Your *rapporteur* proposes that we **move beyond the current situation; we must attempt to solve the current scientific uncertainty**.

Your *rapporteur* proposes that **the research be relaunched** and **a new risk assessment be conducted in five years' time**; this evaluation could be carried out on the request of the government via AFSSET.

The three main avenues of research are: to reinforce the ongoing **epidemiological** studies in France, to carry out studies on an appropriate **animal model**, and to pursue research on the causes of leukaemia. This must be **undertaken rapidly and with the appropriate means**.

**By 2015**, awaiting these new results, **your *rapporteur* recommends - in a prudent manner** and taking into account the scientific uncertainties - that parents and authorities (in particular, elected officials) **seek to avoid, whenever possible and at a reasonable cost, the exposure of children aged 0 to 6 years, as well as unborn children, to fields greater than 0.4 µT on average**.

Drawing inspiration from the Netherlands, the French government should recommend - in a nonbinding manner - that one avoid building new constructions in which very young children spend a considerable amount of time all year long (households, day nurseries, nursery schools, etc.) within a "caution zone" in which exposure would be greater than this value. Conversely, lines or other significant sources of fields should not be installed in proximity to these "sensitive" sites frequented by very young children.

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Second question: Do the electric and magnetic fields emitted by high and extra high voltage lines have an **impact on the environment**?

With regard to **wild flora and fauna**, your *rapporteur* regrets the **insufficiency of the scientific data** dealing directly with this subject. However, **observation data** for flora and fauna show that **nature can opportunistically benefit from the artificial and, to a certain extent, protected environment created by the lines** and forest corridors to reproduce and prosper.

In this regard, your *rapporteur* **requests that RTE** - in addition to its already existing partnerships, for the most part with associations - **establish a greater number of scientific partnerships** to help it measure the impact of existing or planned lines on the environment, so as to eventually lead to the publication of further peer-validated results/ knowledge. This would serve to widen the information base available to elected officials, associations, local residents and the general public.

**The scientific literature dealing with agriculture is abundant and clear. The fields have no direct impact.**

However, power lines can **indirectly impact farm-raised animals** via induction or leakage phenomena. **This problem is globally well understood and the methodology to remedy it is well established. These difficulties remain few in number**, for, since 1999, the GPSE ("Permanent Group for Electrical Safety" on animal farms) has only been solicited **3.5 times per year** on average.

A **renovation of the current system** is nevertheless necessary, to **emphasize the informing of farmers** and encourage their participation. The educational aspect is essential. To this end, it is indispensable to adopt a **transparent system** in which the **responsibilities and roles of the French state and RTE are much more clearly defined** and in which the **mechanisms for covering farmers obey rules known to all parties**.

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# High and Extra High Voltage Lines, Health and the Environment

**By Mr Daniel RAOUL, Senator of Maine-et-Loire**

*This report was prepared by the Economic Affairs Commission of the French Senate within the framework of the OPECST study.*

## *Main conclusions*

France is **the European country with the most extensive network of high and extra high voltage lines** (+ 50 kV and + de 200 kV). Electricity distribution has been seen, ever since the interwar years, as an essential public service. Following the Second World War and thanks to its nationalization, the network was standardized and developed as part of a modernization and socio-economic development project.

Even today, RTE – the manager-operator of France's high voltage system – is a 100% state-owned company. **A reliable, well-performing network is an absolute necessity for a developed economy. It corresponds, today as it did yesterday, to public decisions made by the national democratic authorities in accordance with the general interest.**

The power network, no matter the source of energy, serves as the link between production sites and consumption sites, in such a way as to guarantee the provision of power even in the event of one element of the system failing. For the high voltage network, tomorrow's challenge is the incorporation of renewable energy production plants.

It is desirable that **the French state once again assume its full responsibility in informing the public and financing research and expertise**. It is also necessary that, via a **renewed dialogue between the operator and local elected officials, the latter once again play a central role in the system** and act as the initiators - thanks to the operator's expertise - of the network's evolutions, such as a regional project. Finally, **the operator must** widen its methods of dialogue and information distribution, so as to **sustainably involve a much wider public**, well beyond just the immediate residents and the preparation and installation of lines. **A dialogue must be implemented and sustained throughout the entire lifetime of a power line.**

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The public's misgivings with regard to the installation of high and extra high voltage lines often result in **burying** being proposed as a solution.

Burying power lines offers real advantages and allows for **a significant reduc-**

**tion of the magnetic field, while at the same time eliminating the electric field**.

But each decision to bury a line must be **the subject of a cost-benefit analysis**. For high voltages, the costs are often under control and it can be in RTE's interest to bury the lines. On the other hand, burying quickly becomes very costly and complex for extra high voltages, even excessively so for a voltage of 400 kV.

However, so as to improve the quality of life of urban residents, we should **facilitate the elimination of existing 225-kV lines beneath or immediately next to which lie homes**.

This could be included in a modification of RTE's public service contract with the French state. The financial means would have to be specified in such a manner as to create a project jointly funded by the regional authorities and RTE.

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These high and extra high voltage lines **emit** extremely low frequency fields. These fields are of two distinct types: **magnetic fields and electric fields**. These fields must not be confused with the very high frequency fields emitted by relay antennas and mobile telephones.

Electric fields are constant, but magnetic fields vary according to the strength of the current flowing through the line. Magnetic fields therefore vary throughout the day and year, as well as from one line to another.

**High and extra high voltage lines are not the only emission sources** of these fields. Other sources also exist, both within homes and offices (such as electrical devices) and outside residences (such as SNCF lines).

**Household exposure is therefore estimated at around 0.2 µT.** Exterior exposure varies constantly. A **computer screen** emits a field in the region of **0.7 µT**. Travelling via **TGV** high-speed rail would expose a traveller to a field averaging **2.5 to 7 µT**.

RTE estimates that around **0.6% of the French population (375,000 people) is exposed to over 0,4 µT due to nearby power transmission lines**.

**The exposure** of the overall population and individual exposure typologies are still not well known. This question should incite **new research**.

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Do these magnetic and electric fields have an **impact on human health**?

This question has been asked for over the past 30 years. **A clear answer can now be provided, given the current state of scientific knowledge.**

**A solid international consensus - expressed by global, European, foreign and national health authorities - exists with regard to this question**, even if certain divergent opinions also exist.


Source: RTE Médiathèque RTE/Michel **Monteaux**

**The international standards** (limit of 100µT at 50 Hz) **are effective to protect the population from the short-term effects linked to acute exposures. They therefore do not require modification.**

With regard to **chronic exposures to small doses and in the long term**, extremely low frequency electric and magnetic fields **have no impact on human health (except, perhaps, for three specific pathologies** touched upon below). Collective assessments indicate that those factors pointing to a possible link between these fields and other diseases are either too weak, inexistent or, on the contrary, have allowed for this connection to be dismissed.

The three pathologies for which a debate persists are: electromagnetic hypersensitivity, certain neurodegenerative diseases, and acute juvenile leukaemias.

Concerning **electromagnetic hypersensitivity, no causal link has been established**. Furthermore, the diversity of the syndromes and the "auto-declarative" nature of the ailment (in other words, it is the patