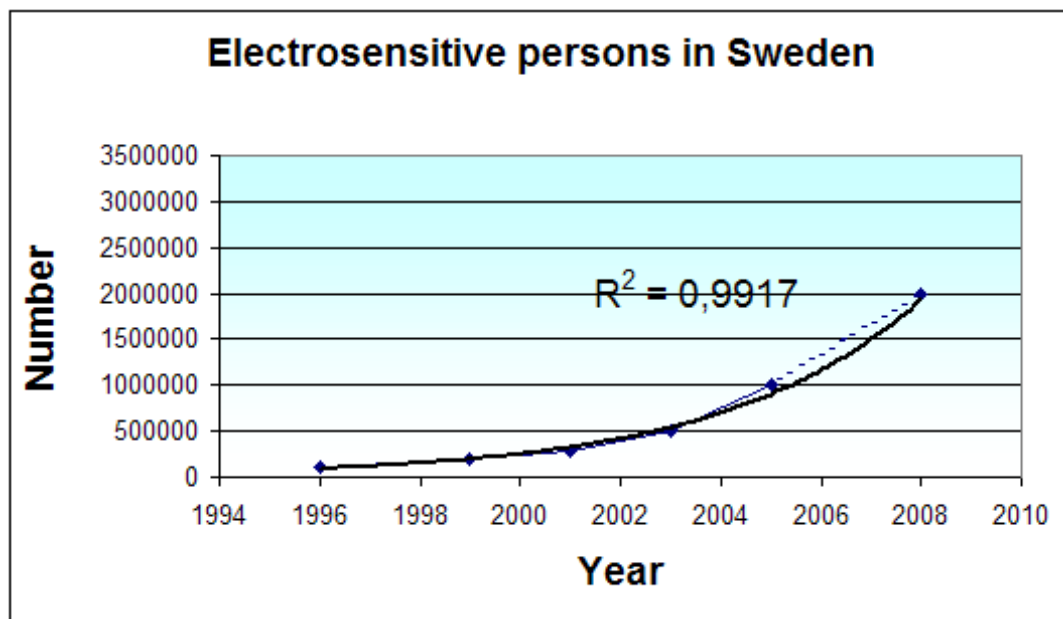
Generally, electromagnetic fields (EMFs) can be biologically active, capable of making changes in the structure of human and animal cells which are exposed to them. Research has shown that there is an association between exposure to EMFs, produced whenever we are exposed to the use of electricity and microwaves, and adverse health effects in at least some people and animals. Milham and Osslander, in a paper published in 2001 [see references], linked the increase in childhood leukaemia with the arrival of electrification throughout the US. Childhood leukaemia is fortunately rare, though tragic for the families who are affected.

What we do not know is what effects electrification has had on the general population, effects that are more subtle than cancer. In an increasingly polluted world, electromagnetic radiation takes its place among other sources of environmental pollution such as pesticides and herbicides, fuel by-products, chemicals in and on foods and used in the home and garden, nuclear radiation, exposure to industrial toxins and waste products ... the list goes on. Various estimates indicate that about 10% of the population are sensitive to radiation and chemicals / pharmaceuticals. The environmental group Polluting Our Future determines that about 1 in 200 American children live with developmental or neurological disabilities caused by exposure to toxic substances. The California Department of Developmental Services reported a 273% increase in the number of people receiving autism services between 1987 and 1998. The article says there is a genetic predisposition, but apparently some environmental factor is triggering it. They speculate about a chemical trigger. Electromagnetic pollution (electro-smog) is no more damaging than many of

these, but when you add it into the toxic soup, it leads to more people being affected by an increasingly hazardous environment.

People vary in their sensitivity to EMFs. Some people can detect the unseen presence of electricity, but remain unaffected by it (these people are sometimes referred to as electrosensible). Some people cannot detect it consciously, but their health and wellbeing are damaged in its presence. Some both detect electricity and are adversely affected by it. These people who are affected by EMFs are called electrically hypersensitive (EHS). EHS is possibly triggered off by exposure to one or more of the other pollutants, especially chemicals, mentioned above. EHS is a primarily a syndrome of adults and the levels of EHS are higher in Sweden, Germany and Denmark than in the UK, Austria and France.

T Lindblom, in a private communication said that in Sweden in 2005, 1 million people believed that EMFs caused their health problems. He believes that the number is doubling every 3 years. By 2008 there may be 13 million people affected in the UK and perhaps over a third of the population by 2010. Persson and Salford (Swedish researchers on the effects of microwaves on brain functioning) believe the percentage could be as high as 48%. Lindblom says that the cost for sick leave has developed along an identical exponential curve starting from 1996 when mobile phones became common in Sweden. The cost in 2006 is anticipated to be 89 billion kronor, to rise to 204 billion kronor by 2010 ($R^2=0.994$). The authorities are suggesting 90 billion kronor. Who will be nearest?



It has been estimated that maybe up to 35% of the population already show some indications of electro-stress. The problem with normal epidemiology (the study of health in the population) is that it still looks for problems to show up in studies of whole (“randomly selected”) groups of the population. This methodology worked well when looking for the causes of cholera or malaria, but when only a small percentage of the population are strongly affected, what should be strong evidence disappears into the “noise”. This effect is explained in Chapter 3.

It is not yet known whether EHS is an independent condition, or a kind of Multiple Environmental Sensitivity Syndrome, linked possibly to Multiple Chemical Sensitivity Syndrome.

A study conducted by Dr Lena Hillert of the Karolinska Institute in January 2002 and another reported by Leitgeb & Schröttner in 2003, found that the incidence of EHS was slightly higher in

women than men, and that there were significant day to day variations in their sensitivity. More than 40% of EHS people had incomes below \$15,000 US and were more likely to be unemployed. Almost twice as many EHS sufferers were born outside Europe; this could be due to many things including genetic susceptibility. We suspect these demographics may be more to do with women's, especially immigrant women's, employment being paid worse, with fewer health and safety regulations, and the fact that the symptoms often lead to the inability to work in a 'normal' environment. A study by the Irish Doctors Environmental Association [see websites] reported that half the people reporting ill-health effects as a result of living near to mobile phone base stations were unable to work due to the severity of the symptoms. They also led a very restricted social life, feeling like 'prisoners' in their own homes, which were not always comfortable places for them to be either.

Kjell Hansson Mild, of the National Institute for Working Life in Sweden, has done quite a lot of research into EHS and he believes that there is a proportion of the population which is more sensitive to environmental influences, and likely to develop more than one idiopathic (allergic) reaction. As well as food allergies, people may also suffer from asthma or hay fever or other response to an identified allergen. This may be the subgroup in which the majority of EHS people fall, although certainly not exclusively. Mild has co-authored papers with Lyskov and Sandström [see references].

According to a Government report in July 2006 about a third of the population, approximately 18 million people, will develop an allergy at some time in their lives. The rise in the number of allergy sufferers has been linked to oversensitive immune systems. There are six major allergy centres in the UK, all in the south and south-east. Training in allergy recognition and treatment is minimal or non-existent.

People who have developed EHS have a physiological disorder, characterized by neurological and idiopathic or allergic-type symptoms, that *noticeably* reacts or intensifies near sources of EMFs such as electrical appliances, especially VDUs (computer monitors), power lines, mobile phones, mobile phone base stations, etc. Being EHS means experiencing *recurring* feelings of stress or illness when near an EMF source. Any noticeable, recurring ill health that is triggered by an electromagnetic field, and that diminishes or disappears away from the EMF source, constitutes a case of electrical sensitivity. While symptoms may diminish quickly after the exposure is reduced, it can take several days, or even more time, for the effects to disappear.

There are degrees of EHS, just as there are degrees of all allergic reactions. The reversible form of EHS seems to be representative of a mild form of EHS. A one-time experience should be considered a warning sign of possible chronic susceptibility. Over time, if not dealt with, EHS may become more and more life-debilitating. It is a serious public health concern and the number of people suffering from this condition is growing. In an increasingly electromagnetic world, this is hardly surprising. While the mechanism by which the onset of EHS syndrome takes place is only just beginning to be understood, the condition itself has clearly been reported, described and discussed in detail. We look at some of the work on the biological mechanisms which may underlie EHS in chapter 4.

A hypersensitive person cannot easily be diagnosed. They often cannot go into hospital even to visit. Fluorescent lights (a common trigger for EHS and intolerable to most EHS people) are used in public offices (making it hard to make claims for, or to draw Social Security benefits), shops, libraries, theatres, cinemas, concert halls, restaurants, churches, trains, trams and buses. Neighbours who are 'ham' radio operators can, even unwittingly, make an EHS neighbour's life almost unbearable. A nearby lamp-post height mobile phone mast can make a house

uninhabitable by an EHS person. They may not even be able to go down a road where one of these masts is situated. This makes living a 'normal' life almost impossible in severe cases of EHS.

Even cars have electrical and electronic equipment (power wiring, fan motors, computerised controls and dashboards) that can disturb electrically sensitive people, especially in the front seat. The steel re-inforcing of radial tyres is often magnetised during manufacture. As the tyres rotate, they produce low frequency pulsing electromagnetic fields that some people react adversely to. Driving is all but impossible as the sensitive driver risks loss of coordination and fatigue that can result in dangerous driver error. A friend measured 13 microtesla in a small hot spot in the passenger seat of her Honda car. In February 2002, the V70, S60 and S80 Volvo models were measured to have electromagnetic fields of 12 - 18 microtesla in the driver's part of the car, when fields of 0.4 microtesla have been associated with ill health [California reference]. The three models in question have the battery in the back/boot and only run a single power cable to the front engine compartment, relying on local connections to the chassis. Hansson Mild questioned the safety of children in these cars. Volvo did not dispute the findings. Ford (who own Volvo) initially made the following statement *"Because there is no evidence about risks of electromagnetic fields in cars, Volvo is not currently taking technical or other measures"*. The sales of Volvo cars dipped after this was made public. Since then, they have developed a €225 'fix' for concerned owners, but they are not going to actively market it as they don't want the subject discussed in public. Some other cars (e.g. BMW and Mercedes) also carry their batteries in the rear of the vehicle and may suffer similar problems.

Many electrically sensitive people seem to have quite dry skin and can carry high electrostatic charges on their body. Not only can other people experience a 'zap' when touching the person, but the electrostatic charges can also be transferred to electronic equipment causing equipment to malfunction. This can sometimes give an appearance of clumsiness or ineptitude, which can lead to a lack of confidence in using electrical equipment. This is quite concerning when young people, even in pre-school nurseries, are being exposed to computers, and they may develop this sensitivity, which can lead to a lifelong lack of confidence and self-esteem problems. If you experience these problems, then you should wear clothes and shoes made of natural materials or even special conductive clothing and footwear that is made for workers in the electronics semiconductor industry. You need to have flooring that is made of natural material, as you build up static charges every time you move your feet. You should 'earth' yourself frequently, by touching metal objects, or walking barefoot on the earth.

A hospital in Sweden has banned workers from wearing Crocs slippers after learning that the popular footwear can build up static electricity. They found that it interfered with medical equipment after two pieces of respiratory equipment for premature babies shut off for no apparent reason. The mysterious power outage was linked to the plastic slippers worn by members of staff. The slippers were capable of becoming charged with an electrical charge of up to 25,000 volts (reported in The EMC Journal July 2007).

There is a wide variation among non-EHS people in the amount of electric potential they produce in the course of the normal functioning of the body. Added to this is electrostatic charge build up in rooms where there are furnishings, especially carpets, made of man-made materials (the charge from which may be made worse by the dry atmosphere encountered within houses or offices with central heating and inadequate humidity or ventilation). Another common place for even non-EHS people to experience a high electrostatic charge is when sliding across the seat cover (made of man-made material) to get out of a car. This charge is then discharged on the metal of the car, giving rise to a small shock. This is normal, but can be somewhat unpleasant. The way to prevent it is to hold on to the metal door frame as you shift across the seat to get out.

In the early seventies, the first EHS cases were identified and became a matter for public discussion and concern. Dr Robert Becker [see references] points to similarities from a neurological standpoint, between symptoms of chronic fatigue syndrome, multiple chemical sensitivity syndrome (MCS), and EHS. They result from a breakdown of the body's systems for dealing with stress. Research suggests that EMFs can affect biological functions by their influence on the production of neurohormones and which act as a biological stressor.

For EHS sufferers living in a high EMF environment, it is like a person with auditory sensitivity trying to carry on normal life with someone shouting in both ears all the time. One of the possible symptoms of microwave sickness is loud tinnitus-like symptoms. Microwave sickness has been identified since we first used microwaves in radar. Charlotte Silverman [see references] linked low levels of radiofrequency (RF) energy with asthenias (debilities or weaknesses) 30 years ago.

Knowing that particular frequencies of pulsed EMF have a debilitating effect on people, the military have used RF energy for offensive purposes over many years. Pulsed microwaves were used in the 1980s to cause distressing effects in the women protestors at Greenham Common Air Base. One of the more recent weapons is one announced in March 2001 by the USAF at a Pentagon briefing (the Active Denial System). This a 95 GHz pulsed microwave source mounted on a Humvee (jeep)-mounted antenna that can cause people up to 700 yards away to drop to the ground curled up in a foetal position believing that their entire skin is burning. This device was first knowingly discussed by the US Defense Intelligence Agency way back in 1972.

Who gets electrical hypersensitivity?

A host of conditions have been clustered under the umbrella of environmental illness, including multiple chemical sensitivity (MCS), cancer, chronic fatigue syndrome (CFS), ME (there is some evidence that ME can be triggered by electric fields), sick-building syndrome (SBS), asthma, candida-related complex, fibromyalgia, and EHS.

Electrical hypersensitivity can have a variety of causes; computer monitors (VDUs) and mobile phones are believed to be two of the most common initiators of the problem; chemical overload, 'closed head' injury, allergy, trauma, electric shock, or metallic implants are other fairly commonly encountered initiators, and others, like lightning strikes, are rather less common. Many people experience an abrupt onset of symptoms following exposure to a novel EMF such as fields associated with a new computer, a new phone or new fluorescent lights.

Working in high electromagnetic fields can produce sensitivity. Drivers of electric trains are members of a group in which sensitivity can lead to very dangerous consequences. 10 - 25% of UK train drivers report 'missing time', time in which they were unaware of their surroundings. However brief this 'absence' may be, if it is at a critical place, e.g. coming up to a red light, it is possible that this could lead to fatal accidents.

Drivers of local suburban trains, underground trains and trams are subject to high levels of EMFs. Passengers are also subject to these fields, which may have consequences for them. These types of transport use 'pseudo-DC (direct current)' with a large AC (alternating current) component (*full wave rectified unsmoothed AC*). This gives rise to very high AC fields at floor level due to the underfloor traction equipment. No research has been done into these fields recently, as train operators have concerned themselves with other health and safety issues which have taken priority. However, it can clearly be imagined that EHS drivers may make less than optimal decisions when in charge of these vehicles. Passengers, too, are unaware, of their exposure levels. Recent research by De-Kun Li has shown that high magnetic field exposure such as would be

experienced in these sorts of trains and trams is associated with an increased risk of miscarriage. Research reported in May 2002, by T Hondou, in Japan showed the potentially high levels of radiofrequency emissions people may be exposed to from mobile phone use in trains. He calculated the combined field levels when several people use mobile phones at the same time, taking into account the way that the metal carriages reflect the microwaves. He hypothesised that the field levels could exceed ICNIRP (International Committee for Non-Ionising Radiation Protection) level. Whilst we believe that exceeding this level is unlikely as the people act as quite efficient microwave absorbers, these exposures could easily lead to an increase in the number of EHS sufferers.

As well as low-frequency electromagnetic fields, radiofrequency fields are becoming an increasing problem for rail travellers. We already are surrounded by travellers wanting to use their mobile phones on their journeys. Wireless Internet access is already being made available to some travellers and it is to extend across most of the UK rail network! Icomera, a Swedish company, is providing the commercial 3G Wi-Fi service used on GNER's fleet of trains. They have been testing the system on GNER's East Coast route and by May 2007, every GNER train will be fitted with the new wireless 3G data communication system. All 13 diesel trains and 30 electric trains will have the facilities of 'a mobile office'. Virgin Voyager trains have already got a 'Connected Carriage' system offering the same service and T-Mobile and Southern are providing a faster broadband service.

It is not just in trains that people with EHS may experience adverse health symptoms. They may begin to feel quite ill while waiting for their train to leave. Reading, Bristol Temple Meads, Bath Spa, Didcot Parkway, Swindon, Exeter St Davids, Bristol Parkway, Plymouth, Newbury and Slough stations began to offer online internet access for use by business passengers waiting for trains on platforms or in the waiting areas. There is a charge for the service that may put off people wanting to use the system to watch video or play games or music, but many may decide to use the system to pass the time. First Great Western and First Great Western Link have signed a contract with The Cloud to bring wireless Internet access to every one of its 85 stations.

Many regular train travellers may become sensitised to microwave radiation. Travelling may well become almost impossible for those with EHS.

British biophysicist Peter Alexander said, "*Once the individual is sensitized to an agent the initial aggressor is immaterial. The biological reaction will be the same to all agents.*" EHS commonly also develops with multiple chemical sensitivity (MCS). Computer monitors, and many other electronic items, give off quite toxic volatile organic chemicals (VOCs) when the cases and electronic components 'burn in' from new. Some companies have initiated a burn-in time for new computers, where they are left running 24 hours a day in an unused room for two weeks before they are moved to the office where they are to be used. This can help, but the offending chemicals can continue to be 'outgassed' for up to 6 months and it can sometimes take even longer. Other initiators of EHS and MCS that have been indicated are agricultural and garden chemical exposure, wood treatment and carpet glues, some volatile cleaning chemicals, and some hair perm chemicals. According to the UK's Building Research Establishment, and a separate Australian study, new houses 1-2 years old can emit many times the level of potentially carcinogenic volatile organic compounds as houses built just 10 years ago. The sources include formaldehyde from treated wooden floors and furniture, toxic compounds from fresh paints and solvents, and hormone disrupting chemicals from carpets and vinyl flooring.

Dr. Robert Becker [see references] describes the symptoms of MCS and EHS, especially those symptoms associated with the central nervous system, as being virtually identical. Both disorders share the general characteristics of involvement of the central nervous system and the immune

system. Dr Bill Curry, a US based EMF physicist and bio-effects expert, believes that whilst there is an effect of genetic variability, anyone subjected to microwave radiation on a chronic basis will eventually become electrosensitive. The symptoms often are not immediately recognized by the injured person as having been brought on by EMF or chemical exposure. Much more research on this phenomenon is urgently needed in order to quantify just how widespread the problem is and to try and understand the mechanisms behind it.

Dr. William Rea (who suffers from EHS himself) reports that he is treating five hundred patients who are EHS at his clinic in Dallas, Texas. Rea reports that at least 80% of these patients are also chemically sensitive and he too suspects and discusses links between EHS and MCS. Those who suffer from both MCS and EHS have found that the symptoms which they feel after either electrical, microwave or chemical exposure are essentially the same; they are frequently unsure as to which type of exposure brought the symptoms on.

This debilitating disorder is increasing according to a Swedish Union [see references]. In 1993 about 10% of 'white collar' workers were reporting some form of reaction to EMF sources. By 1996, 20% were reporting *serious* problems and 7% were reporting *extremely serious* problems. These figures may include people using mobile phones but are unlikely to have begun to include those who are affected by the phenomenally rapid increase in exposure due to the erection of thousands of mobile phone base stations.

'Street furniture' mobile phone transmitter masts (microcells), are being situated along streets to boost reception or to handle increasing 'call-traffic density' in areas that have a high proportion of users. They are not needed for 'area coverage', but people are using their phones to such an extent that there are not enough channels available to handle the density of call traffic without risk of the system 'dropping' calls. More people want to use their mobile phones *inside* buildings, so more masts have to be erected to cope with the demand, and to provide the increased power necessary to penetrate building materials. A recent offer by one of the phone companies was for a monthly package which included free weekend call times. People who choose this tariff are going to want to use their mobile phone for free, rather than use their wired phone at home for their calls. This means more mobile phone base stations will appear close to homes - the cellular phone industry predicts a base station every 50 metres in urban areas within the next few years.

The microcells were originally intended to be able to work at low power as a booster to cope with extra calls. To provide coverage *inside* buildings and give good quality calls, they are going to have to be quite high powered, bathing passers-by in a sea of radiation waves. These masts may make many streets impassable for EHS individuals, and some houses, with microcell antennas radiating outside, will be uninhabitable for EHS people. Locating such devices so close to people's living spaces will no doubt create thousands more EHS sufferers.

Some very low power 'fill-in' base stations may be appropriate - actually reducing everybody's overall exposure because the power of the base stations and the phone handsets will be lower. However, these need to be carefully located. In many areas of London, in a quarter of a square mile area, there will typically be 50 or more mobile phone base stations, many with multiple operators or operating systems! Many of these will be 'covert' ones, looking like innocuous small telephone connection boxes on the walls of buildings - often even painted the same colour as the wall. Some are appropriately low powered (a few watts EIRP), but some may be much more powerful, emitted hundreds of watts EIRP.

Our exposure to new sources of electromagnetic pollution is increasing all the time. We hear, through the New Scientist of 6th April 2002, that a Japanese electronics company is making sure that our wine glasses may never be empty again, but refilled by ever-attentive waiters. Mitsubishi

in Cambridge, Massachusetts, uses an adaptation of the radio frequency identification (RFID) tag technology that's used to stop people stealing goods from shops, for its improved service. The glasses have a unique code which electronics in the table detects and continually transmits to the bar, letting the waiting staff know when they are empty. When this happens, they are discreetly refilled by the staff. The iGlassware system transmits its data on frequencies similar to those used by cell-phones.

Most chronic environmental pollution problems take many years to manifest in a generally healthy population. Some sensitive individuals will succumb in a much shorter time frame, but these will just appear as 'noise' in any generalised research data on sections of the whole population and so are likely to be ignored.

Some relatively new environmental pollution exposures may be predisposing people to EHS, either directly or due to the general weakening of the immune system. Fluoridation of water is resulting in many people being poisoned by fluoride, which has a strong biphasic response, see Chapter on the Biology. In July 2002 in the Daily Mail, new research from Newcastle University, found that volunteers who ate one meal containing genetically modified soya had traces of the modified bacteria in their small intestines. Scientists now fear that GM foods, which are often modified to be resistant to antibiotics, will leave us vulnerable to untreatable diseases. Geneticist Dr Michael Antoniou of Guy's Hospital, London, said 'Bacteria in the gut are going to take up genes that will make them resistant to potentially therapeutic antibiotics'. Digestive disturbances are reported by EHS sufferers, but whether these disturbances are more common in EHS people than in the general population is unknown. It is certainly another factor to eliminate, if you suffer in this way.

2. How does EHS start?

Electrical hypersensitivity (EHS) is a combination of up to three factors:

- a) a natural sensitivity, similar to other idiopathic or allergic reactions, which is not common in (or, at least, not typical of) the general population. There are about 12 million allergy sufferers in Britain and the number is increasing all the time.
- b) sensitisation by some trigger, which could be one or more of a variety of commonly encountered substances.
- c) sensitisation by some incident, which has the capability of damaging the bioelectrochemical communication within the body.

Most research studies have not found a direct link between electromagnetic fields and EHS. One survey by Haysom [see references] of 692 people in two housing estates found increased headaches and migraine in those who lived between 50 - 100 metres from an overhead power line. Headaches and migraine are not the most usual initial symptoms of EHS, but may be indicators of environmental sensitivity. There are clearly many factors involved in this complex syndrome. Chronic environmental overload, both physical / chemical and psychosocial, when added to genetic predisposition and chronic or acute illness (e.g. viruses have certainly been implicated in some environmental syndromes) increase a person's susceptibility and contributes to the development of electromagnetic sensitivity symptoms. The World Health Organisation's Dr Michael Repacholi, co-ordinator for the International EMF project says *"we are aware that certain people are more sensitive than others, and research should concentrate on studying this group and their symptoms."* One theory of susceptibility includes a belief or suspicion that EHS is brought on by a latent brain injury, which predisposes some to become EHS, in a similar way to that which can predispose to epilepsy.

Another theory, suggested by an EHS sufferer, and supported by her contact with other EHS sufferers, seems worthy of further investigation. She found that a significant proportion of those she was in contact with had suffered damage to the back, often from car accidents. This jarring to the spine led to an imbalance in the cranial fluid cushioning the brain, which was felt to result in a decreased ability of the brain to deal with external stimuli. When faced with such a stimulus, the three layers of tissue around the brain go into spasm. It is not clear what effect this would have on general biological functioning, but it may well explain some of the differences in symptoms experienced by EHS sufferers.

We have had contact with a family in which a mother and daughter both suffered from EHS, and another where a mother and two daughters all suffered from EHS. This may indicate not only a genetic susceptibility, but possibly an inheritable genetic susceptibility. Whether it is linked by gender is another interesting question. This possibility has implications for being careful and informative with the children (of the same sex?) as a parent who is EHS, and ensuring their environment is not going to present the trigger for an onset of EHS. Once the child ventures into the larger world, we encounter the problems of ignorance and disbelief. It is important that the general public and the medical profession are educated as to the existence of EHS and the acceptance will follow.

It makes little difference what the initial provocation is. Once a person is exposed to time-varying electric and magnetic fields, they may begin to react to chemicals, including pesticides and herbicides, and / or electromagnetic radiation, whether ionising or non-ionising in a sensitised manner. The condition is usually associated with a severely dysfunctional immune system. In a study carried out by Eltiti and colleagues [2004] 54% of EHS respondents indicated that they were also sensitive to chemicals and there was a significant correlation between the degree of sensitivity to chemicals and sensitivity to EMFs.

Initiation of EHS often comes at a time when people are experiencing an intensive work period, which suggests that the changes in people's systems due to stress may increase the person's sensitivity to environmental factors. Stress sensitive hormones such as prolactin and thyroxine have been found to be elevated in people at work in electromagnetic environments (and in EHS sufferers), but not when they are at leisure. Prolactin plays a key role in moderating parts of the neuroimmune system and may also be an important precipitator of autoimmune diseases.

Some common initiators associated with the development of electrical hypersensitivity which have been proposed are:

Computer monitors - Visual Display Units (VDUs)

These used to give off very high electric and magnetic fields from the screen (VDU, or visual display unit) and associated scanning coils. In the late 1980s a Swedish trade union that had been looking at 'anecdotal' evidence from its workers, demanded that the EMFs from computer VDUs be strictly limited to levels way below those being emitted by most of the VDUs in use at that time. In 1990 the Swedish National Board for Measurement and Testing issued guidelines known as MPRII. The industry reacted by saying that the extra work and materials needed in order to achieve such low fields would double the price of VDUs. They predicted that very few would be purchased and it was a waste of time and resources to try. A Swedish firm (Nokia), that was trying to break into lucrative electronic markets, saw a possible niche product for the Swedish governmental and corporate markets and produced low EMF VDUs in the late 80s and early 90s. Despite being considerably more expensive than ordinary monitors, these new low EMF ones were surprisingly popular.

The rest of the industry was pressurised into offering monitors that complied with the MPRII standard. This led to competition, and within a few years low EMF computer monitors were readily available at prices close to, and even lower than, those of the previous, high radiation monitors. MPRII and subsequently TCO-92 and TCO-95 standards have been adopted throughout the world. The fields from a modern standard cathode ray tube (CRT) computer monitor screen are now very low.

This, unfortunately, did not end the problem. In Sweden, in 1986-7, as a result of voluntary testing of VDUs, electrostatic fields were virtually eliminated and magnetic fields in line frequency were substantially reduced. Despite this, the number of people affected by suspected hypersensitivity to electricity increased dramatically during the latter half of the 80s. An article in a Swedish computer magazine in 1989 included " ... *Stopping working with VDUs was the most well-trying, and similarly the most effective method of reducing symptoms. Changing to a "low-emission" VDU usually did not lead to improvements - on the contrary, in several cases deterioration was noted ...*"

So, even low-emission VDT monitors can provoke symptoms in EHS people. It is important to remember that monitors give off higher fields to the side and the back, so keep your distance. Laptop computers are usually worse, most being unearthed and giving off enormous power-

frequency electric fields. **It is important that you earth a laptop computer, or run it off batteries.** If you have an internet connection through a dLAN (through the house wiring, rather than a telephone or wireless system), it is important to earth the laptop even if you run it off batteries, as it will pick up and re-radiate electric fields from the house wiring through the dLAN connection. We have measured 400 V/m at the keyboard of one model. Lap-tops and flat desk-top screens do not need the strong low frequency magnetic fields of a traditional CRT monitor, however they use high-frequency fields for driving the back-illumination and also can emit significant levels of radio-frequency electric fields (30 kHz to 300 kHz) from the back illumination and scanning processes. Some EHS people react even more strongly to these, that is why TCO and MPRII specify much lower limits for higher frequencies. ELF (5 Hz to 2 kHz) allowed electric and magnetic fields EMFs are about 10 times higher than those allowed at VLF (2 kHz to 400 kHz).

Sandström and others [1997] hypothesised that the exposure to flickering light might be one of the factors that can be considered as a trigger for further neurochemical disturbances, leading to typical symptoms of hypersensitivity. It is known that the nervous system is able to respond to amplitude-modulated light with frequencies above the critical flicker fusion frequency, i.e. the frequency of the flickering light above which the light is perceived as continuous. They also noted that the higher the amplitude modulation level was, the more negative effects were reported. (Note, 100% modulation is the light pulsing on and off, 50% is full brightness falling to half brightness before rising to full brightness, etc.)

When traditional cathode ray tubes (CRTs) were first used in VDUs the phosphor coating (that glows when hit by the internal electron beam) had a long persistence time; i.e. it continued to glow for about 10 to 20 milliseconds after it had first lit up. This was what had been found to be best for television displays as it is similar to the persistence of vision of the human eye. The display is produced by scanning horizontally, line by line, from the top left corner down to the bottom right. The time taken for a full scan was about 20 ms or 50 times every second, so the amplitude modulation of a white spot in the picture was only between about 25% and 50% of full brightness. The viewer's persistence of vision only had to make up this relatively small amount in order for the spot not to flicker.

The default vertical scan for most PC computers is 60 times a second, though 72 times a second is now the slowest recommended for general use, and 90 to 100 times a second is not uncommon. In our experience it is unwise to have a vertical refresh rate slower than 72 or faster than 100 times a second as more people report eye strain and headaches outside of this range.

One factor, which to our knowledge has not been properly researched, that may be extremely important is the very short persistence time of the phosphors used in modern high-resolution computer displays. When examined using a fast photodiode sensor, it turns out that the pixels (smallest dots) light up VERY brightly only for 5 to 15 microseconds and are dark for the rest of the time. **So what looks like a sharp non-flickering image is actually **flashing at you blindingly bright** for very small periods of time and your eye and brain are averaging these flashes to produce a steady image.** As the image is being repeated between (hopefully!) 72 and 96 times each second, this is faster than your persistence of vision and hence appears flicker free. But this flicker-free image is being produced by a form of illumination that human eyes had never seen before about 10 to 15 years ago. Until then the averaging was achieved by a combination of eye and screen so that the screen itself was fairly flicker free. Now you have a blindingly bright flash of say 10 microseconds repeated about 100 times per second. So that bright flash is actually 1,000 times brighter than the screen actually appears to the viewer (averaged over time), and can be up to 5,000 times as bright. We have no idea what the long-term consequences might be of this novel form of illumination, especially as some people sit in front of their screen for many hours every day. This extreme form of pulsing will certainly affect visual evoked potentials (VEP) in the

viewer and will probably affect other EEG signals as well. Sandström et al [1997] found that the VEPs of people reporting EHS symptoms could react to higher frequencies than non-affected people. This area needs to be actively researched using actual light from a variety of modern high resolution VDUs.

Sandström and her team [1995] found a significant link between people experiencing skin problems (a common EHS symptom), increased electrical fields and low-frequency magnetic fields from VDUs in their workplace. Bergdahl (1998) investigated 28 patients reporting symptoms, including oral ones (craniomandibular dysfunction) allegedly caused by electricity or VDUs. The conclusion was that some of the symptoms could be helped by treating dental diseases.

Work done at Bristol University has shown that the static electric field generated by monitors and TV screens attract negatively charged particles to the screen and positively charged particles are attracted in the opposite direction - towards the user. These particles may include chemicals that can trigger or perpetuate EHS symptoms. There has been some speculation that high levels of positive ions such as found in offices where VDUs are used are responsible for impairing health in a number of ways, one of which is to stimulate increased production of the neurohormone serotonin. High levels of serotonin are associated with depression and tiredness. [See London Hazards Centre VDU book, getting old now in VDU terms at 1993, but excellent nevertheless].

Most people feel better in a negatively ionised environment, such as is found naturally in mountainous areas, and by rivers or lakes. The use of most electrical equipment results in positive ions being generated. You might choose to buy a negative ioniser which will help restore the ion balance in your home or workplace. Be careful in your purchase of a negative ioniser, should you choose to get one. Some generate positive as well as negative ions; and some contain a cheap transformer, which can give off high electromagnetic fields nearby, undoing much of the good of the negative ion effect.

Other research from Bristol by Henshaw et al, has described the way that airborne particles are attracted to sources of electric fields, especially power lines, which could increase the quantity of pollutants and possible allergens that people are exposed to. This could affect the skin and when breathed in, affect mouth and breathing reactions.

Equipment with strong harmonic generating electronics

Compared with the 50Hz signal we have always had in most electrical appliances, we now get frequencies of tens of thousands of Hz with associated harmonics.

In an experiment conducted in the workplace by Andersson & Westlund [1991], they found that ordinary electric bulbs with a frequency of 50Hz did not normally cause any irritation. But when a thyristor or triac controller was connected to the lighting to control the brightness, or it was replaced by high-frequency fluorescent tubes, people experienced symptoms of ill-health.

A person in the study developed EHS when her computer monitor was changed. Although the monitor complied with the Swedish low-emission standards, an analysis showed new harmonics in the radio-frequency range.

Certain types of household appliances contain thyristors (SCR) or triacs. These control the power to the appliance. A cooker with a fan, or a vacuum cleaner with a regulated vacuum speed, may be controlled with such an electronic device. These can give off significant RF electric fields. One

way of testing if your appliance is giving this problem is to hold a medium or long-wave radio, tuned off-station next to the appliance. Near to the controller and wiring it will emit a loud, buzzing noise. Due to the EMC regulations now existing Europe-wide, limiting the ability of one electrical appliance to affect the functioning of another, this is much less of a problem. However even the new ones generate much more radio-frequency energy pulsing at mains frequency (e.g. 50 Hz) than a simple resistive controller or just an on-off switch. EHS people should avoid all electronic room light dimmer switches.

Working or living in high magnetic fields

Working in high fields can precipitate sensitivity. This could apply to working environments such as power-line maintenance, railway workers on electrified lines, or machinery that generates high fields such as welding equipment, industrial sewing machines, etc. Existing evidence indicates that exposure to environmental level 50-60Hz electromagnetic fields may be an immune system stressor with the potential to cause hormone disruption and changes at a cellular level, therefore having the capacity to impact adversely on the immune system. Consequently, electromagnetic field exposure should be evaluated as a potential risk factor for people suffering from CFS or showing chronic fatigue related symptoms (a dysfunctional immune system, extreme fatigue, short-term memory loss, depression, headaches and sleep problems).

A study by Don Maisch in 2002 found that prolonged exposure to household appliances including electric blankets, heated water beds and bedheads positioned next to the meter box could contribute to CFS.

Fluorescent Lighting

It is unclear what aspect of fluorescent lighting may be involved in the initiation and perpetuation of EHS. Various hypotheses have linked EHS with the electromagnetic fields which include the transformers in the tube fixtures, the 'flicker' of the light or the spectrum of light.

Fluorescent lamps placed in the ceiling hardly contribute to the general magnetic field in a room, however if the lamp is not properly earthed or screened, it might be a major source of electric fields. Sometimes new fittings of high-frequency lights are installed on existing cables, with no protective earth. The entire fitting then acts as an aerial for high-frequency signals. UK wiring regulations now require that all lighting wiring includes a safety electrical earth wire that is connected to all the light fittings. Although a qualified electrician should upgrade the wiring before installing a new light fitting, some do not and it is not a requirement for do-it-yourself installations by the building owner. It is not now legal in the UK for non-qualified persons to carry out electrical wiring within buildings that they do not own.

Old fluorescent tube lights used a large "ballast coil" which emitted significant electromagnetic fields when pulsed by the 'starter' in order to cause a high 'striking voltage' across the tube. You could often hear the pulsing and buzzing while this happened, especially if the tube was getting old and difficult to light. Once lit, these coils also gave off a magnetic field that could be measured in the room directly above the light - not a good floor for children to play on. You can still get these type of lights (they are the cheapest), but most now have electronic ballasts that emit a much lower level of EMFs.

Because these old style of lights pulsed at mains frequency (50 - 120 Hz) some people were affected by the flickering. By the late 1980s all businesses were being recommended to fit high-frequency (HF) units that applied a much higher frequency across the tube. Most recent HF ones

use a 32 kHz crystal oscillator, do not flicker at all, and give off negligible amounts of electric or magnetic fields. However, we have come across a number of instances in offices with many people suffering from EHS like symptoms where early units (made by a large firm in the mid-80s and early 90s) gave off a wide spectrum of RF noise (from 35 to 140 kHz) with over 50 volts per metre electric field at the head of a worker sitting at their desk. In one large council office this gave symptoms that the workers were blaming on two mobile phone base stations mounted on the roof. Neither the cellular phone operator, nor the UK NRPB, found any problem and we were called in by the trade union to confirm, or otherwise, the previous results. We found no problem with the base station emissions but, unlike the other investigators who only measured microwaves, we measure all the EMF frequencies and so we found the problem with the lights. An experiment was tried using temporary non-fluorescent desk lights, and people felt much better. The council had many hundreds of light fittings to replace. This was both costly and frustrating for them as they had been one of the first to replace all their old lights and install HF non-flicker lights to benefit their employees around 1990. This is a good example of how all the issues must be considered in a holistic way. It is all too easy, with the best of intentions, to make changes that improve one aspect and introduce a new problem.

Some of the early 'high efficiency compact fluorescent' bulbs that were produced to plug in to existing incandescent bulb holders caused considerable EMF exposure problems. Some gave off very high electric and magnetic fields and some emitted higher-frequency EMFs. Even the better modern ones, with electronic high-frequency ballasts, give off higher EMFs than an equivalent old-fashioned incandescent bulb, and while they are useful for power-saving in hallways and rooms where the light is on for long periods, we do not recommend them for use in desk or bedside lights. Where they are used for corridor lights in places such as schools, we have found that they almost always give off higher RF radiation than found in the corridor from a base station mast on the roof of the building. While it doesn't pulse on and off in the destructive way GSM base station signals do, we believe that we should minimise our exposure to all sources of RF radiation.

As fluorescent tubes age, their ends tend to darken. This is a sign that they are overdue for replacement, as these 'darker' ends give off significant levels of ultra-violet light. Remember that fluorescent tubes contain a toxic mix of phosphors and should be disposed of carefully. Such tubes used in commercial and industrial premises are classed as hazardous waste and have to be crushed and the resulting dust contained in an airtight bag before being transported to a hazardous waste site by an approved contractor. Unfortunately many smaller firms, knowingly or unknowingly, fail to comply with this environmental safety law.

Low energy lamps can also trigger EHS reactions.

Atmospheric disturbances

EHS can be triggered by electric storms (e.g. lightning). Magnetic storms caused by solar flares cause wide variations in the Earth's geomagnetic field. These have been shown to cause human and animal behavioural disturbances. In one large (early 1960s) US study [Becker & Friedman] of 28,000 psychiatric hospital admissions, they found that significantly more people were referred just after geomagnetic disturbances. Further investigations confirmed a wide range of effects on behaviour and well-being.

Chemicals

Electrical Hypersensitivity is very often associated with Multiple Chemical Sensitivity (MCS). It is not always clear what comes first, but many people with EHS develop intolerance to chemicals and vice-versa. Children's more vulnerable systems may become sensitised due to food toxins, ever present in packaging as well as suspect forms of prepared 'junk' food. It has also been suggested that indoor air pollution could be a major factor in sudden infant death syndrome. One possible explanation is that babies become sensitised to synthetic chemicals even before birth. Foetuses are exposed to the same pollutants as their mothers, but their dynamic growth state makes them more vulnerable to the adverse effects of such exposure. A freshly painted nursery, complete with new carpeting, cot, mattresses, blankets, clothing and toys is a room that is likely to be high in chemical emissions. Good fresh ventilation is important - air the room well during the day and have a window or ventilator slightly open at night. Many parents also use EMF (from a mains adapter) (or RF/microwave) emitting baby monitors, placed very close to the baby's head to ensure that they hear any problems. We believe that these RF and power-frequency EMFs can work with the chemicals and increase sensitivity.

The Environmental Protection Agency (EPA) in America, currently recognises more than four million chemical compounds. More than 60,000 of these are produced commercially, with three new compounds introduced each day - the vast majority were not found in the natural environment of people living on Earth.

In 1992, the EPA published the results of a study in which the urine of 7,000 Americans was tested for toxic chemical residues. Some of these chemicals were found in 71 percent of individuals tested. These people were not chosen because their work exposed them to hazardous substances, they were chosen at random.

Many doctors who work with chronically fatigued patients and those who work in the field of environmental medicine, agree that chemical exposure is a major cause of fatigue, depression and poor concentration. In September 2003, a study by Caress & Steinemann in Georgia, America estimated that 12.6% of the US population suffers from MCS and 13.5% of people with MCS report losing their job because of it.

Dr. R. A. Buist, author of 'Chronic Fatigue Syndrome and Chemical Overload', goes on to point out that toxins can disrupt muscle metabolism, accounting for the pain and fatigability of muscles experienced by many people who suffer from MCS and EHS. Buist also notes that in many chronic fatigue patients, environmental exposure preceded the onset of their fatigue.

In an address to the Well Mind Association in Seattle, Washington, Dr David S. Buscher said *"70% of my patients with chronic fatigue had a chemical trigger. The affected person's detoxification system is clogged up or destroyed, they get a backlog of chemicals, and their immune system goes down."*

It is likely that it is the chemicals (especially ozone) emitted by photocopiers trigger off EHS.

A study in Canada by Fox and colleagues, found a number of hospital employees were becoming increasingly affected by an environmental factor. They believe it was related to the use of chemically treated steam (using an anti-corrosive amine mixture) for heating and humidification. The amines bind to the central nervous system, leading to cognitive dysfunction. This suggested to them that the increased amine exposure contributed to the pathophysiological changes in the brain.

Some chemicals used in the home (insecticides, pesticides, bleaches and cleansers) or in DIY (woodworm and flea treatment, carpet glue, paint, wood glue and varnish) or in the workplace or garden (almost too numerous to mention), can cause similar neurological damage.

There is some evidence that dental amalgam illness may be a significant factor in many older people's electrical hypersensitivity. Mixtures of metals in the mouth (e.g. gold caps, mercury amalgam, titanium crown posts, stainless steel, etc) cause electro-chemical potentials to be set up in the mouth and anecdotal evidence suggests this may make matters worse. Removing amalgam fillings can also provoke EHS.

Regular use of a mobile phone or a digital cordless phone

Radiofrequency emissions (from mobile phones, cordless phones, or even MRI scanners) can cause the blood brain barrier to allow toxic chemicals to crossover. The emissions may interfere with the way that chemicals are stored in the body, leading to peripheral neuropathy (stinging, burning pain, numbness, tingling and prickling of extremities). We also believe that the non-thermal interactions of the pulsing microwave signals from such phones represents a long-term hazard to most people's health and well being. If you are developing EHS-like symptoms, then we strongly recommend that you use neither a mobile phone nor a cordless phone, especially the digital DECT ones. Even using ordinary telephones can become difficult for the person with EHS.

As well as the radiofrequency emissions, researchers in Estonia, led by Dr Taal [2001] measured magnetic fields of up to 2 microtesla and electric fields as high as 4,000 V/m from a mobile phone handset. We have seen other reports from leading scientists of fields of up to 6 microtesla 10 cm from the phone (i.e. inside the user's head), and electric fields at the head surface of 350 V/m measured by one mobile phone handset maker [Andersen and Pedersen,1997,1999].

Mobile phone use is one of the most commonly reported initiators of EHS. If you get any adverse health effects from using a mobile phone, then closely monitor your symptoms and compare them with the amount of time you use your phone. Our book *Mobile Phones and Masts, the Health Risks* has a chapter detailing how you can reduce exposure to the radiation from phones if you *have* to use one. If possible, stop using your phone for a while (it may take some weeks for the effect to go away altogether). Remember, that if you ignore the warning signs, you may go on to develop an irreversible form of EHS.

EHS has been initiated by living near a mobile phone base station. This may become an increasing problem as more masts are continually being erected.

Working on radar, or other sources of microwave radiation

People who live near sources of radar such as airports or docks may react to radar emissions, as well as those who use radar as part of their employment. Most radars are scanned and sensitive people can pick up the high power scanning beam as it passes them, often causing pulsing headaches or, if the beam is very powerful, apparent 'clicks' are heard inside the head. It is unclear how far away people can be sensitive to such signals, but we have been told of sensitivity to radar sources 10 miles away. The Acousti-COM monitor can pick up these signals, if you are not sure if they are detectable in your locality.

Exposure to microwave weaponry

Microwave weaponry has been used by the military in various conflicts, or as a crowd control mechanism at political demonstrations or such as used against the women protestors at Greenham Common Airbase. Pulsed microwave weapons which can disorientate, confuse and even stun are available on the world weapons market. The latest high power one, demonstrated by the Pentagon in 2001, is mounted on a jeep-like vehicle and can make people up to 700 yards away drop to the ground and curl up believing that all their skin is on fire.

Tasers are a form of crowd control instrument, using 40,000 volts. This can be applied directly (as in a stun baton) or down a wire or a stream of ionised water to transfer the voltage to the target person.

Disturbances in the immune system or hormone or enzyme balance

The symptoms of electrical hypersensitivity resemble rheumatic reactions connected with the auto immune system. There are indications that the auto immune system itself becomes disturbed. 20-30% of patients diagnosed with one or more porphyrin enzyme deficiencies (Porphyria) become EHS and sun sensitive. Porphyria also leads to heavy metal toxicity as the liver loses its ability to detoxify properly. This causes chemicals and heavy metals to be re-circulated and stored in various parts of the body. Porphyria can also be induced by a combination of exposures to chemicals found in pharmaceuticals and pesticides.

Nuclear weapons tests

It is unclear what role nuclear weapons test exposure may have in deranging people's biochemical responses, but it is possible that it may.

In February 2002 a US government study reported that 15,000 cancer deaths had been caused in the US alone by radioactive fallout from Cold War nuclear weapons tests worldwide. They also suggested that a further 20,000 nonfatal cancers among US residents born after 1951 could be linked to fallout from aboveground weapons tests. When fallout from all domestic and foreign tests was combined, no US resident born after 1951 escaped exposure, according to the study. Dr Alice Stewart has shown that a sensitive sub-group of the population is highly affected by very low doses of radiation, well below those thought to cause problems by 'official' government bodies, so the total numbers of related cancers may be many times higher than the US study predicted.

Contamination from the Chernobyl explosion on 26th April 1986 can still be detected in Britain. A few years later, one of the authors of this book had a whole body scan. This is where you lie on a stretcher that passes slowly through a chamber with sensitive radiation detectors (it takes about 20 minutes). These chambers have to be made from recovered first-world warship steel, because all steel made since the 1940s is too contaminated with radioactive particles to be used – it gives background readings that are too high! Alasdair Philips had a high peak for Caesium 137 which only comes from nuclear facilities, which he has never lived near, and nuclear bomb fall out. The possible explanation that was suggested by the researchers was that they had found some people who regularly drank herb tea who had similar peaks and that they thought that the herbs were contaminated by the Chernobyl fall out. Evidently many herb teas are grown in Eastern Europe. So much for healthy drinking!

3. How EHS affects people

When a person starts to show symptoms of problems after exposure to an initiator, sensitivity tends to increase and individuals claim they react to more and more kinds of electrical equipment. This is because exposure to a previously innocuous substance or frequency while reacting to an allergen, can lead to an increasing sensitivity to that substance or frequency.

A high-profile EHS sufferer was reported in the Norwegian papers in March 2002. The World Health Organisation (WHO) Director-General and former Norwegian Prime Minister, medical doctor and master of public health, Gro Harlem Brundtland, gets headaches every time she's near a mobile phone. She has become so sensitive to mobile phone radiation that people within 4 metres of her must turn their phones off in order to stop her feeling ill. Even phones turned on, but not in use, set off her headaches. She thought she could avoid the pain by reducing the time she spent on the phone, but it didn't help. The headache she gets from the radiation goes away within half an hour to an hour after her exposure stops.

She gets an instant reaction if she touches a DECT phone, which gives off as much microwave radiation as a mobile phone. She also has symptoms from her laptop PC, but not a desktop PC. If she holds it to read what's on the screen, she says *"it feels like I get an electric shock through my arms."* She says *"Some people develop sensitivity to electricity and radiation from equipment such as mobile phones and personal computers. Whether this sensitivity can lead to serious outcomes such as cancer or other diseases, we still do not know, but I am convinced this must be taken seriously."*

Symptoms of electrical hypersensitivity can occur in the presence of most types of energy within the electromagnetic spectrum (ELF, VLF, RF, infrared radiation and sunlight), though individuals with EHS are primarily sensitive to certain frequencies of EMF. The symptoms can be very variable, affecting most systems in the body and they vary in severity. Research carried out by Lyskov et al [2001, 2001] and Sandstrom et al [2003], indicated distinctive differences in physiological parameters between patients with EHS and those without, both in resting conditions as well as in responsiveness to sensor stimulation. They reported that patients with EHS have an imbalance in the autonomic regulation, mainly sympathetic hypertone, increased responsiveness to a variety of environmental stimuli and psychophysiological signs of sustained arousal. They believe that sustained arousal and altered stress responsivity are important factors in the genesis of different forms of IEI or Idiopathic Environmental Intolerance.

Many of the symptoms are also commonly experienced in other stress related conditions, which is why it is difficult to have EHS accepted as a diagnosis. A multifactorial background implies that the symptoms can be caused by a number of different situations which in turn means that not everyone with a particular symptom or combination of symptoms will have developed them through the same causal chain. Another characteristic of a multifactorial background is that a combination of factors, possibly a large number of factors, will have to be present before the symptoms present themselves.

Hillert (1999) surveyed a number of people reporting hypersensitivity and concluded that skin, and not neurovegetative symptoms, characterize the syndrome, at least during the first years of illness. Stenberg (2002) concluded that people with skin symptoms had a better prognosis than those with a more generalised sensitivity to electricity. Eltiti et al [2007] developed a

questionnaire with 8 subsets of symptoms: neurovegetative, skin, auditory, headache, cardiorespiratory, cold-related, locomotor and allergy-related. People with EHS showed a greater severity of symptoms on all subscales compared to the control group. On a self-assessment part of the questionnaire, there were significant differences between people with EHS and others according to their responses to the sources of EMFs listed below. The percentages given here are based on their responses as to whether they believed their symptoms were linked to their exposure “quite a bit” or “a great deal”. The number outside the bracket is the percentage of people with EHS who link the two and the number inside the bracket are the control (non-EHS) group who linked the two.

- Chemicals 26% (7%)
- Computers 42% (6%)
- Electrical appliances 42% (less than 1%)
- Fluorescent lighting 42% (2%)
- Microwave ovens 32% (2%)
- Powerlines 40% (4%)
- Radio/TV transmitters 48% (3%)
- Telecommunications masts 60% (4%)
- Televisions 46% (2%)

This may be a very useful tool to help researchers identify the subgroup of people with EHS, so that they do not get ‘lost’ in studies of the general population.

There has to be a combination of a number of the symptoms, plus the fact that these symptoms *noticeably* appear or get worse near electrical appliances, power lines, mobile phones, mobile phone base stations and / or other electromagnetic field sources, and that they *diminish* (or *occasionally disappear*) away from the EMF source. We do not know the time scales for the development of EHS, nor the time scales for the effects to go away when the person is in an electrically quieter environment. We do know from repeated anecdotal evidence that the more highly EHS a person is, and the longer they have suffered from it, then the longer it takes for the symptoms to subside when they go away to an electrically quiet place (like a cottage without electricity). We do know that it can take at least several weeks for the benefits to be felt. It has been suggested at a seminar on EHS held at the Royal College of Medicine, London, in September 2003, that 3 months should be allowed for the body to detoxify after an acute exposure, before an attempt is made to re-introduce the offending EMF source. People with skin-only symptoms are reported to have a better prognosis, with the cessation of symptoms expected after some months. Experience, especially from Sweden, suggests that early intervention in helping people manage their EHS may prevent an aggravation of symptoms, and possibly lead to a better prognosis.

People vary in their sensitivity to EMFs, and a proportion of the population can become EHS possibly triggered off by exposure to one or more of the other pollutants, especially chemicals, mentioned above. We estimate (from assessing various sources of information) that about 3 to 5% of the population of industrialised societies are significantly EHS and maybe up to 35 % show some indications of electro-stress. The problem with normal epidemiology (the study of health in the population) is that it still looks for problems to show up in studies of whole, “randomly selected”, groups of the population. This worked well when looking for the causes of cholera or malaria, but when only a small percentage of the population are strongly affected, what should be strong evidence disappears into the “noise”.

The Doll-Hill [1956] smoking risk figures were re-examined by Sam Milham [1998]. The Relative Risk (RR) for heavy smokers with respect to non-smokers is 23.7; compared with light smokers it falls to 3.5 and with medium smokers to a mere 1.9. These are typical RRs we see in many

epidemiological studies into possible EMF related adverse health outcomes. We are all exposed to light or medium levels of EMF pollution, so even if EMFs cause a lot of chronic health problems, they would be unlikely to stand out from the background noise in whole, or random, population studies.

For example, say that 3% of the population have tension-type headaches caused by exposure to a particular EMF frequency, but the other 97% do not. Say also that we are looking at chronic headaches that occur daily in 3%, and weekly in about 15%, of the UK general population (NHS data, excluding migraines) due to other, usually stress related, causes. We then split the population into two groups, one that we believe are regularly exposed to this particular EMF, and one who are not. This process is itself, very subject to a large degree of error due to the crude methods we have in assessing EMF exposure over large groups of people, but let us, for now, assume we could perfectly do this separation into the two groups.

In the 'unexposed' group we would have a frequent headache occurrence of somewhere between 5 and 10%, say 7.5%. In the 'exposed' group we would still have this 5 to 10% from other causes plus an additional few % from the electrically sensitive people. This would be less than the 3% figure, because evidence suggests that people who are EHS often also react adversely to other environmental stresses. Let us say an extra 2% of the 'exposed' group would develop headaches. So the chance of someone developing a headache when exposed to this EMF would apparently increase from 7.5 in 100 to 9.5 in 100, a Relative Risk of only 1.3 which is non-significant and completely lost in the natural variation of 5 to 10% (0.7 to 1.3) of the unexposed population. Anything less than a doubling in incidence will certainly be ignored by regulators and it is usually necessary to have a three or four-fold increase in incidence before stricter guidelines are introduced. However, 2% of a population of 60 million people (approx UK population) actually represents extra suffering by 1,200,000 individuals!

That simplistic analysis was done assuming one effect (headache) with one type of EMF exposure. Of course, in practice, both the effects and the exposures are much more complex than that, so the 'cause and effect' relationship is even harder to identify. It is also probably impossible to find the control group of "EMF-unexposed people" within any modern developed society. This will weaken the results of any comparisons between the reactions or symptoms of "exposed" and "unexposed" people.

Indeed, most epidemiology still seems to ignore the modern epidemiological concept that it is necessary to identify susceptible sub-groups in the population and to advise guidelines that help protect these vulnerable people. Gone is the time that we can expect to identify problems caused by single factors that affect almost everyone exposed (e.g. cholera spread by drinking contaminated water). We now have many different and novel hazards that people react to in different ways, some being more susceptible to them than others. In whole population studies, the problems of susceptible individuals will always get masked by the majority of people and so the apparent relative risks (RR) are low and usually insignificant, whereas they are *much* higher and significant for the *susceptible groups* of people. At the 2001 Bradford-Hill Memorial Lecture, Dr David Strachan described the modern task of epidemiology to help provide "*safety for the susceptible*". This requires a significant change of emphasis for many epidemiologists and public health officials.

The following lists the groups of symptoms that are reported by people who suffer from EHS. Most of the symptoms are also experienced in other disorders. Research by a Swedish Trade Union [see references and websites] looked at the incidence of EHS symptoms in Union members in 1993 & 1996 which were reported as very serious. Many of the problems associated with VDU use, where EHS was first recognised, begin with eye problems and facial heat or burning. The

problems, if not addressed, then are associated with other symptoms, indicating that neurological systems are becoming affected.

Eyes

4.9% were very seriously affected in 1993 and 14.6% in 1996. Eye trouble is the most frequent symptom reported. People experience difficulty in seeing, or they have a smarting, irritating sensation, pain, or a feeling as if they had grit in the eyes. People can become sensitive to light, especially from fluorescent lights, computer screens, and even sunshine. Since MC became electrically sensitive, he has been able to see the flicker from fluorescent lights and the TV screen, which he is unable to watch. He was unable to see the flicker before his EHS started.

Skin

4.7% were very seriously affected in 1993 and 12.0% in 1996. Skin problems are the second most frequently experienced symptoms. The skin feels dry, can go red and rashes develop. These are likely to be similar to the rashes resulting from allergic responses, with an increased number of mast cells in the dermis. Much of the work carried out since the early 1990s by Olle Johansson and his team at the Karolinska Institute in Stockholm, Sweden, has shown these effects and they have published hypotheses to support their findings (Rajkovic 2005). These can be accompanied by tingling sensations, both facially and / or over other parts of the body. A Japanese study showed that microwave radiation enhanced some allergy-induced skin wheal responses, but not all. It has been established experimentally that electrical stimulation of the hippocampal-amygdaloid complex of EHS people have produced the experience of vibrations or tingling sensations.

Three people living in the vicinity of a mobile phone base station developed severe skin rashes. One rash lasted for 6 weeks and the other two for approximately one year before they all had to resort to a course of steroids to get rid of it. Since then there have been a number of anecdotal reports of sensitive people living near to mobile phone base stations developing unusual rashes, often all over their body.

Other symptoms experienced on the face or in the head

Faces feel swollen, they sting, and blisters can appear. People experience warmth, or a burning sensation in the face, not unlike strong sunburn. The mucous membranes can feel dry or can become swollen, resulting in nonviral / bacterial swelling of nose, throat, ear and sinuses. They can get blisters and a metallic taste in the mouth. They might feel pain in their teeth and jaws, and it can spread all over the face. Ears can feel blocked up, and noses sometimes itch. People may suffer from headaches which can be accompanied by a buzzing sound or feelings of depression. Swollen glands have also been reported.

The Swedish study reported symptoms involving:

Nose	1993 - 2.3% very serious;	1996 - 5.6% very serious
Stinging Face	1993 - 4.2% very serious;	1996 - 11.7% very serious
Mouth	1993 - 1.2% very serious;	1996 - 3.7% very serious
Facial Pain	1993 - 2.0% very serious;	1996 - 7.4% very serious
Mucous Membranes	1993 - 2.4% very serious;	1996 - 6.5% very serious
Headaches	1993 - 4.2% very serious;	1996 - 8.8% very serious

Joint, muscle, limb and nerve sensations

EHS people can get aches, pain, numbness, or prickling sensations in joints, bones and muscles in shoulders, arms, legs, feet, wrists, ankles, elbows and pelvis and cramp in arms and legs. This can develop into chronic, sometimes severe pain, especially fibromyalgia. These changes have been linked to magnesium deficiency, especially combined with selenium & thiamine deficiency [Durrant-Peatfield]. Hypothyroidism (too little thyroxine), has been linked to fibromyalgia and ME. It has been suggested that levels of domestic and industrial pollution may be responsible.

Joint Pains	1993 - 5.3% very serious;	1996 - 10.0% very serious
Numbness	1993 - 2.8% very serious;	1996 - 7.1% very serious

Tiredness & dizziness

Feelings of abnormal tiredness, weakness, tremor, faintness and dizziness can be experienced.

Tiredness	1993 - 4.9% very serious;	1996 - 11.0% very serious
Dizziness	1993 - 2.3% very serious;	1996 - 5.3% very serious

Ingestion and digestion disturbances

dry mouth, loss of appetite [Ray & Behari, 1990, Navarro et al, 2003], nausea, excessive thirst, loss of taste, gagging, sickly feeling in stomach, stomach upset, bowel disturbances.

Cardiac problems

You may experience irregular heartbeats (arrhythmia).

Breathing

People with EHS might have difficulty in breathing. They may have shallow laboured breath, breathlessness, or a feeling of pressure in the chest. They may develop an intolerance to perfume. Some people cannot manage to be indoors unless they are in a draught of outdoor fresh air.

Breathing	1993 - 2.0% very serious;	1996 - 4.2% very serious
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Haematological effects

Profuse nose bleeds and blood pressure changes.

Cognitive

The person with EHS complains of being unable to think, finding it difficult to concentrate and suffering from memory loss, the latter two particularly in people who use mobile phones often. They first notice the problem with regard to short-term memory. It is unclear whether there may be longer-term repercussions. The person with EHS may experience periods of 'missing time', or blackouts, which can be induced by external electric fields on the sensitised EHS brain, producing this epileptic-like activity.

Psychological

Bouts of extreme rage, violence, destructiveness, irritability, feelings of hostility may develop. Feelings of depression, crying day and night, feeling unsociable, wanting to withdraw, even suicidal tendencies, are reported. Anxiety, hysteria, feeling insane, out of control, mind interfered with can follow.

Behavioural disturbances

People may roll on the floor, be restless, agitated, very disturbed. Their bodies won't hold adjustments, spontaneous snapping out of neck and spinal vertebrae, and spinal and lower backache. Adolescents who are at the centre of 'poltergeist' phenomena are always EHS.

Sufferers may get a generalised feeling of impending influenza that never quite breaks out. This is quiet common, especially in the early stages of becoming EHS.

People may experience weight gain, low body temperature and pulse rate and lupus-like symptoms.

Some people get abdominal pressure and pain, paralysis, balance problems, body and / or muscle spasms, convulsions, confusion and sleep disturbances [The NEMESIS Project, Mueller et al]. There is an indication that increased electrosensitivity in the evening might be associated with impaired sleep quality. Temperature changes, including a rise in the groin and rectal area, loss of libido and rectal twitching and pain may be experienced. Some develop rare diseases, such as Myasthenia or Sjogrens disease or thyroid problems. People with EHS may feel vibration in the walls around them, and a loss of sense of touch.

People who are most severely affected by EHS, also become exquisitely sensitive to daylight (porphyria), wearing tinted glasses, or even having to keep indoors during the day, only opening curtains and venturing out in the dark.

This sensitivity can extend to other senses, (hyperaesthesia) perhaps hearing sounds outside the 'normal' range, so the microwave signals from mobile phone base stations or radar or other similar installations may register as clicks, humming, buzzing, hissing or a high-pitched whine. This has sometimes been diagnosed as 'tinnitus', a misdiagnosis. It has been suggested that this auditory effect could be due to a change in rigidity in the middle ear, caused by the lowering of the threshold of excitation of muscles, as microwaves can depolarise nerve and muscle cells. It also may be that the microwaves resonate within the brain cavity and the sensation is registered by the brain as if it were sound. Lin & Wang (2007) suggested that a microwave pulse can be absorbed by the soft tissues in the head, and it then launches a "thermoelastic wave of acoustic pressure that travels by bone conduction to the inner ear." It then "activates the cochlear receptors via the same process involved for normal hearing." Earplugs will not change this way of 'hearing' microwaves, so clearly the mechanism is directly experienced by the brain, without the involvement of the ears.

There are many people who hear the 'Hum'. There have been theories about what may be causing this highly disruptive sound, and there may be more than one source. If you are interested in finding out more about this condition, see the Hum website in the references section.

Many EHS sufferers have immune system abnormalities. Evidence from those who also experience MCS indicates a possible link to hypothyroidism, a metabolism problem at a cellular

level, possibly due to cell receptor inactivation caused by heavy metals and toxic chemicals (including pesticide exposure at an early age).

Resonance migraines are present in most EHS people. There are five types of migraines, three of which do not have the severe head pains that are commonly associated with migraines. It is believed that resonance migraines are caused as a result of pulsed fields on the brain stem.

The growth of bacteria and yeasts is affected by specific frequencies.

The emission of electromagnetic fields from a small number of EHS people is able to cause electrical equipment to malfunction. It is possible to record these personal fields as a static-like noise on a recording. Fields of between 0.5 Hz and 30 Hz are typically emitted; some researchers have recorded a range up to about 2,000 Hz, and one leading researcher recorded 2 MHz. Such fields are emitted as coherent oscillations due to the body of that particular EHS person re-radiating ambient fields. These signals can actually be large enough to produce allergic reactions in sensitive individuals nearby.

If electric bulbs keep failing in your home, it may be that the voltage to your home, as supplied by the Electricity Industry, is too high. Bulbs are manufactured to European standards to function at 230 volts. The British supply was changed from 240 volts +/- 6% to 230 volts - 6% + 22% in order to avoid the expense necessary in changing the supply network. This has resulted in supplies being well above the nominal 230 volts, especially near to substations. A 20% over-voltage will reduce the life of a bulb by a factor of about 4. If incandescent bulbs are affected wherever the EHS person goes, without exception, then it is more likely to be due to the person.

Once a sensitivity has developed, the following can provoke symptoms:

- Laptop computers when used with their mains adapters
- Televisions
- Battery-operated appliances
- Fish tank heaters or lights
- Telephones, answering machines and faxes
- Mobile and digital cordless phones, including other people's, even in standby mode
- Refrigerators, freezers, electric cookers (including induction hobs), vacuum cleaners etc.
- Photocopiers
- Signalling circuits for cable TV
- Lamps with attached or built-in transformers, dimmer switches
- Fire alarms and burglar alarms
- Fluorescent lights
- Low energy, mercury and sodium lights
- Fuse panels
- Pylons, powerlines, substations
- Underground electric cables
- Water and gas pipelines with associated 'net' currents
- Uninterrupted Power Supply (UPS)
- Electric fields due to house wiring
- Hearing-aid induction loops
- Electrical 'noise' in trains, underground trains, trams, buses and cars
- Mobile phone base station masts
- Fan rooms

- High-frequency amplitude-modulated light
- Heat
- Computer monitors (VDTs, VDUs) - problems have been experienced as being worse in people with mercury/amalgam fillings in the teeth
- Electronic medical procedures, especially MRI scans
- Daylight
- Electronic 'anti-theft' tagging scanners at the exits to many department stores.
- Thyristors (used for controlling power in appliances - vacuum cleaners, cooker fans, etc)
- Some new, up-market cars, especially those with RF CANBUS, or Bluetooth-enabled systems.
- Wireless enabled lap tops
- Laser beams in supermarkets
- WLAN systems in trains and train stations
- Weather changes

According to evidence collected by Kjell Hansson Mild in Sweden, of 18 people who reported symptoms from base station exposure, 17 were generally EHS. In a study by Fransson of Swedish Union members (SIF), 18% of sufferers had 7 or more symptoms. Small companies (0-9 union members) had a higher percentage of personnel with symptoms. Most respondents said that no measures had been taken at their workplaces in connection with their problems, and only those people reporting more than 10 symptoms had reported them as work-related injuries to the National Insurance office.

At first, the symptoms have an intermittent character and disappear after a short-term rest away from the EMF source, but for some patients the symptoms become more persistent. In the study by Fox, worker's symptoms became sufficiently severe that 25% had to modify their lifestyles in different ways and 75% had ongoing symptoms that needed to be controlled by avoidance.

One person reports "one gets used to the feelings that are present 99.9% of the time so that if I am either on the mend/recuperating (not had high exposure for a while), then I am more sensitive when I am next exposed to a significant EMF. If I am somewhat overloaded then my body seems to go into a quiescent state for a while, only to feel really rough some time later - the Pay back!

At the moment EHS is not recognised, or at best reluctantly recognised, by GPs in the UK. This may change as the result of a report in October 2005, by Dr Neil Irvine, commissioned by the Health Protection Agency - Radiological Protection Division (HPA-RPD, used to be the NRPB), which acknowledges EHS as a multi-faceted syndrome, which sets the scene for it being a recognised valid diagnosis and calls for more research into treatment and causes (see Appendix). The condition is well established in Sweden, where EHS was recognised as a physical impairment in 2000, and Norway. About 300,000 Swedish men and women are sufferers. In Austria, 64% of GPs are convinced that ambient EMFs can cause health problems when considered together with other environmental stressors.

Electricity has been around for a long time, and the benefits have been focused on almost exclusively, without any consideration to a potential harmful side, except for electric shocks. One of the difficulties of studying the condition is that hospitals are almost impossible for many EHS sufferers to enter, due to the high technology used there, including reliance on fluorescent lighting. The medical profession tend to dismiss the symptoms (which could be due to other problems) and concerns (which can be dismissed as stress or anxiety) of sufferers, prescribing tranquillisers and / or referring patients to their psychiatric colleagues for treatment. Recent figures on the UK National Health Service explain why such referrals are so readily made. The

service contains approximately 31,000 GPs, 34,000 psychiatrists, 10,000 psychologists, 1,200 toxicologists and only 350 neurologists.

It is clear why GPs might refer patients to their psychiatric colleagues (apart from the number of them). We do not have the sensitive instrumentation to quantify people's subjective experiences of pain, tingling, etc. These are very real experiences but can only be expressed in subjective terminology. People vary in their ability to describe their own symptoms, and further problems arise depending on the experience and appropriate vocabulary of the person to whom these symptoms are being described. Psychiatrists are accustomed to attempting to make sense of subjective terminology.

Access to medical services can be very problematic for sufferers of EHS. Not only are hospitals almost impossible to enter due to the EMF pollution levels, but also dental practices rely heavily on fluorescent lighting for good visibility. Halogen lights commonly used in practices are basically bright filament lights and should not be a problem as long as the transformer is some distance from the patient. It is unclear what effect these may have on people who have become photosensitive.

People suffering from EHS can also suffer from hallucinatory experiences. Brain research by scientists such as Wilder Penfield has shown that different brain areas, when they are stimulated electrically give rise to a wide variety of experiences and hallucinatory effects. EMFs in the house of a person with EHS can produce a complex series of visual hallucinations and odd sensations which can be very strange indeed. The areas called the temporal lobes, which are the most electrically unstable brain areas, create a feeling called a 'sense of presence' when they are irradiated by an electronic signal. This is where a person has the overwhelming feeling that someone is in the room with them and they are being watched, although nothing can be seen. [For a thorough analysis of these issues, see Budden].

Psychologist Dr Michael Persinger, who has researched into the sensitivities of the temporal lobes, has found that this brain area in particular is responsible for paranormal experiences. He states: *"These areas are also the most electrically labile portions of the human brain of people who display limbic or temporal lobe epilepsy. People with this enhanced electrical lability often display quantitative increases in the report of mystical or paranormal experiences, altered states, or an inordinate interest in poetry, philosophical or religious themes."*

Some people with EHS can apparently detect information stored as electromagnetic fields in the water of the bricks and cement of buildings. They may also be able to access information from the nervous system of others, much like an electric fish can detect impulses from other living organisms in its environment. This is a testable sixth sense, and doctors working in this field take for granted that EHS people have paranormal experiences due to the emission of these personal fields when in a hypersensitive state. Some of the apparitions that these people report may not be hallucinations, but actual 'recordings' made by the electrical emissions of other people who are EHS that have been stored in the materials that buildings are constructed of. Therefore, the person with EHS may see (or feel) hallucinations which are generated within the brain due to the stimulation of external electromagnetic fields to which the skull is entirely transparent, or due to their ability to read personal recordings.

It is easy to see how the difficulty the patient has in describing their symptoms can be handed over to psychiatric experts, who are more experienced in dealing with abnormalities of people's experience when they relate to the external world, or in describing their internal reality. The difficulty arises when the experiences of the electrically sensitive are dealt with as if they are describing a *distortion* of 'reality', a subjective abnormal response to a benign environment.

Patients with diagnosed psychiatric disorders are often treated with drugs for cognitive or chemical imbalances. EHS people, after referral for psychiatric consultations, may be offered such drug therapy, and, in fact, some EHS people's experiences *do* change after such treatment. There is no doubt that the gross chemical flooding of the neurological system by drugs can have effects that might improve the condition, although the side effects from such medication can also be very unpleasant. Some psychiatric medication can be addictive, and after taking it for some time, a person's tolerance level is reached and they can experience withdrawal symptoms whilst on the same dosage of the drug. Electrical hypersensitivity (and other idiopathic conditions) can produce neurological changes similar to those that accompany some psychiatric conditions, which may then be alleviated through drug treatment. It is impossible to assume from this that the neurological abnormalities created the electrical sensitivity.

As it can be assumed that the biological, and possibly other energy, systems of an EHS person, especially someone with severe EHS (who may also have Multiple Chemical Sensitivity (MCS)), are in a sensitised state and are likely to be more affected by such drugs, including their adverse effects, and possibly with permanent damage to organs such as the kidneys and liver as well as the brain.

Taking such drugs may be seen as an appropriate response by a doctor desperate to find a remedy for a patient whose illness they do not understand or even accept. It is difficult to see how such medication is likely to be of benefit to the EHS person, particularly in the medium to long-term. Having a history of psychiatric treatment may not be in the best interests of the patient. Their primary problem is a physical condition that could, indeed, bring on a psychological problem, as can any illness.

At the moment hypersensitive people usually cannot get entitlement to the special benefits available for people with disabilities or get any financial support for reorganising their home, without accepting some form of psychiatric diagnosis.

An environmental exposure questionnaire is not completed for most medical examinations, despite the fact that this could help reduce the number of blind alleys investigations go down. This is not just the case in the UK as we see from this report from Canada. In April 2002, the Nova Scotia Environmental Health Centre's Dr. Jonathan Fox said he sees many patients who report that their family doctors are confused by their collection of symptoms. "*An individual may have gastrointestinal symptoms which they may have been referred to a gastroenterologist to assess at the same time as they're having muscle pain and they're seeing a rheumatologist and it's often not connected together*" said Fox.

Fox estimates 15 to 20 per cent of the Canadian population may show symptoms that are linked to exposure to environmental toxins such as pesticides, lead or any of the 70,000 industrial chemicals used in Canada. The Canadian Medical Association Journal suggested that a routine environmental exposure history on new patients, or those with puzzling symptoms should be taken.

When Rea et al. did double-blind testing in an environmentally controlled unit on 16 patients who had already been thoroughly investigated and treated, all of them reacted to the 16 active challenges and none reacted to the 80 placebo challenges. Reactions were predominantly associated with the central nervous system, for instance muscle spasms and lack of coordination, but one patient had a 20% drop in pulmonary function, another a 40% increase in heart rate and two became depressed and finally collapsed. Symptoms lasted from 5 hours to 3 days.

Provocation tests are helpful in the diagnosis of patients but the conduct of neurological provocation tests warrants discussion regarding: type of test, exposure time, 'washout' times between tests, blinding, statistical aspects, ethics of provocation tests and the availability of tests.

Doctors' independent status with respect to large drug companies has come under challenge from time to time. EHS cannot be directly ameliorated by most medication, so this may have an effect on whether it is recognised, as the drug companies do not see a way of making a profit from it. Homoeopathy can help some people with EHS, but these treatments do not have the same commercial backing as allopathic treatments, and are probably not subject to the same commercial pressures.

In February 2002, the Journal of the American Medical Association revealed that the vast majority of doctors involved in establishing national guidelines on disease treatment have financial ties to the pharmaceutical industry that could potentially sway their recommendations and inappropriately influence thousands of other physicians. 87% of guideline authors had some type of relationship with drug companies, which is probably an underestimate as only 52% of the authors contacted about their involvement, for the survey, responded.

While industry ties don't necessarily mean that a doctor can't provide an objective opinion, "*it's a potential problem,*" the author of the study Dr. Allan Detsky, physician-in-chief at Mount Sinai Hospital in Toronto, told Reuters Health.

Modern medical practitioners not only fail to recognise EHS, but also other environmental illnesses. It will not make these illnesses go away, in fact they are likely to become an increasing drain on the resources of an overstretched NHS as the number of mobile phone masts keeps growing and the length of time people have used their mobile phones leads to EHS reactions. Even if it is only a subset of the population who are susceptible to this condition, it could be a subset of millions. The time is fast approaching when it will be impossible for our public health systems ignore this reality by denying it or by attributing its causation to psychological dysfunction.

Professor Brice Dickson, Chief Commissioner of the Northern Ireland Human Rights Commission wishes to have put on the agenda the human rights violation inherent in medical misdiagnosis. He has indicated his support of the right of people who are electrically hypersensitive to have their human rights grievances duly considered by Human Rights Commissions.

The following are a few real life stories of real people; some of you who have told us your story will recognise your situation. Most people's real names are not given, except where they are choosing to actively campaign for recognition of this problem. Others who are experiencing EHS and think they're alone will feel supported in the knowledge that other people know what it is like and may have similar symptoms.

Frans, who lives in Holland with his wife and daughter, fled his apartment in the Hague due to the EHS he developed there, but the new house proved to be just as bad. Although it was a reasonable distance from phone masts, he had not allowed for the effect of DECT telephones, which were much stronger than the GSM mast signals. His wife began to feel ice-cold and very tired in the new house, his daughter started itching and became hyperactive. Frans started burning. Soon, they experienced nausea, severe sweating, cognitive problems and the six year old started bed wetting. Within a few months Frans couldn't sleep at all, his skin felt as if it were burning, he was trembling and he experienced electrical sensations all over his body. He kept waking up at 3.00 a.m. with the sensation that the inside of his head had become totally fluid and was sloshing around like hot water.

His blood and urine were tested four times. No one could find a disease or pathology, though the blood tests did show cell/muscle damage and lowered pseudocholinesterase, neither inherited nor due to chemical exposure, which he concluded was probably due to chronic exposure to EMFs.

Kathy Morris, who lives in New Jersey and her sister who lives in California are both EHS. They became chemically sensitive first. Kathy says her mother was a nurse before she and her sister were born and she said that when nurses worked with x-rays in the 1940s they did not protect themselves and she thinks her mother got a lot of exposure. Kathy wonders if this could have made her mother and her two daughters susceptible. She says that the thing that would have protected her and her sister the most would have been keeping them away from high EMF sources as a habit of daily life. She wished she had been aware when she developed chemical sensitivity, that the odds of developing subsequent EHS were high.

Isabelle R experienced various minor "buzzings" throughout the night, then microwave shock, which paralysed her whole body, numbing her brain; she was unable to move for an uncertain period of time which could have been seconds or minutes. The nerves / muscles in her whole body were tingling. She had a mental picture of herself in a foetal position against the doorjamb with her hand on the light switch and a 15 amp cable coming up from the floor to the switch. This image persisted throughout the period of paralysis. She then experienced a colossal microwave pounding of the whole house, the doors were rattling, and she could hear "WOW WOW WOW" roaring noises in her head. A friend staying with her felt "buzzing" in his head, which reminded him of sensations he sometimes got when using his mobile phone.

Richard O is sensitive to quartz wristwatches. He can't wear them. They give him headaches that switch sides when he moves the watch from one arm to the other. More specifically, they affect his ability to focus his eye on that side and weaken the muscles in that arm. This sensitivity is apparently not uncommon, as he later found out in John Ott's book called "Light Radiation and You." [Ott, 1982]

Arthur Firstenberg [1997] became electrically sensitive in 1982 as a pre-med student at the University of California at Irvine, after he received more than 40 dental X-rays. One day he collapsed on the hospital floor with heart pains and subsequently he lost 15 pounds in two weeks. He also grew short of breath around electrical equipment. He still managed to graduate from Cornell University with a degree in mathematics and a minor in physics.

He can detect, and reacts to, the electromagnetic fields emitted by everything from hair driers to power lines. He is president of Wireless Free Mendocino, a group that wants to ban wireless services from Mendocino, a village on California's Northern Coast.

One of the targets he has been attacking is the American Telecommunications Act of 1996, which prohibits local governments from banning wireless facilities on the grounds of the environmental effects of the radio frequency emissions. A teacher in the high school, which fought hard to establish a high-speed wireless Internet service in the village last year, says "this overexposure to pulsed microwaves has been a personal tragedy for me. I'm left hypersensitive, even my mouse burns my hand when I use my computer now."

Firstenberg says he and the group are fighting to protect the health of the townspeople, but his detractors say they have created a brain drain of entrepreneurs to more 'connected' locales, bogging Mendocino down in low-paying tourism industry jobs and reducing future opportunities. If he visits wireless-saturated San Francisco, three hours south of Mendocino, he

experiences multiple symptoms, including an unquenchable thirst, a pressure in his chest and behind his eyeballs, and "buzzing sensations" in his lips.

Chloe T became EHS following a Magnetic Resonance Imaging scan 8 years ago and has become progressively more sun sensitive in recent years. Some of the Gadolinium salts injected into MRI subjects, as contrast enhancers, are known to be quite toxic. She now has stinging and burning sensations from the hips down. When she moved into a house with 0.01-0.02 microtesla magnetic fields (lower than average), her nerves continued to be irritated, though we don't know what the *electric* fields in the house were like. Going outdoors to do some gardening, she believes that the fading UV light really fires up her nerve endings.

Derek B also reacted to an MRI scan, feeling an extreme burning sensation in his chest. Subsequently, he experienced chest pain and headaches when near an EMF source.

Mary F, a former researcher at the University of Vancouver BC, developed EHS after working with x-rays to monitor seedling growth in order to cultivate the forests of Canada. Exposure to chemicals induces the same symptoms as if she were exposed to EMF radiation. So when doctors injected her with the ionised chemical solution required to have an MRI, Mary became paralysed and to date still has to use a wheel chair to get around.

When Yumio M, a housewife and mother of two, approaches operating electric appliances, such as microwave ovens, she suffers headaches, dizziness and tingling sensations. She went on holiday last year and stayed in a cottage equipped with an induction hob. When her friend turned the cooker on, her body was thrown backward as if she received a heavy blow -- even though she was standing almost a meter away from it. She said she immediately left, but headaches, dizziness and tingling continued for about an hour.

Christina N's EHS was initiated when she was on holiday, in her 50s, when there was a violent electric storm. She has been subject to severe pain whenever she is in contact with electricity for the twenty years that have followed this exposure, and has to have her shoes especially lined so she does not feel pain whilst out walking, when she may step over underground cables. She has to wrap herself in a survival blanket and wear rubber boots during electric storms to stop the pain she experiences becoming unbearable. Homoeopathic de-sensitising drops, taken daily, help.

Melvin became rapidly ill after being exposed to fluorescent lighting and a high number of computers, CTR and LCD screens at work for 2 years. His main symptoms were dry burning eyes and face. From the first symptoms to his being too ill to work was only 3 months. He took vitamin and mineral supplements, homoeopathic medication and after a year could begin to use a computer again, with keyboard and mouse extensions to keep the equipment well away from him. He is still bothered by fluorescent lights and CRT screens and TVs if he is too close.

Donna S took her own life when she could not find the answers to "How will I survive when no doctor, no lawyer and few friends and family members will believe that I am so sensitive to electromagnetic fields? Who will be my advocate when I am too sick to be my own? How can I face the prospect of never again being able to participate in normal society?"

In Sweden Gunni Nordstrom and Carl von Scheele, two journalists, wrote one book with case histories of about 10 people, and then another book with a few follow-ups and more about EHS in general.

Animal Case histories

In 1963 Peter G was an Air Traffic Controller in East Anglia. Aircraft were talked down to the ground in bad visibility using a Ground Control Approach Radar by the side of the runway. On summer nights, waiting for the first sorties of night flying to leave, it was common practice for the 3 radar controllers to sit outside the radar truck and enjoy the summer evenings.

They became very familiar with a barn owl who seemed to have a regular patrol route, flying about five feet above the ground, some 20 to 30 feet in front of the radar and consequently through the radar beams.

The Search Radar beam (which rotated through 360 degrees) appeared to have no adverse effects on the bird, regardless of whether Circular Polarisation was used or not. However, it was a source of some amusement that the owl's steady and sedate flight would suddenly become erratic (in height and heading) as the owl entered the coverage of the Precision Radar beams. These were electronically scanned through 20 degrees in azimuth and 6 degrees in elevation from the truck into the runway approach lane.

PG remembers with particular interest that they observed that the owl's flight was not affected on one occasion when the Precision Radar was off the air for maintenance but the Search Radar was still working. He recalls that they repeated the experiment by switching off the Precision Radar to confirm that the erratic flight only took place when the owl was within the Precision Radar Coverage.

4. The Biology of EHS and Research

We have evolved and live in a world that is primarily governed by electromagnetic interactions. Many traditional main-line scientists still hold that bio-chemical reactions are the ones that are really important, however it is increasingly clear that at a quantum level it is electric and magnetic fields that control chemical and bio-chemical interactions. The best scientific text book, by far, at the moment is, without doubt, **Magnetobiology - Underlying Physical Problems** by Vladimir Binhi [2002]. In our opinion this requires the reader to have a minimum of university entrance requirements understanding of physics and / or mathematics, but it is a comprehensive over-view of this whole subject area.

All living beings detect and use information in order to survive. This essential fact is not taken into account in most of the EMF research that has assumed “averaged energy” is the active factor. Our direct senses of sight, sound, etc., are only of use because we extract information from the physical responses of our sensors. Language, music, art, science and other human endeavours only exist because we interpret and use informational input.

Imagine attending a performance of the Swan Lake ballet. Conventional physical and medical science could record the movements and sounds and analyse them into data sets and look for patterns. It could also analyse the clothes of the dancer, and the ballet shoes, their materials and method of construction. But it would completely miss the whole point of the ballet, and would be able to say nothing about the human (invoked) response to the ballet.

We can only measure things our instruments are capable of measuring within their physical, chemical and biological limitations. It is possible that the measuring equipment cannot objectify the contents of individual perception, or that individual experiences can't be represented by measuring processes using methods of experimental research design in a laboratory. It is possible that the stimuli are only perceived at certain times and you are measuring during the wrong time period. It may also be dependent on the physiological and psychological well being of the person which is also likely to be time dependent. You might have to allow for a synergic interaction between individual-specific substances that cause allergic reactions and this might be connected to inter-individual differing specific windows to the EMF.

Sensitivity to stimuli may be determined by selection of information, which is influenced by the person's own sensory experience and perception and also their cognitive information resources for differentiating the stimuli. Bob Coghill of the Wake Forest University School of Medicine in Winston-Salem, North Carolina, tested the pain sensitivity of 17 healthy volunteers normally, and when they were in MRI brain scanners, the scans showed very different responses depending on whether the volunteers had previously expressed the ability to bear pain. The thalamus, which receives pain messages from the spinal cord and peripheral nerves, was active in all 17. Those least able to bear pain showed more activity in the cerebral cortex, associated with higher cognitive function. The Leitgeb & Schröttner study [2003] showed that EHS people had a higher level of cortical arousal, as well as other differences in physiological baselines, than non-EHS people. Coghill's conclusion was that the pain was not dampened en route to the brain, so all the differences must be due to the way the cerebral cortex interprets the information based on prior experience. People suffering from EHS may be 'conditioned' to respond far more strongly to

stimuli than other people, following the sensitisation of parts of the brain from some as yet unidentified electro-bio-chemical signal.

We also have to distinguish between sensory and extrasensory perception.

An important factor is an unspecific fear about risks occurring from poorly understood technologies. This fear cannot be formulated in an explicit way.

The general and technical interest in power frequency electromagnetic and radiofrequency emissions has resulted in the publication of between 1100 and 1800 articles per year between 1990 and 1994, the last year for which we have seen data. It is difficult to know how to deal with the amount of information on the subject, never mind try to summarise it. What is listed below, is clearly only a tiny number with our selection bias.

Quite a lot of research has been done on the effects of electromagnetic fields on cell biology. Quite a lot of epidemiology has been carried out into whether EMFs are associated with adverse health problems in the community.

In February 2006, at a meeting of the Dutch working group on EHS, Hugo Schooneveld, a neurobiologist, and himself a sufferer, showed how different radiation can have different effects on different people. He showed that there may be some delay before health effects are experienced. Indeed they can be perceived as positive at first and negative after a lengthy exposure. Sometimes low and high exposure do not have effects, but exposure in between has (called a 'window' effect, see below). He also confirmed from his clinical experience that although EMFs may only cause small effects in biological systems, small effects on a cellular level can lead to large consequences on the organ level.

However, people who experience acute or chronic symptoms of EHS are in a minority (though a significant one) of the population, and so the effects would disappear 'into the noise' in a randomised study of the general population. Little research has been done specifically into what biological changes are associated with the EHS condition, especially as it is not yet recognised as a medical condition in most countries.

Dr Cyril Smith, a retired UK bio-physicist, with a deep interest in homoeopathy and living systems' reactions to electromagnetic fields says that the frequency patterns of mobile phones and their masts can resemble the homoeopathic equivalent of toxic chemicals and therefore be effectively causing chronic poisoning of the population. He produces homoeopathic remedies on an individual basis after testing the patient, or remotely using a sample of the patient's hair. He has worked with Dr Rae at his clinic in the USA.

It is always an assumption, which does not necessarily hold true, that cellular effects found in the laboratory are the same as the cellular effects in the bodies of living beings in the world at large. It is also assumed that no effects in the laboratory means that there are no effects in the population. However, the laboratory is a place to start (even if it is an oversimplified environment, which is not always very well-controlled in EMF terms) when we are unravelling the complexities of environmental exposure. Because of the type of responses reported by EHS people, there is likely to be a nervous system involvement and possibly a hormonal / endocrinal system involvement. It is impossible to separate out the different systems of the complex human organism with respect to its day-to-day functioning in the world; all aspects are likely to be affected to a certain degree, but the research has to start somewhere!

The National Institute of Environmental Health Sciences (NIEHS) and the US Department of Energy (DOE) state that human exposure to electric and magnetic fields (EMFs) from electrical wiring and appliances produces weak electric currents between cells in the body [1995].

Russian research [Guy, 1984] shows that bio-electrical interference or stress acting on the nervous system causes nervous system and cardiovascular system problems. When nerve cells malfunction, they can, in turn, adversely affect muscle function. A way that EMFs cause this stress is that they seem to trigger an opening of calcium flow through cellular membranes in the nervous system. This causes a strong signal in the nervous system producing an overreaction in a lot of muscles and other things controlled by the nervous system.

EHS people can reach the biologically destructive point, where they are incapable of transmitting normal nerve impulses as they did before their use of and/or exposure to electronic products.

The problem of EMFs in relation to effects on the nervous system may not be the amperage of these currents but their voltage level. The reason is that nerve cells maintain a static 60-mV positive charge on the outside and a static 70-mV negative charge on the inside. Sir John Eccles [1963] found that a difference in potential of only 15 mV across this gradient causes a nerve cell to naturally discharge an electrical pulse. The presence of a voltage between two nerve cells with a difference in potential of more or less than 15 mV can disturb their electrical balance.

In some laboratory studies the biological effects of EMFs and the weak electric currents they create in the body are:

- Changes in functions of cells and tissue
- Accelerated tumour growth
- Decrease in the hormone melatonin
- Changes in biorhythms
- Alterations of the immune system
- Changes in human brain activity and heart rate

The human immune system requires a fine balance between the two types of protector cells Th1 and Th2. Th1 cells inhibit hypersensitive reactions by reducing immunoglobulin E(IgE) levels. Th2 cells increase these levels, thus encouraging hypersensitive reactions as a side effect. Many atopic diseases are linked to a shift in the immune system profile towards Th2 dominance.

Professor Olle Johansson of the Karolinska Institute (and the Swedish National Institute of Working Life) has investigated numbers of people suffering from exposure to computer monitors (VDUs) and other EMF sources. Many of these people first suffer from skin irritation such as itching, heat sensations and reddening. In some of these people with EHS he has found the peripheral nerve fibres in the epithelium are significantly damaged. He has clear photomicrographs showing peripheral damage in the nerve endings which can be found within 10 to 20 μm (0.010 to 0.020 mm) of the skin surface (epidermis). The normal purpose of these nerve fibres is unclear, but it does appear they are involved in at least some cases of EHS. They seem to become super-sensitive and react both more quickly and more highly to external stimuli - especially electric fields and some chemicals. It is known that new electronic equipment, including computers, give off significant levels of volatile organic fire-retardant chemicals that can mimic natural body messenger chemicals, and these are believed to be involved in the triggering of EHS in some people.

Professor Johansson and colleagues, especially Dr Gangi, whose name appears first as lead author in some of the references, [1994, 1995, 1997, 2000, 2001] have found that the appearance of the

peripheral nerve damage under the microscope is similar to the sort of early damage that occurs when a person gets sunburnt. There also appears to be a large increase in the number of mast cells (as measured by mast cell markers such as histamine, chymase and tryptase) in the skin of electrosensitive people. They found that the number of mast cells in the upper dermis was increased in the EHS group, leading to itching, eczema, and other similar symptoms. A different pattern of mast cell distribution also occurred in the EHS group, namely, the normally empty zone between the dermo-epidermal junction and mid-to-upper dermis disappeared in the EHS group and, instead, this zone had a high density of mast cell infiltration. These cells also seemed to have a tendency to migrate towards the epidermis (epidermiontrophism) and many of them emptied their granular content (degranulation) in the dermal papillary layer. Furthermore, more degranulated mast cells could be seen in the dermal reticular layer in the EHS group, especially in those cases which had the mast cell epidermiontrophism phenomenon described above. Finally, in the EHS group, the cytoplasmic granules were more densely distributed and more strongly stained than in the control group, and, generally, the size of the infiltrating mast cells was found to be larger in the EHS group as well. This is similar to the effect of exposure to ionising radiation. When ordinary people were exposed to EMF radiation (from a TV) on their backs for 4 hours, they had a similar change in mast cells, which normalised after 24 hours.

Mast cells play a large role in various types of well known allergic reactions, such as asthma, and have been seen to increase in the skin of healthy volunteers sitting in front of some computer monitors. We do not know if it is the EMFs from the screen or the quality of the flashing light that is responsible. It is not uncommon for EHS people to become sensitive to most kinds of light.

In Sweden, there is a phenomenal increase in asthma amongst youngsters up to the age of 18 years. It is thought that this may be the result of an idiopathic reaction to IT and may be exacerbated by Henshaw's research on the attraction of pollutants to the static field generated by computer monitors.

Also from the Swedish National Institute of Working Life, has come research by Kjell Hansson Mild et al, who have had results indicating that EHS patients show an imbalance in the autonomic nervous system, and a tendency to increased arousal as a result of external physical factors. This was induced by audio and visual stimulation, and was measured in brain and heart reactions.

Resonance migraines which do not involve the headaches normally associated with migraines, and which are symptoms of EHS, are believed to be caused by paroxysms of electrical energy in the brain. Some of the other symptoms of resonance migraines are yawning when you're not tired, an 'ice-pick' pain, hyperactivity or fatigue, microsleep, depression or elation, disorientation, massive thirst and cardiac arrhythmia.

There are currently 5 studies of EHS underway in the UK. Four of them are to do with RF exposure from mobile phone handsets (2 from GSM 900 MHz and 2 from TETRA), the fifth is concerned with RF exposure from GSM and 3G mobile phone base stations.

Professor Luxon and colleagues are looking at whether mobile phone exposure stimulates the inner ear, as many of the symptoms reported by people with EHS are similar to those resulting from stimulation of the vestibular labyrinth.

Professor Wessely and colleagues are investigating whether certain hormones levels can be changed by exposure from GSM phones, and his team is also studying the effects of the TETRA system on serving police officers, EHS and non-EHS. This study focuses on symptoms rather than

blood changes. Professor Wessely is known for his study of Gulf War Syndrome, when he concluded that it does not exist except as a psychological condition.

The fourth study, by Dr Burgess and colleagues is looking at EEG, ECG and behavioural responses of EHS and non-EHS police officers using TETRA handsets.

The base station study is being carried out by Professor Fox's team at Essex University, testing cognitive responses and physiological changes. This reported in 2007 and found differences in responses between people with ES and those without. The differences were not significant as the numbers of people studied were too low to achieve significance.

The NRPB commissioned a public health review of EHS in order to more fully inform its advice. The review was conducted by Neil Irvine, Consultant in Public Health, Health Protection Agency, Northern Ireland. For our review of this research which reported in October 2005 see the Appendix. We feel it missed a good opportunity to give the information needed to the government and medical professionals, to offer an effective management policy to improve the wellbeing of people with EHS.

One of the stated areas of concern was secondary prevention; ways of decreasing exposure to electromagnetic radiation in susceptible individuals. This could include practical measures to avoid or decrease exposures in susceptible individuals. We feel that they discovered ways this could be done in some of the research they looked at, but deliberately chose not to recommend further work to test these findings.

The Federal Office of Public Health in Berne, Switzerland, suggest that observation and monitoring, especially by medical practitioners, should be an important part of governmental fact finding.

EMF-attributed symptoms are being collected in Germany and Australia. EHS indicators are being studied (sometimes looking at other allergies and environmental sensitivities) in Germany and Japan. EMF perception and biological responses are being studied in Austria, Finland, Germany, Korea, the Netherlands, Sweden and Switzerland. All EHS symptoms are commonly reported in the general population (prevalence range 5-60% - NRPB figure) EHS sufferers and their support groups tend to describe a much wider range of symptoms and diseases as EHS than in the research studies and literature.

Belyaev (2005) in Sweden found that when exposed to 50 Hz magnetic fields or 915 MHz microwave fields lymphocyte responses were similar to the stress response induced by heat shock.

Sleep disturbance as a symptom of EMF sensitivity are being investigated in Switzerland, the UK, Austria and Germany.

The World Health Organisation is co-ordinating a world-wide programme of EMF research and has identified studies on EHS as a priority for research, with particular emphasis being placed on possible health consequences of low-level exposure. It is also promoting discussion and debate on the use of rational, well thought-out precautionary measures based on scientific principles to minimise potential risks from new technologies or other potential risk factors. Research should consider the role of EMFs as cofactors or promoters and not just causative.

The Neil Irvine report for the HPA (above, see Appendix) concluded that it was impossible to construct even a symptom-based case definition of EHS. This has major implications for the

future study of EHS using a conventional epidemiological approach and in particular makes any findings population-specific. However, research by O Hänninen of the University of Kuopio in Finland, found people with EHS had shifts in their heart rate and blood pressure as a result of EMF exposure that were not found in the control group. He suggested that it may be possible to use recordings of circulatory parameters controlled by the autonomous nervous system in the evaluation of subjects reporting EHS. What has become clear, said the team led by Huss from Switzerland, is that EHS people have highly complex problems. Only an interdisciplinary team is likely to be able to adequately diagnose environmental related health problems and provide suitable advice to concerned persons.

Electrical hypersensitivity is also a lifestyle problem. Humans have evolved over the millennia to be naturally bio-electrically grounded. The important finding of a study by Clint Ober [see references], is that a previously unknown natural bio-electrical shield of negative ions exists in and around the body when humans maintain physical contact with the earth. This shield plays a vital role in protecting the bio-electrical activities of the body from extraneous electrical interference. Further, when humans are grounded, their nervous system calms, muscles relax, chronic pain subsides and they sleep better. The voltage levels created by electric fields found in all homes on the bodies of the participants in this study varied significantly but all were several times the potential of nerve cells. Most people now sleep within 12" of electrical wiring in the wall at the head of their bed. All of which radiate electric fields throughout the night and maintain a constant flow of measurable weak electric currents in the body. The Ober study was replicated by two other studies, acting without knowledge of each other's work at the time. Note that grounding a person within a room with significant electric fields will actually increase the person's exposure and the electric fields will be attracted towards the person's earthed body.

If Ober is right and the human body has evolved to maintain a field of negative ions in and around the body that naturally neutralizes positive ions, this natural occurring event may have a significant part in human biological development, especially with respect to the nervous system, which communicates with electrical pulses. Cilia in the trachea are part of the detoxifying mechanisms of the body. When they work well, in the presence of negative ions, the bacteria level in the body decreases and oxygen intake is increased. In the presence of positive air ionisation, the cilia efficiency is dramatically impaired.

These days almost everyone seems stressed, their muscles are tense, back and joint pain is the norm and most do not sleep well. These conditions all relate to the nervous system.

Today humans have insulated themselves from direct physical contact with the earth by wearing synthetic soled shoes and many rarely go outside in the course of their working day. Those who do may not make direct physical contact with the ground. The consequence of interrupting this natural flow of negative ions on the body is that humans now store and conduct free positive ions, including static electricity and radiated positive ions from electric-fields.

We urgently need to adopt a more holistic approach that addresses issues at the very core of the biological organisation of life processes. Presman [1970] summarised leading Soviet bioelectromagnetic insights up to that time. His work contains an outline of a holistic electromagnetic field theory of living organisms and their relationship to their environment. There is now plenty of evidence for endogenous EMFs and that significant bioeffects can result from external EMFs. One western scientist who has regularly explored these areas since the 1970s is Ross Adey [e.g. Adey, 1990]. It is now established that living organisms can react sensitively to weak EMFs. We know that weak endogenous EMFs are involved in the regeneration and growth of new tissue. EMFs (including biophotons [Brugemann, 1993]) are emitted from living beings,

and communication using EMF signals is established for some fishes and insects, and is strongly suspected as being utilised at some level by all living organisms.

Scientists need to direct their attention to 'wholeness' and ask radically new questions. Not only is our universe electromagnetic, but we are also electromagnetic beings. When the electricity is no longer within our being, our physical body ceases to function at the level we describe as living. For all our clever molecular biological genetic "fiddling" with the matter of life, we are unable to give life to a dead mass of cells.

We are dealing with living beings constantly seeking homeostasis, and a stronger signal does not necessarily mean that it will have a larger or more serious effect. Incoming information with virtually zero energy can have a dramatic effect on a person's state of wellbeing (e.g. a doctor telling a patient that they have cancer). "Understandable information" (such as sound level, language, visual information, etc) goes in through sensitive "windows". Likewise, pulsing at a regular (coherent) rate can have a dramatic effect if the repetition rate finds a natural resonance in the system upon which it impinges. That is why troops were ordered to break step when crossing a bridge. Some of our individual sensitivities are influenced by our personal genetic history and sensitivities developed during our life.

Our sensitivity is affected by:

- Age, gender, psychosocial load and other stresses.
- Physical wellness, including skin condition and conductivity.
- The biocompatibility of the incoming signals (both in energy and informational content).
- Exposure to other insults (e.g. chemicals).
- Stability of the point of optimum homeostasis.
- Response latencies and relaxation times.
- Genetic and life-history factors.

There is a very low level ELF magnetic field 'noise' (geopathic stress) from various underground natural features. These natural variations are amplified and maybe modulated by underground features and water flows.

The Earth's ambient geomagnetic field varies around the world and ranges over about 20 to 70 microtesla (20,000 - 70,000 nanotesla or gamma) range. The level in any one location varies slightly in diurnal, lunar and sidereal time frames.

At super-low frequencies we have magnetic noise from changes in the Earth's magnetic core current flows. These come to the surface of the Earth in various ways depending on the magnetic and electrical properties of the underlying strata. Old "country wisdom" has long recognised that some places are not good to live and sleep in. People used to pen cattle into fields in areas where they wanted to build a house and watch to see which parts they would choose to settle in (=good) and which parts they would avoid (=bad). Cancers and other serious illnesses were thought likely to result when people lived and slept in geopathically active areas. In Germany it is common practice for oncologists to work with dowsers to check the houses and bed places of cancer sufferers for geopathically active zones.

As we consider the extremely low frequencies (ELF) we have low level, but fairly coherent, waves generated by lightning strikes powering natural Earth-Ionosphere cavity resonances. These Schumann resonances are in the range 8 to 40 Hz, i.e. the frequency range of most endogenous human and animal body "vital signs" signals and are claimed to be important to life and health.

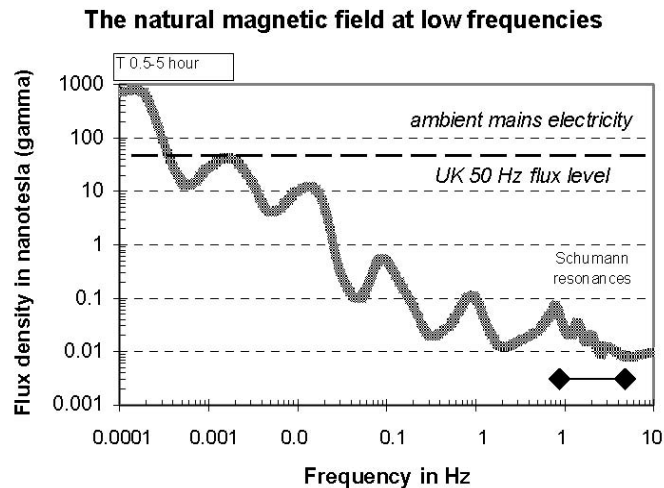


Figure 1 - Geomagnetic fields [derived from Campbell W, 1997; Spaceweb, 2002]

Figure 1 shows average geomagnetic variations, and the main Schumann resonances, against frequency. The current ambient power-frequency 50 Hz magnetic field in most UK homes and offices is around 30 – 50 nanotesla, whereas the natural Schumann signals are a factor of 1000 lower, around 50 picotesla (pT). If bodily awareness of the Schumann rhythm is important and necessary for wellbeing, then swamping this rhythm with power-frequency or pulsing microwave fields may be unwise. Because GSM mobile phone base stations pulse at ELF and VLF (217 Hz, etc) and the ICNIRP safety guidance allows up to 195 nT of ELF pulsing at mobile phone frequencies, these ‘pollutant’ pulsing signals can effectively be detected by biological tissue as over 10,000 times higher than natural ELF/VLF fields.

The human pineal gland synthesises melatonin and may be one of our main magnetic field sensors. Though some laboratories have found no effects, at least six have published the results of studies that show low-intensity ELF EMFs can suppress night time melatonin levels. We also have evidence that low levels of melatonin are associated with a number of cancers, including breast cancer. It is an ubiquitously acting endocrine gland, modifying directly or indirectly every system in the body. The pineal gland has also been associated with clairvoyance. We do not know whether people with some clairvoyant ability may be more, or less, likely to have effects from melatonin level changes.

Dr Cyril Smith calculates [see Smith, 1985; and Smith and Best, 1989] that a quantum of magnetic flux through a typical human pineal gland would result in a flux of 75 pT, and that the minimum detectable magnetic flux needed to overcome the random thermal energy in the pineal would be 240 pT. This suggests that we would only be aware of the 50 pT Schumann waves if several parts of our body were co-operatively involved with the detection process.

The auditory vibration sensitivity of a normal human ear is quite amazing at around 10^{-11} m, about the diameter of a hydrogen atom. This quantum limit to detection is achieved despite large amounts of thermal noise. To achieve this, the inner ear must possess amplifiers whose noise performance could only be achieved by traditional electronics circuitry working at near 0°K. The only way that this performance could be achieved at normal body temperature is if large numbers of cells are working in a highly co-operative and coherent way. This sensitivity cannot be described by any mechanistic chemical kinetic model, and may be representative of a more general ‘living tissue’ property. [Adey, 1998]

We do know that some birds and insects are very sensitive to the background magnetic field while flying, being able to detect changes in the order of 1 nanotesla [Keeton, 1979]. Non-modulated (i.e. CW) and FM (e.g. VHF radio) signals are merely likely to mask the subtle signals in which human beings have evolved. The pulsing amplitude of many modern data signals (e.g. mobile phone GSM TDMA signals) vibrate strongly at ELF/VLF frequencies similar to those of our own bodies' endogenous signals. These are very likely to have biological consequences.

A number of sensitive frequencies have been suggested. There is research-based evidence of types of "ion cyclotron" and "Larmor" resonance effects at various low frequency magnetic fields. These are caused by molecular resonances in the Earth's geomagnetic field. They include, amongst other effects, important cellular calcium efflux changes that have been reported by many laboratory studies. These were recently discussed in considerable detail by a leading EMF-bio-effects expert, Professor Ross Adey [1999].

We are now surrounded by unnatural pulsing electromagnetic signals millions of times stronger than were present only 50 years ago. We are "broad-band receivers" whose cells and tissue can act in non-linear ways [e.g. Wessel, 1999] to "detect" incoming RF signals; we are not frequency selective, though resonances do occur (e.g. body size resonances at VHF frequencies, and under-wired bras can resonate at cell-phone frequencies) providing windows where effects will be enhanced. Electronics is used in almost everything now. Current trends are to make everything work faster and faster pulsed signals produce higher induced signals in tissue.

A potentially much more bioactive change has also taken place. The "digital revolution" has caused signals to become "lumpy", with bursts of full amplitude data pulses often emitted at human endogenous bio-signalling rates. The form of our exposure has changed dramatically over the last 15 years. GSM phone signals are *very* different in character from analogue TV and FM radio transmissions. Are these changes relevant? There is good evidence that they are. As higher speeds were introduced in the 1980s, so were reports of cases of electrical hypersensitivity. [Katajainen and Knave, 1995; Smith and Choy, 1986; Choy, Monro and Smith, 1987].

We propose that it is likely that adverse health effects caused by EMFs may well have a biphasic response curve causing a low level dosage window response. This may be deduced as likely from the substantial amount of published peer-reviewed research into the biological responses of animals and humans to very low doses of many pharmacological substances [Biphasic, 2002].

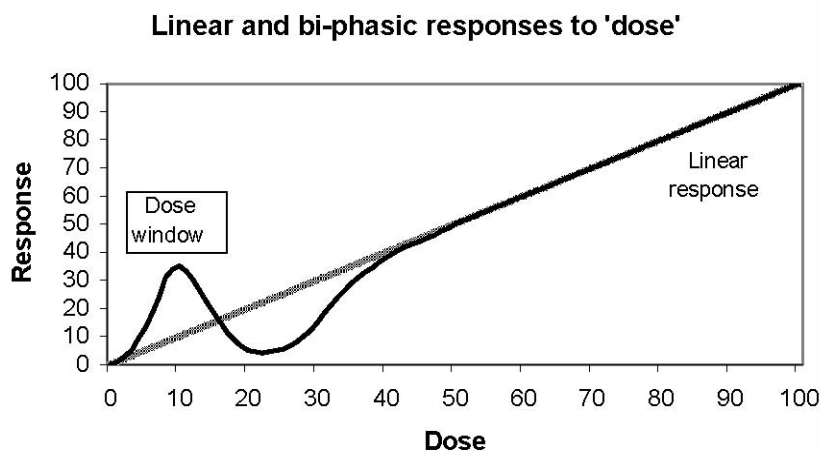


Figure 3 - Biphasic and linear dose-response curves

It is quite possible that cancers caused by exposure to low-levels of ionising radiation also follow this type of response curve. There are real low-level exposure effects that may initiate cancer and other adverse health effects before the living system starts to detect and repair the damage. We propose that it is also likely that EHS occurs on an early biphasic sensitivity peak.

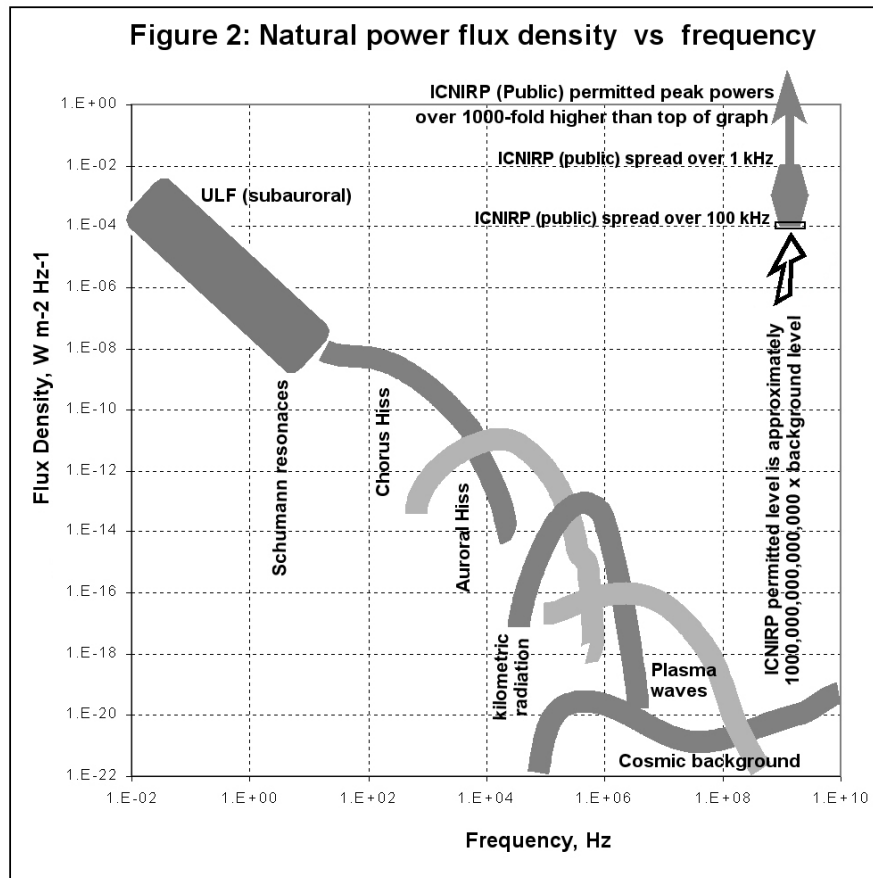
Precautionary measures might be taken for children because of the categorisation of EMFs as a “possible carcinogen” with respect to childhood leukaemia. If the evidence level should increase, these precautionary measures might be applied to other groups or situations, too.

The sides of the early response peak define the dangerous exposure window. Damage starts to occur at very low levels of long-term chronic exposure in ways that are not detected by the immune system. Then, a level is reached where cellular repair mechanisms start to operate. These provide protection until the exposure reaches high levels when there can be too much damage to be repaired. The response then follows a more typical dose-response curve.

We suspect that this early biphasic response becomes greater and greater as the individual’s ES develops.

There are naturally “electromagnetically quiet” regions in the ambient EMF spectrum. The main cosmic quiet “radio window” happens to be just in the place where we locate the mobile phone bands (900 and 1800 MHz) and the microwave oven frequency (2450 MHz). This can be seen in Figure 2. [derived from NASA 1994, and also Kraus and Fleisch, 1999]

Using basic physics we can calculate that the ICNIRP exposure guidelines allow radio signals in the mobile phone bands some 10^{15} or more times higher than the natural background levels that we were exposed to only 50 years ago.



5. What you can do if you've got electrical hypersensitivity

If you believe your symptoms could be due to electrical, microwave or chemical exposure, and they occur in the vicinity of electrical appliances and are improved when you are away from such sources, take the symptoms seriously! **Remember the first signs are warnings of potential EHS that can develop into a much worse condition if ignored.** The level of knowledge concerning hypersensitivity to electricity varies greatly in company and public health services. It is usually minimal. Don't be satisfied with ointments and pain-killers that just relieve the symptoms temporarily. Listen instead to your body's warning signals and seek the cause of the problems.

It is believed, by the (few) experts in the field at the moment that if EHS becomes severe, it becomes impossible to ameliorate, except in an electrically isolated environment. This is likely to mean isolation from most 'normal' environments. This has happened to a number of people that we have heard of and from, and they are the vocal ones, who may be the tip of the iceberg. The number of people suffering from this condition has been rising and is likely to increase dramatically in the coming years.

Talk to family, friends, neighbours, work colleagues, some of whom may be reacting as you are. Getting support from sympathetic people is very important as there is very little medical acceptance of EHS. It has the same sort of level of credibility as ME, or 'yuppie 'flu' as it was first known, used to have. One of the reasons why the medical profession is showing so little interest, we suspect, is because there is no money for the drug companies in recognising it. There is no magic bullet for them to sell. So, GPs do not get inundated with 'cures' from the drug companies for them to prescribe for their patients.

People can become electrically sensitive to a specific EMF source or location. If their EMF exposure is reduced, they may avoid the development of a more severe and permanent EHS. It is important that you make changes in your lifestyle as EHS does not go away if your exposure stays the same, and they may not ever go away entirely, anyway. You may need to take drastic action, such as moving house or changing job, with all the potential consequences and disruption this entails.

Having EHS is a bit like having diabetes. Once you are diagnosed, life will never be the same again. You will need to change the EHS equivalent of diet, medication and precautionary action. EHS, in fact, is worse, because whilst diabetes only happens with changes inside your body, with EHS, you are being exposed to precipitants in the environment, some of which are invisible, that you have to predict, where possible, and take avoiding action.

The change of greatest importance, in the opinion of many who are EHS, is avoidance of EMF radiation. The two most obvious places where EMFs are encountered are in the home and at work. EMFs in the environment are also frequently encountered. It is a good idea to identify these sources and avoid them wherever possible.

Reduction of exposure in the house

There are two main sources of EMFs inside the home. The house wiring, and electrical appliances.

Safety regulations that electricians adhere to when wiring a house, guard against electric shocks. They do not take into consideration the advisability of the wiring producing low levels of EMFs, as there is no accepted problem from EMFs that has needed regulating. In over 50% of the houses we have assessed for EMF levels, we have found high electric field levels due to the way the house has been wired. About 10% of UK houses have elevated magnetic fields due to unseen faults in the power ring wiring for the 13 Amp electrical sockets.

Some countries, including the UK, recommend the power circuits to be wired in a ring, starting at the consumer (fuse) box and going round all the sockets and ending up back at the fuse box. This means that the current can flow either way around the wires. The 'advantage' was that thinner wires can be used than is the case if all the current flows in one direction - cable rated at 15 Amps is used allowing 30 Amps to flow around the ring. In fact, other than in the kitchen and/or utility room, nowadays almost no power circuits ever have to supply more than 15 Amps. One large 3 kW electric fire needs 12 Amps, and few people use such loads today. Most things like televisions, computers, desk lights, etc., generally consume about one Amp or less, so you can have lots of those before reaching a 15 Amp limit. The big disadvantage with ring wiring is that one conductor can be broken or disconnected at a socket (surprisingly common after DIY changes!) and the circuit still seems to work perfectly. However the ring gets transformed into a single-turn transformer loop and high magnetic fields are created when using even very low powered loads. We recommend that only radial wiring is used, see 'The Powerwatch Handbook' by the authors of this book, A & J Philips, in the references section.

When houses were first connected to the electricity system, the wires were put in earthed metal conduit. This effectively shielded against electric fields. Modern plastic cables do not have this protective effect, and the walls they are run in can produce significant levels of electric fields detectable across much of the wall area. It is the electric field component of EMFs that are believed to be the most important factor in EHS. In Sweden, special cables are installed in the homes of EHS sufferers.

As a result of using plastic cables, most modern houses have elevated electric fields on the pillow area of beds which are pushed up to the wall. A simple way of reducing electric field exposure (sometimes quite substantially), is to move the bed 6" or so away from the wall. It is certainly much easier than digging out the wires and putting them in conduit.

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Metal edging strips under plasterwork can act as antennas, picking up RF fields or amplifying electric fields. They need to be earthed, as do metal wiring cover strips that are often used nowadays to hold wiring in place before a wall is plastered. We recommend that all mains electricity wiring is (ideally) run in earthed metal conduit (pipe) as was the practice 50 years ago. This almost completely removes the electric field inside the house.

It has been reported that deteriorating power quality is becoming increasingly common in developed countries. We have measured the electricity supply in different parts of the UK, and

conclude that it is not common here. Poor power quality, also known as dirty electricity, refers to a combination of harmonics and transients generated by electronic devices such as computers, television, dimmer switches, and energy efficient lighting and appliances. These devices as well as sparking on distribution lines and radio frequency radiation from nearby wireless telecommunication base stations, all contribute to dirty electricity by producing small microsuges that ride on top of the 50/60 hertz sine wave.

In a single blind study, Graham/Stetzer filters placed in a school in Toronto, Canada resulted in the following: teachers were less tired, less frustrated, less irritable; they had fewer headaches and body pain; they were more focussed and had more energy, and a greater sense of satisfaction and accomplishment. Elementary students in the same school were more actively involved in their classes, needed instructions repeated less frequently and were less disruptive while the filters were installed.

Diabetics have lower fasting plasma glucose levels and require less insulin when the filters are installed in their homes. Those with multiple sclerosis have reported a lessening of their symptoms within a few days. We do not know whether there would be any difference in the UK's 'cleaner' electricity supply.

Incoming telephone lines (primarily overhead ones) can pick up RF / microwave signals and bring them into the house. We recommend that an RF line filter consisting of ferrite beads and capacitors is fitted - BT supplies the MF50 which costs about £12 (they are often also needed to allow FAXs, etc. to work in buildings near powerful transmitters). They reduce high frequency noise on the line.

Sometimes, high electric fields are measurable from pendant light fittings. This is less of a problem for most people as we sit far enough away not to be exposed too highly. If you are EHS, however, it is definitely worth measuring the mains frequency electric fields.

'Demand switches' can be useful to reduce night-time EMFs dramatically when re-wiring isn't a possibility. They sense whether or not a load is required and when current falls below a pre-set low limit they throw a relay / contactor to reduce the voltage on the wires to a few volts for monitoring purposes only. When they detect a low impedance from a light or appliance being switched on they restore the full mains voltage. This is only any use if you can use separate circuitry for equipment such as fridges, freezers and air conditioning etc. which need to work all night, and you do not use any appliances on the Economy 7 ("off-peak") tariff. Demand switches are available from EMFields.

Lighting circuits are the main cause of high electric fields, especially in bedrooms, where they come from wires running under floorboards. Just turning these off at the main consumer unit ("fuse-box") at nights can help greatly (and use a small, plugged in, bedroom light). Install direct current (DC) lighting circuits.

All electric appliances give off EMFs. Ones which require power for motors and heaters give off most, e.g. hairdryers. For details of most electric appliances in the home, their fields and avoidance possibilities, see 'The Powerwatch Handbook' by A & J Philips [2006]. In Sweden, People with EHS receive government support to replace their electric cookers with gas cookers.

Ideally ensure your bed has no metal parts. These can capture low-frequency and high-frequency EMFs and distort the Earth's DC fields in major ways. Check for metal springs in the mattress. If you sleep poorly, try placing the bed so that your head is to the North.

Telephones can create problems for many EHS people. Mobile phones and digital cordless (DECT) phones can trigger EHS and are certainly likely to aggravate it significantly. We recommend that neither are used by people with EHS and non-EHS people should only use them in emergencies. Ordinary wired phones are usually OK, but may sometimes be a problem. Sometimes an earthing strap (see below) will remedy the situation. FEB (the Swedish Electrical Sensitivity Group) suggest a couple of easy alternatives that might be worth trying.

Cut a hole in the bottom of a plastic cup. Tape the bottom of the cup to the receiver. You will hear just as well, but the receiver will be further away from your head.

Buy a stethoscope and use insulating tape to fasten the cone of the stethoscope to the loudspeaker inside the receiver. The stethoscope tubes can be changed for longer ones, so the receiver can be even further away. The person you are speaking to will still be able to hear you.

One EHS person solved her phone problem by attaching a rubber hosepipe to the telephone receiver with gaffer tape, and held a cardboard tube to the speaker. The hook is pressed down by a weight. She said it is a bit unwieldy but it works.

We have been informed about a phone for electrically sensitive people manufactured by TeLoRay Systems in Sweden (www.teloray.se). It is CE-marked, tested and approved for use throughout the EU. Normally it is equipped with a 6/4RJ-plug (standard pinout) but they can fit any connector. There is a trial period of one month. We have not tested this phone, but on a trial basis, it may be worth having a go.

As most people who have EHS seem to react more to electric fields than magnetic fields, it is important to remember to unplug appliances when not in use. The cables from the socket to an appliance still radiate electric fields even when the appliance is not in use.

For most people keeping a metre away from most electrical appliances will expose you to a reasonably low EMF level. For electrically sensitive individuals, it is much more difficult to predict where the field drops off to a level that will not affect them. As field levels from the same sort of appliance can vary from make to make, there is really no alternative to measuring the field levels when you have some idea of the level you respond to. If you don't yet know, it may be important to keep to areas where the levels are as low as possible.

The two areas of greatest importance is where you sleep, especially the pillow area, and where you spend some considerable time sitting, probably 2 hours or more at a time. Biological systems seem to respond more when exposure is lengthy. Our body can usually repair the damage done to it during the day during our night-time sleep. The repair mechanism is mediated by melatonin, a hormone produced by the pineal gland which lies in the centre of the brain from the forehead (about where the 'third eye' is). Melatonin is only produced at night and its production by the pineal gland is 'switched on' by darkness. The pineal gland does not produce melatonin at all during the night if it is exposed to high magnetic fields late-ish in the evening. We recommend avoiding such fields after about 7.00 p.m. Do not use electric hairdryers or stand next to operating cooker hoods in the evening. Be careful of bedside light fields. (If you are not sure, you may need to measure the EMFs from them.)

This is common sense even if you are not EHS. Cancers, immune system disorders and clinical depression are associated with low levels of melatonin. If you are EHS, it is even more important to take no risks with an immune system that is already compromised. Researchers from Tel Aviv University in Israel, believe that caffeine, especially taken after lunch-time, interferes with the body's production of melatonin.

Metal framed windows (including new aluminium framing on double glazing) can resonate at microwave frequencies and amplify the signals coming into a room. Pilkington 'k' glass is reported to reduce microwave signals coming through the window - but windows made of this will also reduce the spectrum of natural daylight. Opening the windows (recommended for good ventilation and health) will reduce the screening properties of Pilkington-K glass. Microwaves will also still get through the windowframes.

Cows also produce melatonin at night. You may be able to find a local farmer / smallholder, who is willing to supply you with milk from a *morning* (important) milking. Other sources of melatonin if you feel peckish in the evening are oats and bananas. Melatonin pills can be bought from the USA and are often used to counteract 'jet-lag', but the UK banned their over-the-counter sale following some ridiculous trials with college students taking them at breakfast time. It was clearly set up to discredit melatonin as a supplement. Perhaps improved labelling would have been a better response, instead of banning it. Melatonin is still available in this country on prescription. Dr Robert Winston, a leading UK doctor, showed on BBC television that babies produce melatonin in the evening and this triggers a direct sleep response that dictates when they need to go to bed. In some babies ('lark' types of people genetically, who wake early and sleep early) this occurs at 7 or 8 pm, and in others ("owl" types, who are slower to wake in the morning and choose to sleep later in the evening) the timing can be several hours later. Obviously these are just the ends of a spectrum of response, but Dr Winston said that it was both pointless and not healthy for people to be subject to an inappropriate sleep / wake timing rhythm. Especially in adults, it is important for bedrooms to be dark (and EMF free!) places so that a natural melatonin rhythm is encouraged, though some people sleep well in natural moonlight.

Underwired bras can act as 'antennas' re-radiating EMFs, including microwave radiation from mobile phones, into the body. With the genetic predisposition that some women have to breast cancer and the overall increase in rate of breast cancer, we cannot recommend the wearing of bras underwired with metal. Bras using plastic to shape the cup do not have this antenna effect. Someone who wrote to us said she has scars and lumps under her breasts, due she believes to the radiation from the FM / AM radio towers next to her farm. The worst problems she experienced were near metal buildings, tractors, trucks, pipe fences and people and animals wearing metal.

An ME sufferer that we heard from, who was forced to look at the way she could ameliorate any of her symptoms, found that her continuous migraine-type headaches were entirely eliminated when she started wearing glasses with all plastic frames instead of metal ones. She thinks that possibly the metal frames were 'picking up' electrical or other forms of radiated fields.

Some people recommend that silver or steel necklaces are not worn as they form a conductive loop that can capture and amplify some electromagnetic fields. If you really want to wear them we suggest you have a plastic connector inserted so that the metal does not make a complete loop. Gold seems to be okay.

One EHS sufferer developed acute tremors and trembling with atrial fibrillation, with an apparent connection to adrenal malfunction, after a new gas central heating boiler was installed. These symptoms were tracked down to the electromagnetic timer, which was changed to an electronic timer. This made things worse. However, operating the system manually brought a complete cure, despite the fact that the timer only showed readings of 0.02 microtesla magnetic field and 15 V/m electric field. Some systems use a slow timed pulsed (about 1 second) motorised flow valve to switch between water heater and central heating water flows and keep this centralised (using the pulsing) when both are required. We have measured considerable transient spikes from some systems each time this occurs. To detect it take a medium-wave transistor radio and hold it near the central heating unit. You will hear regular 'ticks' if this is a problem.

Reduction of exposure at work

Many offices are full of electronic and electric appliances, computers, faxes, printers, photocopiers, air conditioners, de-humidifiers, electric fans, etc. Phones and burglar alarms can use microwaves. Computers are increasingly networked using microwaves. All these can make working life unbearable for the EHS office worker. Schools, hospitals, residential homes, shops are all full of fluorescent lighting and other equipment that can provoke idiopathic reactions in the EHS person, making their tolerance level even more sensitised.

Industrial machinery in factories and plant rooms can all give off very high fields indeed, as can the cables which power up the equipment.

In Scandinavia, hypersensitivity to electricity is more widely recognised, and some companies make provision to avoid some of the more obvious sources of high fields and the resulting pollution that can be caused.

The insurance company Skandia, in Sweden, is one of several companies that have reorganised their electrical systems at work. This has resulted in a dramatic reduction in people calling in sick. 300 employees had symptoms prior to the reorganisation of the electrical systems and other measures. Today no-one is sick due to hypersensitivity to electricity and the company has established a purchasing policy for display screens and electrical apparatus.

Many people (especially men) remain silent about the symptoms they experience at work. It is important to start a discussion at the work place as soon as symptoms of hypersensitivity to electricity appear. Relatively simple measures may be sufficient if the problems are dealt with early. Start by listing and recording problems.

Which piece(s) of equipment is (are) causing problems?

How many people experience the problems?

What is the situation in other similar work places?

Is expert help available for study and analysis of the electrical work environment?

There are general measures that can be taken, before a full survey is undertaken, which may alleviate many of the symptoms.

Computer screens should be 70-80cm from where people sit, and glasses for use during computer work should be adjusted for this distance. Some companies sell screens to put in front of computers. Most of these are really only anti-glare screens and can help, but they do not reduce EMFs.

Some expensive ones have a conductive coating on the glass or consist of a very fine wire mesh, and come with an "Earthing wire"; these will remove the electric field. These are sometimes described as 'anti-static' screens. As the most commonly reported symptoms of EHS are eye problems, then even just reducing glare can also be helpful. Modern flat (e.g. TFT) screens will need the conductive coated glass rather than the wire mesh which can give visible 'moire fringing' patterns (visible distortions).

Make sure that the vertical refresh rate is between 72 and 96 times each second. This can be checked on a PC by choosing:

My Computer -> Control Panel -> Display -> Settings -> Advanced Properties

and looking at the refresh rate. If unsure, contact your IT technician or a local dealer.

Limit the time spent working without a break in front of a screen. This is good practice anyway. Breaks of at least 5 minutes per hour, every hour, is suggested.

Keep the office as free from dust as possible, having a clean desk and floor. Electric fields act as a 'magnet', attracting all sorts of unwanted particles, including bacteria and toxins to the screen. It is important to keep the screen clean using an anti-static wipe, and to avoid pollutant materials, including all chemicals (air fresheners, perfume etc., spray polish), in your office space.

Replace older fluorescent fittings with modern high-frequency ones with diffusers. If this is not possible, turn them off and use an earthed desk lamp with an ordinary incandescent bulb. It is usually necessary to replace the two-wire (live and neutral) mains lead with a 3-wire (live, neutral and earth) lead, preferably using screened mains cable.

Avoid steel constructions in office equipment when building or converting. These can pick up and re-radiate EMFs and microwaves, and steel also distorts the geomagnetic field in ways which are harmful according to some investigators. Make sure all metals are bonded to the building earth (and that this earthing is functional!)

Sort out cable coils. Coils produce higher fields than straight wires.

Allow newly purchased electrical office equipment in plastic casings to run at maximum power for at least 2 weeks in a well-ventilated room that is not used as a work place. (This greatly reduces later problems from chemical compounds such as toxic fire retardants being emitted from various components in new equipment). Plastic cases and components continue to give off low levels of chemicals for some months, but the first two weeks or so are the worst.

Ensure good ventilation, by having a window open. Make sure the air circulates well, breathe as much outside air as possible, keeping your lungs functioning effectively, and keep the ambient temperature as cool as you can manage. Warmth breeds bacteria which can further impair a vulnerable immune system.

Keep air-conditioning systems clean and well maintained. If not, they effectively re-circulate all the bugs, having given them the opportunity to breed in warm, dark corners.

Use of electric / electronic equipment

Computers

Try using a monitor with EMF-shielding for the high-frequency range. You may need to leave time to desensitise your system to evaluate this properly. Check the vertical refresh rate on the screen and make sure that it is between 72 and 100 times a second. Refresh rates outside of this range can have adverse physiological effects.

Laptop computers that run from a mains adapter MUST be 'earthed' or they float high and can give a field of 1,000 volts per metre (V/m) at the keyboard! All that is needed is a wire from the safety protective electrical earth (ground) of the building electricity supply taken to a clip (a small 'crocodile' clip with serrated jaws is best). The crocodile clip is attached to one of the metal posts

next to the serial and printer connectors at the rear of the laptop. The electric field at the keyboard then falls to almost zero.

This voltage does not exist if you charge the batteries, and then use the laptop on batteries after disconnecting the mains adapter / charger, although this is obviously not very convenient for long periods.

There is also a high frequency electric field (typically 35 - 100 kHz) coming from the display (including the good TFT displays). This can be as high as 100 V/m next to the screen! This falls off rapidly but EHS people should use an earthed conductive glass VDU screen in front of the display if they are affected by high frequency electric fields.

There are no power frequency magnetic fields from the screen of any significance.

It is also worth noting that laptops, with their small movement keys are very much worse for repetitive strain injuries (RSI) if you type a lot ~ occasional or low use isn't a problem. RSI appears when your fingers make lots of small distance and small force movements over a long period of time. Most laptops have sockets that can take full size keyboards, which do not have the same effect. They can also take full CRT displays and a normal mouse. If you need to use a laptop as your main computer, we recommend that you consider using these full-sized accessories in your main workplace.

The other extreme is an old-fashioned large mechanical typewriter, which has never been known to cause RSI as the hand and finger movements are large and quite forceful.

Televisions

Some EHS (and ME) sufferers find their symptoms are made worse when watching television. The ME society suggest that a change worth trying is that of ensuring that the watcher does not sit between the television set and the aerial. He or she should sit so that they face the television and the aerial is also in front of them, in whatever way it is mounted. We see no technical reason why this should reduce the symptoms people suffer, but it worked for a sufferer from severe EHS who we know, who had tried everything else. It may be that the body, as a living system somehow forms a 'loop' with the two pieces of equipment in a way that is unhelpful, biologically. At the moment we do not have any measuring devices sensitive enough to detect this change, as it will be at a very subtle level, if indeed, this is the explanation. Anyway, moving the TV, seat or aerial is worth a try.

Speakerphones

Some EHS people find that they react, not only to mobile phones and DECT phones, but they can also react to ordinary wired phones. If you are reacting to ordinary landlines, you can buy an ASDL phone line filter (from a local computer or phone shop). The filter plugs into the phone socket and the phone is then plugged into the filter socket.

Speakerphones can be used to increase the distance between the speaker and the equipment. Downsides that we have been told of by an EHS person, though it could have been a problem with the particular speakerphone she was using, were:- an inability of the other person to hear *brief* feedback (such as 'yes'); difficulty in interrupting someone in mid-flow (there are times when this is necessary); and if the other's environment is noisy, it is difficult to break into the conversation again.

Some telephones with loud-speakers have been associated with the initiation of EHS, when ordinary phones did not produce the symptoms. You can always earth a speakerphone by putting it into an earthed headnet, which removes any RF or electric fields coming from it.

Avoidance of sources of EMFs in the environment

Cars

The steel radial reinforcing wires in car tyres can become highly magnetised in manufacture, which can result in high levels of low frequency EMFs as the wheel rotates, especially in the front driver and passenger footwells. Car wheels themselves are less likely to be a problem, so an alternative such as aluminium, which has been suggested by some mechanics, is unlikely to solve the problem. Power wiring, fan motors, computerised controls and dashboards can also give off EMFs. Some models of Volvo were shown in February 2002, to expose the driver especially, but other passengers to a lesser extent, to magnetic fields of up to 18 microtesla, hundreds of times higher than those which have been associated with ill-health. One person, who had recently (September 2002) bought a new BMW X5, had fields of 8 microtesla in the car. She was quite ill, whenever she travelled in it, but she had not had problems in the previous car used by the family. The car was worse when stationary with the engine idling. **It was due to the battery being located at the rear of the car, with a high power cable running under the floor carpet to the engine compartment.** Some upmarket cars (Jaguar, Mercedes, BMW) have electronic control units under (even a part of) the driver's seat. These will give off high levels of magnetic fields. Also worth checking is whether the angle and position of car seats are electrically controlled. Choose your car carefully, preferably using a meter to detect the fields, and keep journeys as short as practicable in cars when you are unaware of the field levels you may be exposed to. An anti-static strip (which prevents the build up of static electricity in a car) is unlikely to help, unless one of your regular symptoms is electric shocks. Do not put homoeopathic remedies near the wheel arches when transporting them around, as they have been shown to lose their potency when exposed to high magnetic fields.

Trains

There are very high fields in the electrified train network. Peak level exposure of 1.6 microteslas or more have been associated with more than double the risk of miscarriage in women [De-Kun Li and colleagues, 2002]. Electric trains commonly expose people to transient levels above this, and in certain seat positions levels can rise to well over 100 microtesla, making journeys both uncomfortable for EHS people and potentially dangerous for all pregnant women. Trains which travel on lines with overhead power cables, (usually powered at 25,000 volts) may have a significant electric field over 100 V/m next to the window of carriages as a result. It is best to choose a seat away from the windows. See 'Trams' for underground tube trains and some suburban trains that pick up their electricity from a third-rail.

Some trains have facilities for using a wireless connected computer for people to use while travelling, either for work, or for games, etc. to pass the time. Many railway stations also have these facilities. People with EHS are going to find it increasingly difficult to travel by rail.

Trams

These are usually operated off DC (direct current) that theoretically does not alternate 50 or 60 times every second. In fact it is usually not proper DC, but rectified alternating current. This

actually produces high fields pulsing 100 (or 120) times every second. It is the same for underground tube trains. They also produce transient surges every time they start moving. These may also be biologically active.

Planes

The personal lights above the seats are often high frequency fluorescent lights now and can be sources of significant electric fields. Some planes have in-flight video screens built into the back of each seat. These are a source of high frequency fields for the people watching the screen and those whose seat it is fitted in to. Planes are developing onboard 'base stations' so that people will be able to use a wireless enabled laptop. This will increase the overall electrosmog conditions in planes.

Buses and coaches

It is advisable not to sit in seats directly above the wheels, for the same reason as cars.

Burglar alarms

Most residential burglar alarms are passive, infra-red devices, which have no EMF hazards attached. Burglar alarms using microwave sensors are unusual, but to be avoided wherever possible, so as not to increase our exposure to this form of radiation.

Shops have electronic tills

Whilst electronic tills are unlikely to be a problem for the customer, a till operator who is EHS could be quite badly affected.

Security tagging devices in shops, etc.

According to the New Scientist in October 2001, scientists at the University of Utah reported that anti-theft security tagging, the mechanism of which is situated in pillars close to shop doors primarily, could be exposing children under five years old to twice the EMF safety limits. Presumably this conclusion was reached when taking into account children's average height and body weight. For EHS people this could also have a significant effect. Although the fields are localised and transitory, they are pulsed (believed to be the bioactive component). Occasionally, they are placed in such a way that means a customer has to spend some time, exposed to this field level whilst purchases are being dealt with.

Many libraries use a related technology, which uses a lower operating frequency, but a higher pulsed field level. These may prove to be a long-term health hazard for some of the staff, especially if they sit near the magnetic eraser.

Hospitals

These are full of electric and electronic components, from intensive care units with life support systems, operating theatres, MRI scanners, autoclaving machines, floor polishers and so many places with different types of equipment almost too numerous to mention. Medical and support staff, in-patients, out-patients and visitors will be subjected to a cocktail of exposures. There is no answer to reducing the exposure generally.

Homoeopathic hospitals and special units for patients with EHS should take a more sensitive approach to the problem, if EHS is to be recognised for the illness that it is. The environment in which homoeopathic remedies are made and stored need to be designed to avoid the remedies being de-potentised by high magnetic fields.

Controlled entrance / exit bars for housing complexes etc

RFID (Radiofrequency identification device) systems use EMF to energise the identity tag that you carry. That then sends an RF signal back to confirm the user's identity. These systems are likely to cause EHS people problems. Swipe card and bar code systems should be fine.

Mobile phone street masts (microcells)

These are wall-mounted or mounted on equipment such as lamp posts, CCTV equipment, etc. Most mobile phone operators keep the power levels quite low. Orange have been known to use macrocell-power transmitters on these sites, and T-Mobile (UK) have done the same very occasionally. This results in very high radiofrequency radiation close to the mast, and if they are wall mounted can produce high fields in accommodation behind the mast.

When really low powered microcells are used the exposure will be substantially lower, and most of the population will be no more adversely affected than from the tall masts. EHS people may well find them still to be a problem.

You may find you need to shield your sleeping place and / or main living space with appropriate material so as not to be unduly affected.

Radar

Microwave radiation from radar sources can affect some EHS people very badly. You can detect any radar signals with an Acousti-COM monitor, if you believe you may be exposed to emissions from such a source. You may need to shield your home as above. We produce a book "EMF and Microwave Protection for you and your family" about screening your home.

The link with chemical exposure

Many people who are electrically sensitive are also sensitive to chemicals to a varying degree. Sometimes EHS is initiated by chemical exposure. It is important if you are EHS, or suspect that you are, to avoid exposure to chemicals. Everyday chemicals you may develop a sensitivity to include household cleaners, pesticides, fresh paint, new carpeting, building materials, newsprint, perfumes, even hair perms.

According to GreenHealthWatch [see references], in 2000, UK householders spent £35 million pounds on pesticides for their houses and gardens (39% up on 1999). Public gardens, parks and playing fields are also treated. Around 20% of old domestic pesticides are disposed of down drains risking river contamination. Legal pesticide safety limits in drinking water are regularly exceeded in the UK.

The American Department of Agriculture and the Food and Drug Administration carried out nearly 43,000 tests for pesticides on produce between 2000 and 2004. As a result, the Shopper's Guide was developed by Environmental Working Group (EWG) listing the "Dirty Dozen" most contaminated fruits and vegetables, and the 12 most "Consistently Clean" items

www.foodnews.org. They said that consumers could cut their pesticide exposure by almost 90 percent by avoiding the most contaminated fruits and vegetables (exposing the eater to about 15 pesticides a day, on average) and eating the least contaminated instead (fewer than 2 pesticides a day).

Peaches (97% tested positive for pesticides and almost 87% had 2 or more pesticide residues) and apples (92% and 79% respectively) topped the Dirty Dozen list. Onions, avocados and sweet corn headed the Consistently Clean list, with over 90% with no detectable pesticide residues.

While washing and rinsing fresh produce can reduce levels of some pesticides, it does not eliminate them. Peeling can remove some of the nutrients. Choose (local) organic wherever possible.

Other things you might consider doing

You might want to see your dentist to check for potential dental disease, or allergic reactions to metal (mercury, gold) fillings.

Hydration

Some EHS sufferers have reported varying degrees of relief of their symptoms from:-

Drinking plenty of water. Most people suffer from a degree of subclinical dehydration. This is because drinking tea and coffee is more popular than water or very dilute, water-based drinks. Tea and coffee both contain diuretics, so you excrete more liquid than you take in. The body needs considerable quantities of water to function effectively. A man should drink 2 litres of still (not fizzy) water and a woman 1½ litres (as well as other drinks). Feeling thirsty is a symptom of *extreme* dehydration. Feeling tired is a symptom of subclinical dehydration.

As an addition to this, try a hypo-allergenic moisturising cream. It helps with skin re-hydration, and may improve skin symptoms and / or general well-being.

Water supply

For EHS people who are also chemically sensitive, it is important to filter water that you drink. In many areas, underground water pipe supplies are run in parallel with electricity supplies which results in the water being imprinted by 50 Hz. Putting a small permanent magnet underneath the filter jug should help remove this. If you use an electric kettle to boil water, which you intend to drink, you should also place the small magnet underneath the mug or cup for a couple of minutes to remove power-frequency imprinting effects induced by the electric current in the heating element. You can obtain small flat magnets from Coghill Research Labs (see Chapter 6).

If you decide to filter your incoming water supply, do not have one that uses reverse osmosis filters as they lead to 'hungry' water, which will leach minerals necessary for health from your body, which you will then excrete in urine.

Diet and supplements

It will be worthwhile monitoring your diet closely. Skin sensitivity (including reddening as an allergic-type reaction to EMF exposure) may be alleviated by reducing intake of some fish and

wines which contain histamine [Malone, 1986] and the celery family which contains skin sensitisers.

The amino acid Tryptophan, which is a precursor of serotonin, and is linked with melatonin levels in the body, is found in turkey, cottage cheese, bananas and eggs. Eating complex carbohydrates maximises the concentration in the blood stream of L-tryptophan, and most people feel calmer within half an hour of a carbohydrate snack (Pitchford). Serotone 5HTP is also a precursor of serotonin. It has been reported to help, but having taken it for 18 months, the people concerned had side effects of heart palpitations, and it seemed to be becoming less effective.

Avoid sources of GM foods where possible if you experience digestive disturbances as part of your ES reactions (see first chapter). It would certainly be worth thinking about buying the best quality food you can afford. The German physicist Fritz-Albert Popp demonstrated that food of the highest quality shows the highest photon transmission, compared with average food quality food of identical caloric value. (Photons are stored in the DNA during photosynthesis and transmitted continuously by living cells.) Popp showed a difference of up to 98% in the amount of low-level luminescence in plant foods from biological farming systems (organic or biodynamic) over that from conventional systems. He also found that forced storage led to a loss of nutrients (Popp 1989, reported in Cook, see refs.).

Vitamin / mineral supplementation, especially methylsulfonylmethane (MSM). MSM (a form of organic sulphur) is considered by some to be a food and is most certainly a chemical. Taken in doses of a gram or so daily it will, according to Dr. Norman Shealy, cause the body to increase its level of dihydroxyepiandrosterone (DHEA) dramatically in about 50% of patients. DHEA is a helpful chemical in humans which, on average, begins to be found at progressively lower levels beyond the age of thirty or so. It is also found at low levels in a depressed immune system or in clinical depression.

Vitamin C taken in addition to MSM increases the level of DHEA in about 70% or so of people. Together with vitamin E, Vitamin C increases protection against membrane damage from free radicals released during detoxification. If, in addition to Vitamin C and MSM, beta 1,3 glucan (a precursor of DHEA) is also taken, the percentage increases to some 90%. There are several types of DHEA supplement that can be bought, (at least in, and from, America). One type has a lot of testosterone which can give a problem with unwanted hair growth, but it is effective in increasing DHEA levels. One other form of DHEA 7-Keto DHEA is believed to be better, but is much more expensive. MSM and Vitamin C also help reduce arthritis symptoms in many people.

Where chemical sensitivity has provoked chemical changes to enzymes, zinc, magnesium, selenium, B vitamins, especially B₁₂ and Cysteine can help detoxify. Buy a good brand (ask your pharmacist, look at the reviews in the health magazine, PROOF! 0870 444 9886; or try The Nutri Centre 020 7436 5122)

Have a trace element test, which your GP can arrange for you. EHS people can be low in zinc, copper, selenium and magnesium. Low selenium levels have been linked with some allergies, and smoking can deplete the body of selenium. Increased selenium intake may be protective, though care must be taken as large amounts are toxic. Good sources of selenium are whole grains, brazil nuts, rice, kidneys and oily fish.

Since 1940, the minerals available from food in the diet has gone down dramatically. Iron content in meat has reduced by 47%, milk 60%, cheeses and cream 50%, vegetables 27% and fruit 24%. Copper has fallen by 60% in meat, 76% in vegetables, 20% in fruit and has almost disappeared

from milk. Magnesium fell by 21% in milk, 24% vegetables, 16% fruit and about 10% in meat. Between 1978 and 1991 vegetables lost 57% of their zinc, and fruit 27%.

Evening Primrose Oil can help with atopic conditions (conditions involving a generalised allergic response, and associated with low levels of gammalinoleic acid). A high dose, 8-12 capsules a day, is necessary to make up for long periods of time with a faulty enzyme. Evening Primrose Oil converts to prostaglandin E1, stimulating T-lymphocytes, a type of white blood cell, involved in the immune system's response to foreign bodies. When this process is faulty, the immune system can turn on the body's own tissues as if they were invading matter, causing damage.

Dried lemon balm leaves have been shown both to increase calm and to enhance the ability to perform difficult timed memory tasks. Taking Methanolic extract, the active ingredient in lemon balm, did not have the same effect.

Treatments

- chiropractic treatment. This has been helpful in cases where EHS has been triggered by trauma, especially to the back and neck.
- osteopathy has apparently helped the immune system of some people with EHS. Cranial osteopathy may also improve cerebrospinal fluid flow in the cranium.
- acupuncture
- homoeopathy. Some homoeopathic remedies have been devised specially for people who are EHS, and mistletoe seems particularly helpful. One EHS sufferer found homoeopathic remedies very helpful in coping with the severe pain she gets a lot of the time. Another person who also has ME has found that belladonna, in homeopathic liquid form helps her balance. We are aware that homoeopaths treat the person and not the symptom, but it needs to be part of the range of treatments available to help people de-toxify after exposure. Your local homoeopath may be unfamiliar with these particular remedies, but could find out from the Homoeopathic Association. In the UK, Dr Jean Monro of the Breakspear Hospital, a private hospital in Hemel Hempstead, also prescribes for the electrically hypersensitive. See also comments about EMFs in the environment and hospitals. Homoeopathic remedies become useless in high EMFs; they lose all their potentiation. Be careful where you put them, not next to magnets, including loudspeaker magnets, and do not put them near to the wheels of cars or trains that you travel in. Using homoeopathic remedies will not help as much if the environment you live / work in remains at a toxic EMF level.
- The use of provocation / neutralization (immunotherapy) has been mentioned by several environmental medicine practitioners as being a key element in the treatment of both EHS and MCS. A signal generator a distance from the patient is used to find the frequency that will trigger the allergic reaction. Then other frequencies are tested to find the neutralising frequencies that stop the reaction. Signals at these frequencies can 'potentise' vials of water that can be carried by the patient and used to stop the reaction. The allergic response is inhibited by holding the vial of water in the hand. In a given patient, the symptoms provoked electrically are similar to those provoked chemically and those provoked by the patient's environment. Electrical and chemical stimuli and neutralisation appear to be interchangeable. [Oschman 2000, Choy et al 1987, Smith & Best 1989]

- Reflexology. It relieved the EHS symptoms in someone who also suffers from Chronic Fatigue Syndrome.
- One person claims to have been cured by Nambudripad Allergy Elimination Technique (NAET), but the details are unknown. Does anyone know any more information about this? If so, please let us know.
- Magnet therapy. One people with EHS and ME found relief from fibromyalgia induced by mast exposure, from using magnets. These can be obtained from Coghill research Labs. [see references].
- Some people with EHS have found limited symptomatic relief from the use of certain anti-seizure medications. Dr Jay Seastrunk of Dallas, Texas, uses the enzyme Neurontin which is reported to help environmentally ill people. Several EHS people who have tried Neurontin, an enzyme used to treat epilepsy (and trigeminal neuralgia), report a lessening of EHS reaction symptoms, especially when they are related to chemical and food sensitivity exposures. Dosage is approximately double what is usually prescribed for anti-seizure use.

The rationale for this treatment is basically a belief or suspicion that EHS is brought on by a latent brain injury which predisposes some to become EHS, and that EHS is actually a kind of seizure disorder.

There seems to be some correlation between the degree of acuteness of a patient's condition and the enthusiasm which they express for Neurontin. More chronic EHS people who have learned to limit exposures, and whose most acute phase has passed, may expect, according to consensus, some minor lessening of symptoms. When on Neurontin and exposed to an EMF/EMR source, you are still "zapped", however.

Dr. Seastrunk claims that the treatment does not merely mask symptoms but rather helps to quiet inflamed cells/tissues and helps to prevent further damage.

- 'Olanzapene,' an antipsychotic drug, helped one EHS person, who found relief from symptoms located around the brain - a sensation of burning; fuzziness; irritation of brain tissue; feeling of brain swelling. However, she did wonder what the effects of continued use would have. There would almost certainly be an increased sensitisation to EMFs as the medication was reducing the effects, and maybe a need to have higher doses, or even a more potent drug to bring the same relief.

It is unclear whether this medication would be prescribed readily by a GP, and adds to the problem of EHS being seen as a psychiatric problem.

- In a study of MCS by Gibson et al. [2003] of James Madison University, they found that very few patients had any mental illness prior to the onset of MCS. Over 37% reported emotional problems after their physical symptoms emerged. The use of antidepressants in their treatment was considered more likely to harm than help. However, prayer was felt to be effective.
- 'Promazin' helped an EHS sufferer cope with the pain she experienced when exposed to EMFs. It is a drug that is also prescribed for radiation sickness. It begs the question again about the benefits of 'masking' symptoms, though individual people will make their own decisions according to the benefits they experience.

- Healers and spiritual healers. We have had some good reports on the effects of healing on people suffering with EHS. Sometimes it eliminates symptoms entirely and sometimes ameliorates them significantly.
- Oxygen therapy. One person, who was in touch with us, was unable to cope with her EHS symptoms without access to fresh air at all times. Oxygen administered for three days after an operation, reduced her need for outdoor air for several months.

Geopathic stress

Sleeping on several different lines of geopathic stress are implicated in the development of serious illness, including cancer and CFS. The edge line of an underground stream is associated with increasing the susceptibility of biological systems to EMF radiation. Dowse where you sleep to ensure that your bed is not on one of the earth energy lines associated with ill-health, and move your bed if this is the case. If you would like a full-house assessment for geopathic stress as well as EMF exposure, Alf Riggs used to be one of the foremost UK Radiesthetists, but is moving to Australia. His son, Roy, is taking over his practice (see practitioners).

Other possibilities

The Vortex Unit has helped a number of people. It certainly seems to have the ability to generate some interesting subtle energy changes that we feel could well be helpful. Unfortunately, Alan Hall who was responsible for the design and manufacture of the Vortex Unit has retired due to ill-health. We do not believe that anyone else has taken over the vital work on this product. If anyone has further news about the availability or ongoing research on the Vortex unit, please let us know.

Some people report that 2 tablespoons of Epsom salts in a bag carried around in places of exposure really helps them. A salt and baking soda bath (using 2 cups of each) is reported to feel soothing when you are feeling 'zapped', 'fried' or 'electrified'. It is unclear why the bath has this effect but it eases the distress. Possibly it changes the skin's conductivity level. It may well be a good idea to use a hypoallergenic moisturising lotion afterwards to keep your skin moist.

Baths using green clay are reported to have been helpful in reducing EHS symptoms for one sufferer. One severe EHS sufferer felt it restored her energy and balance. You can make a drink with the clay, drinking the water after the residue has sunk to the bottom of the glass. The clay residue is not consumed. The clay is available from www.wholistichealthdirect.co.uk 01438 833100 or www.lydia.ltd.uk 01239 615246. Glacial clay helped one person with EHS recover the use of her right hand after it had been badly affected by VDU use.

For acute relief of facial symptoms, try some sea salt and baking soda in a bowl used for about a minute as a face wash. Again, it may well be a good idea to use a hypoallergenic moisturising lotion afterwards to keep the skin moist.

Some EHS people experience a reduction in symptoms when air is ionised using a negative ioniser. (However some ionisers contain a transformer giving off high magnetic fields. It is important for EHS people to check equipment before buying it. EMFields can supply a negative ioniser which is low in EMFs).

Cactuses can be useful in a room where a computer is in use, as the spines can attract positive ions. However, cactuses need to be earthed to discharge them.

Plants (NASA suggests spider plants, Boston ferns and peace lilies amongst others, and these are easy to grow), are excellent for cleansing the air of formaldehyde and other chemicals in small quantities, even in sealed containers. Root microbes biodegrade the pollutants into structures that can be used as a source of food for the microbes and the plant. So there is nothing toxic left to remove, such as the positive ions on cactuses. Boston ferns thrive in areas where there is less light (where there is no convenient window space), as do most ferns. There are several other plants which NASA's Skylab Space Center have identified, but which are less commonly found, or are less hardy. [Wolverton, 1996]. Plants in a room also release phytochemicals that suppress mould spores and bacteria by up to 60%, when compared with a room with no plants.

Some people use crystals and believe them to be very effective. A homoeopath recommends the wearing of tourmaline as a protection against microwave radiation. We are unsure about using crystals, largely because it seems wiser from the point of view of planetary equilibrium to leave them in the ground where they were formed.

Silvio Hellemann wrote a book called "Handbuch fuer Elektrosensible" in which he described a number of 'things' and 'machines' which would help with electrosensitivity. He did not recommend any of them, because he said "*they all suck up the negative energy, and after a while they start transmitting it*". This was confirmed by Charles Claessens (personal communication) who added that this is especially the case for things which contain crystals.

Qi Gong (whatever the spelling) has been helpful for some EHS patients. There is clearly an immune system interaction, the dynamics of which are, as yet, poorly understood. One person finds her practice of Aikido three times a week helps a lot. Tai chi (a Westernised version of tai chi chuan was found to increase memory T cells (a type of immune cell) by 50%, when practised for 45 minutes three days a week for 15 weeks.

Trampolining was suggested by one person. Her husband has been trampolining for 40 years, so presumably is now not so young that age could be a reason for discounting this possibility. He suggests it improves endorphin release and the immune system in general. Other vigorous exercise may be useful.

As long as any co-factor causing hormone disruption and biological changes at a cellular level interfering with immune system function exists, any treatment is unlikely to have any lasting effect.

Protection devices

Grounding

One way of reducing the effects of exposure is by attaching a wire to ground from a copper bracelet. This was reported in a Canadian study by Fox and the detail of the mechanism was not specified, but should be reasonably easy to make.

One person found that a length of copper tube knocked 3 feet into the ground, with a wire attached, greatly reduced her symptoms when she held it indoors. However, it is important to avoid sitting near any electrical appliances when you hold the wire. The electric fields generated by the appliance will seek out the easiest path to earth, which *you* could become. Also, be very aware of the earth energies at the spot you hammer in the copper tube. You may disrupt the earth's geomagnetic field in such a way as to make matters worse rather than better.

An earthing strap is another way you can maintain an earth bond so that your body does not become 'charged up'. However, because in most houses the power circuits are wired at skirting board height, standing or sitting next to an electrical appliance, e.g. a telephone, computer, TV, music centre, etc., can often result in the body acting as part of a circuit. Using an earthing strap is likely to make this WORSE. The correct thing to do is to remove or screen the wiring.

Screening paint

Special screening paint, such as sold by EMFields, will reduce electric fields from wiring, either from wires underneath floorboards or from walls. The plaster in walls is very slightly porous, so the electrical field can 'leak' into the walls from the sockets and cables, causing high fields across large sections. The paint can also reduce incoming microwave fields (e.g. from mobile phone masts). The screening paint is black, as it has carbon as its active ingredient, but as it is water based, you can paint over it using ordinary emulsion paint. As it is water based, it enables the walls to breathe. The paint should be earthed. This can be done easily by attaching one end of a piece of wire to the paint, and attaching the other end to the metal of an earth-bonded radiator, or to the earth pin of a standard plug.

One problem with conductive paint is that it attracts electric fields, so if you haven't covered up the source then the fields can actually increase ~ which is why you often need to do both the walls and the floor.

Other protection devices?

Many devices are available on the market that claim to help protect against or neutralize the EMF / ELF or other output from electrical appliances such as computers, and microwave sources such as mobile phones. With most of the products we have seen there is no scientific foundation for their claims. The pseudo-scientific literature that is associated with the product is usually flawed and completely useless. The only thing you can be sure of is that the manufacturers see a market for the device that will create money for them.

There is a possibility that *some* of these devices may have a very subtle effect on the body's immune system, and help the person using the device to be able to resist the damage from EMFs by improving their immune function. However, the effect is likely to be very subtle and at the moment we do not have the scientific instruments to measure such subtle changes in body dynamics. (There may be exceptions to this, such as Kirlian photography and Harry Oldfield's phasic aura photography. There may also be other techniques the authors are currently unaware of). The 'protection devices' certainly do not eliminate or remove the source of the potential damage, which is still verifiably present.

The EMX biochip was 'invented' (discovered?) by the late Ted Litovitz, who was a professor at Washington Catholic University. He put a lot of effort into looking at ways of mitigating regularly pulsing RF and came up with a brown noise generator (LF-filtered white noise) that generates noise EMFs up to a few hundred hertz. This seems to help mask adverse effects of regularly pulsing RF or 50/60 hertz power-frequency EMFs. It has its place, but we believe avoidance of exposure is much better than trying to mask it with even more EMFs.

People vary greatly, due to inherited factors, and many unquantifiable characteristics. Subtle effects on the immune system may make a significant difference to the well-being of many people.

We suggest that if you are tempted to try one of these devices, obtain it on a money-back if not satisfied arrangement. If it works for you, keep it; if it doesn't, return it.

One of the devices that has been strongly recommended by an EHS sufferer, is the Personal Harmoniser, available from the Centre for Implosion Research (see Chapter 6). She reported that "*my health has Improved enormously*" in the 8 weeks she had been using it. It has helped her energy levels rise, her sensitivities reduce, and her sleep improve. Her sensitivity meant that she could only have the Harmoniser about a metre away to begin with and even later could only wear it for a few hours; she also became aware of some challenging emotional issues that needed to be dealt with. At less than £30, and with a 60-day money back guarantee, it is worth a try.

Psychological improvements

The work by Bob Coghill, which we reported on in the Biology Chapter, on differences in pain sensitivity, suggested that this is at least in part due to the way the cerebral cortex interprets incoming stimuli based on prior experience. For the sensitised individual, it may be useful to find ways of de-sensitising the past experiences, in order to learn new techniques of managing incoming stimuli. Some of the differences in interpreting incoming data may be genetically determined, but some will be learned and thus capable of being re-learned. This may be why in some experiments people report on the effectiveness of placebos as well as 'real' treatments. The re-learning may be helpful when a 'symbol' helps to focus the re-learning process, especially when it is a matter of pain relief and control. Hypnotherapy, meditation, and other 'psychological' techniques have been experienced as effective.

Learn techniques for stress management, because stress makes symptoms worse, even when it was not part of the initial exposure that induced the problem. A report that visualisation (often used as part of stress management techniques) can reduce symptoms is further evidence of psychological changes which effect physiological improvements.

Cognitive behavioural therapy may have beneficial effects in some people with EHS. Various studies [Andersson 1996, Harlacher 1998, Hillert 1998] have shown mixed results, but it could be worth a try.

An interesting anecdotal example of the mind-body interaction that encourages us to look at all possible ways of alleviating difficult-to-treat syndromes is the following: A group of people with allergies were asked to come off all allergy medication for three days before watching the Charlie Chaplin film *Modern Times*. Before, during and after the film they were exposed to various allergy-causing substances. Their allergic responses were significantly reduced after watching the film.

When the same experiment was tried with a group of people watching a weather forecast, no improvements were detected. (Dr Hajime Kimata, Unitika Central Hospital, Japan) Scientists believe that laughter stimulates the production of endorphins, feel-good chemicals which also boost the immune system. Laughter - even the anticipation of laughter - shifts our internal chemistry measurably, reducing stress hormones and increasing the number of natural virus-killer cells available to fight diseases from colds to cancer [see Beck reference]. The amount we laugh appears to reduce as we get older. The average 6-year-old laughs 300 times a day compared to a grouchy 47 laughs a day in adulthood. Women generally laugh more than men.

I am unsure how the researchers determined how often the average person laughs, but you may be aware of where on the laughter spectrum you would put yourself, and see if there is any way you can increase your exposure to laughter-stimulating experiences.

Listening to music you love encourages a profound and positive emotional experience which, in turn, generates the body's production of hormones and chemicals which protect against disease. Students who sing in a school choir or play musical instruments tend to do better all round [see *The Mozart Effect* by Donald Campbell].

6. Support Groups, Practitioners, References and Websites

There are very few sources of information about electrical hypersensitivity. Some international organisations publicise information about electrical hypersensitivity, together with their other information.

British EHS groups

Electrosensitivity-UK (ES-UK), run by Rod Read Tel: 01353 778151. www.electrosensitivity.org.uk or email at electrosensitivity@hotmail.com

Circuit, run by Ann Ermel, who can be contacted at PO Box 1UZ, Newcastle upon Tyne, NE99 1UZ. She is an EHS sufferer herself, and is very knowledgeable and experienced in matters to do with EHS. Whilst only EHS people can really understand the difficulties of living with such a condition, much of the time the illness takes its toll, and contact can be delayed at times for this reason.

Gillian McCarthy is setting up a charity for people primarily with MCS although as always there is a considerable overlap with EHS, called Safe as Houses - Helping you create your Healthy Personal Environment, PO Box 1400, Bristol BS41 9XZ, email: enquiries@safeashouses.info www.MCS-International.org. As well as producing information and support, she is developing a biodome that may also be suitable for people with EHS to live in.

Worldwide groups

- **FEB**; the Swedish association for the Electrosensitive (whose publications are available in English) – Elöverkänsligas Riksförbund, Box 6023, SE-102 31 Stockholm. Sweden
- **Cellular Phone Taskforce** – PO Box 100404, Brooklyn, New York 11210
- **The EMR Network** (Citizens and professionals for responsible use of electromagnetic radiation – PO Box 221, Marshfield, VT 05658. USA email: info@emrnetwork.org)
- **Ergotec** – Bert Dumpe, Ergotec Association Inc., PO Box 9571, Arlington, Virginia 22219. USA
- **IBE** (International Institute for Bau-Biologie and Ecology Inc.) – Helmut Ziehe, Box 387, Clearwater, Florida. FL 3615

UK Practitioners

Dowson Dr David - The Old Ship, 584, Bath Road, Saltford, Bristol BS31 3JL. Tel: 01225 475508

Monro Dr Jean - Breakspear Hospital, Hertfordshire House, Wood Lane, Paradise Estate, Hemel Hempstead. HP2 4FD Tel: 01442 261333

Riggs Alf - Consultant Radiesthesist and Telluric Radiation Detection - 01992 719735. email: info@alfredriggs.com

Riggs Roy - Electromagnetic and Geopathic Energy Surveyor - 01273 732523 or 07960 505134 roy.riggs@ntlworld.com See his website www.royriggs.co.uk

Smith Dr Cyril W email: Cyril.smith@which.net

Tresidder Dr Andrew - Yarn Barton, Sea, Ilminster, Somerset TA19 0SB Tel: 01460 57475 www.drandrew.co.uk

Useful Products

Centre for Implosion Research - PO Box 38, Plympton, Plymouth. PL7 5YX Tel: 01752 345552

Coghill Research Labs (Roger Coghill) - Electromagnetic Products Limited. 01495 763389

EMFields - Powerwatch publications and articles on EMF issues, instrument hire and sale, for measuring power frequency & radiofrequency emissions, demand switches, earthing leads for laptops, 3 types of shielding material for screening microwave radiation, including bed canopies, and carbon-based shielding paint. Tel: 01353 778814 for catalogue or orders

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Websites

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Centre for Implosion research - www.implosionresearch.com

Dutch site (primarily in Dutch) - www.electroallergie.org

Electrosensitivity-UK - www.electrosensitivity.org.uk

FEB - www.feb.se Swedish ES site, primarily in English

GreenHealthWatch - www.greenhealthwatch.com

www.idcnet.com/~jschultz/es.htm - a site about electrosensitivity.

Irish Doctors' Environmental Association - www.ideaireland.org/emr.htm

<http://groups.msn.com/HumSufferers> - a site to register if you hear the Hum, including information exchange and support.

National Institute of Environmental Health Sciences (part of the US Department of Health and Human Services) produces the journal *Environmental Health Perspectives*, available online at www.ehponline.org

Powerwatch - www.powerwatch.org.uk

Swedish Union of Clerical and Technical Employees in Industry: www.sif.se

7. Appendices

Appendix 1

The Powerwatch response to the October 2005 Health Protection Agency – Radiation Protection Division report on Electrical Sensitivity

Summary:

The HPA-RPD report "Definition, Epidemiology and Management of Electrical Hypersensitivity" unfortunately was limited to a carefully conducted review of the published literature - which for EHS is extremely sparse. This HPA-RPD review gathers some useful information together but offers little of any practical use from a public health perspective.

This is a missed opportunity and GPs would have greatly benefited from some practical advice. At present they tend to blame the reported health effects on stress and so prescribe tranquilisers and other psychoactive medication.

We have to ask why, if they really do not have the expertise to recognise medical conditions, did the NRPB (now the HPA-RPD) commission this report in the first place? Who was it for? Who should do what now?

In the words of the review's foreword, the review "was commissioned by the NRPB to consider the definition, epidemiology and management of ES." To do this the review was largely defined by seven questions as follows:

1. Is there a characteristic set of symptoms associated with ES?
2. Are the triggers the same in all sufferers?
3. Is there a characteristic time course and prognosis for the condition?
4. Is the condition more common in certain groups in the population?
5. Is there a diagnostic test or pathophysiological marker characteristic of ES?
6. Are there management strategies that are known to be effective?
7. Is there an overlap with other syndromes such as multiple chemical sensitivity or other environmental illnesses?

Although there are overlaps, questions "1", "2" and "5" can be seen as defining ES, "3" and "4" as the epidemiology of ES, and "5" and "6" as the management of ES.

Definition of ES

The review concluded that "It has not been possible to construct a meaningful definition of ES..." (Section 5.1 paragraph 1).

This conclusion is quite reasonable, due mainly to the wide range of symptoms experienced by ES sufferers and the wide range of sources that appear to cause these symptoms. The statement that "the review found no consistent evidence of objective clinical signs or sensitive/specific pathophysiological markers" (Section 5.1 paragraph 2) is similarly reasonable, though it could be taken as implying that the symptoms may not actually exist - which they do.

The final paragraph in the section is also acceptable, though it has an unnecessary final sentence that seems to have been inserted in order to weaken the section. Having noted that ES seems to share a number of its symptoms with other "functional somatic syndromes" and "idiopathic environmental intolerances" (the difference being that ES is normally attributed by the sufferer to a specific EMF source), the review finishes with "Other than noting the ongoing debate about this attribution, however, this review is unable to comment further". This is a real shame as the content of the review gave plenty of room to make further comments, and the lack of comment is therefore a deliberate decision, as opposed to there being a lack of data to comment on.

It could be argued that they are implying that there is not sufficient evidence to make a genuine association between ES symptoms and an EMF source except for the assertion of the sufferers, whereas some of the research cited in the review clearly suggests otherwise. For example, they cite a published questionnaire in section 4.5.5 (Symptoms of ill health ascribed to electromagnetic field exposure, International Journal of Hygiene and Environmental Health 2004), where 394 people with self-attributed ES had to score the effectiveness of actions they took to reduce the problems they were experiencing from 1 (ineffective) to 6 (very effective), and we see these results as offering good evidence of the reality of EHS. The actions taken and mean effectiveness score for reducing symptoms are displayed in the table below:

<i>Action Category</i>	<i>Mean Effectiveness Rating</i>
Disconnecting Electricity	4.5
Removing indoor source	4.3
Avoiding exposure	4.2
Reconstruction	3.4
Information	3.2
Meditation / Body Work	3.2
Drugs	3.2
Shielding Devices	3.2
Alternative Medicines	3.2
Shielding of the dwelling	3.0
Changing lifestyle	2.3
Law complaint	1.1

With such a huge correlation between the removal of exposure (all top 3 actions fit into this category) and improvement of well-being, it is clear not only that this may well be useful in defining ES for (2) above, warranting further investigation, but it also provides a starting point for management of the condition (6). Recommendations of further work to be done to test these should have been made.

Epidemiology of ES

The review looked both at occupational studies and studies of general populations to estimate the prevalence of ES. The following is taken from section 4.6 of the review, and relates to the findings of the EC expert group (NIWL, Bergqvist et al.) who attempted to estimate the extent of ES within EU countries.

"The group reported that estimates of the total number of cases differed substantially between the answering groups, with self-aid group (SAG) estimates consistently around ten times higher than those of centres of occupational medicine (COM). Estimates ranged from less than a few cases per million of the population (COM estimates from UK, Italy and France) to a few tenths of a per cent of the population (SAG in Denmark, Ireland and Sweden)".

"The group concluded that the differences in prevalence were at least partly due to the differences in available information and media attention around ES that exist in different countries. Similar views have been expressed by other commentators".

EC Expert group (NIWL, Bergqvist et al) findings, Section 4.6 of "Definition, Epidemiology and Management of Electrical Sensitivity"

Report for the HPA-RPD by N Irvine, Regional Epidemiologist, CDSC N. Ireland

From this, it would seem that the real issue here is recognition of the syndrome. It is clear that the lack of recognition of Electrical Sensitivity as a condition is due largely to the lack of ability to clearly define it, either by symptoms or by cause, and that this is therefore going to have a direct effect on the number of people estimated to suffer from it. The disparity in percentages may well be accounted for by the number of people with ES who are unable to continue their employment due to ill-health caused by EMF exposure at work and therefore drop out of occupational medicine statistics. They may then seek alternative sources of support such as self-help groups. It is therefore not possible to currently predict the prevalence of the condition either in the UK, or worldwide until there is a more formal method of defining who has the condition, especially when it seems to overlap with other sensitivity and intolerance responses. Powerwatch believes that around 3% of the UK population (about 2 million people) may experience some degree of electrical hypersensitivity [see Refs 1, 2, 3 & 4].

Management of ES

The opening sentence of the "Policy/management options" section of the review (section 5.2) states "Given that the project did not specifically address the question of aetiology, it is unable to inform policy in terms of setting exposure guidelines". It then comments that there is not sufficient published evidence regarding evaluation of the symptoms and success of management strategies in dealing with the condition, though it does note that the "limited studies to date" show some success.

This section sums up what was really disappointing about the report: a lack of solid suggestions of how to move forward in an attempt to tackle the problem, perceived or otherwise, of Electrical Sensitivity. Aside from the comment that defining whether or not someone actually has ES is an exceptionally tricky prospect (aside from the fact the sufferer themselves thinks it is ES), the report has made some kind of recognition that a condition with apparent connections to EMF sources exists.

However, beyond that, very little support is offered to people who report that they have the syndrome. In fact, the final paragraph in section 5.4 reads "Thus, although symptoms attributed to RF EMF (such as mobile phones/base stations) and other exposures appear to be similar in type, the findings of this review cannot apply in full to these attributions", which is effectively stating once again that they are deliberately leaving open the chance that these symptoms are purely coincidental and are not related to EMF sources.

They conclude their "Future Research" section (5.5) by recommending that future research should control for the placebo effect, should engage with therapists and practitioners currently attempting to look at the condition to see if there are evaluations missed by this review and to conduct clinical trials on cognitive behavioural therapy (CBT). A study carried out by Kennedy (2007) showed that people undergoing CBT treatment demonstrated reduced metabolism in several prefrontal regions. As CBT has been shown to help some people with EHS, this sort of study may help identify neurological changes that may point to a range of appropriate treatments for sufferers of EHS.

Considering the results in the Actions/Effectiveness table (see above), it is infuriating that prevention has not been considered as a valid management tactic, focusing instead entirely on treatment. The results show quite clearly that the removal of the EMF source has the single strongest effect in ameliorating the symptoms. Surely it is worth recommending that studies are done properly to investigate the effectiveness of practical preventative measures.

If EHS is as prevalent as we believe, it is responsible for both a considerable loss and cost to the country, with people living and working well below optimal health. We urgently need the HPA and the Department of Health to proactively take this issue forward.

References and further reading

The original report: HPA-RPD-010, 'Definition, Epidemiology and Management of Electrical Sensitivity' from the Radiation Protection Division of the Health Protection Agency, may be freely downloaded from their website [here](http://www.hpa.org.uk) [www.hpa.org.uk].

[1] [SIF report](#) on hypersensitivity symptoms of members, of which another version is available from [here](http://members.iinet.net.au/~emfacts) [members.iinet.net.au/~emfacts].

[2] 'Black on White' Voices and witnesses about electro-hypersensitivity - the Swedish experience, available from [here](http://www.feb.se) [www.feb.se] - 143 pages, 1.2 MB].

[3] The Charity [ES-UK](#) have written some comments on the HPA-RPD ES Report, available from [here](http://www.electrosensitivity.org.uk) [www.electrosensitivity.org.uk]

[4] The World Health Organisation have some ES information [here](http://www.who.int) [www.who.int], and the Proceedings of their 2004 conference are available from [here](http://www.who.int) [www.who.int].

Other worthwhile reading:

Electromagnetic Hypersensitivity - 2nd Copenhagen Conference Proceedings Eds: Jyrki Katajainen and Bengt Knave ISBN 87-981-270-2-0, Denmark, 1995.

Bergqvist U and Vogel E (1997) Possible health implications of subjective symptoms and electromagnetic field. A report prepared by a European group of experts for the European

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Appendix 2

A recent study on EHS. We report on the study's intent and findings and then add our comments on whether we think this study has moved the subject forward.

Are some people sensitive to mobile phone signals? Within participants double blind randomised provocation study.

James Rubin, et al; BMJ April 2006; 332; 886-891

Their objective was to test whether people who report being sensitive to mobile phone signals have more symptoms when exposed to a pulsing mobile signal than when exposed to a sham signal or a non-pulsing signal.

It was a double blind, randomised, within participants provocation study carried out at a dedicated suite of offices at King's College London, September 2003 to June 2005.

The participants were 60 "sensitive" people who reported often getting headache-like symptoms within 20 minutes of using a global system for mobile communication (GSM) mobile phone and 60 "control" participants who did not report any such symptoms. Intervention Participants were exposed to three conditions: a 900 MHz GSM mobile phone signal, a non-pulsing carrier wave signal, and a sham condition with no signal present. Each exposure lasted for 50 minutes.

The principal outcome measure was headache severity assessed with a 0-100 visual analogue scale. Other outcomes included six other subjective symptoms and participants' ability to judge whether a signal was present.

Headache severity increased during exposure and decreased immediately afterwards. However, no strong evidence was found of any difference between the conditions in terms of symptom severity. Nor did evidence of any differential effect of condition between the two groups exist. The proportion of sensitive participants who believed a signal was present during GSM exposure (60%) was similar to the proportion who believed one was present during sham exposure (63%).

They concluded that no evidence was found to indicate that people with self reported sensitivity to mobile phone signals are able to detect such signals or that they react to them with increased symptom severity. As sham exposure was sufficient to trigger severe symptoms in some participants, psychological factors may have an important role in causing this condition.

Powerwatch Comments on Rubin et al study

There are a number of problems with this study that will contribute to the "no evidence" conclusions.

Firstly, a number of really ES people who volunteered to take part were too badly affected, did not complete the tests and so had to be excluded from the analysis. Indeed, to be included you had to be able to use a mobile phone.

Secondly, the background RF fields in the rooms were not controlled and the rooms were not screened so (a) there was a general level of RF pollution all the time and (b) any mobile phones in nearby rooms would have, at times, affected the ambient microwave fields.

Thirdly, and probably the most important problem was due to the design of the MTHR (UK Govt Mobile Telecommunications and Health Research) handset that was used in the tests. In order that the handset should “warm up” the same in “sham” mode as it usually would in normal use, the MTHR specified that the microwave power should still operate and just be fed to a “dummy load” inside the handset. That works fine for the temperature control but also results in significant microwave fields around the handset when in the “sham” (= no exposure) mode. These are shown at: http://www.mcluk.org/MTHR_exposure_systems/SARplots.htm

What do we mean by “significant microwave fields”? Well, the TNO human volunteer study [a, below], which was well designed and carried out, found adverse effects on the well-being of sensitive people at microwave levels which caused SARs of less than 0.1 mW/kg. This was at a microwave field signal strength of 1 V/m. Various reports show adverse effects in the reported symptoms at levels above 0.05 V/m approximately (some of these are documented on the Powerwatch website at:

<http://www.powerwatch.org.uk/masts.asp>).

The MTHR handset when in the “sham” (=no exposure) mode has SARs up to about 5 mW/kg, fifty times the power level found by the TNO study as capable of inducing adverse effects on wellbeing and many more times the level at which sensitive people experience adverse effects when living near to mobile phone base stations.

http://www.mcluk.org/MTHR_exposure_systems/SARplots.htm

So, it is hardly surprising that the Rubin study did not find significant differences between the “sham” and “real” exposure conditions, as the “sham” exposure was exposing participants quite highly. It would have been so easy to have had a further test with the phone completely “turned off”.

It would also have been easy for the MTHR handset to be designed so that the direct battery voltage was used to heat the handset without generating and dissipating any microwave energy next to the volunteer’s head. This error in design will potentially invalidate a number of the MTHR research projects – especially any which involve testing sensitive people.

[a] See:

http://www.tno.nl/tno/actueel/tno_nieuws/2003/onderzoek_tno_naar_effect/tno_fel_report_03148.pdf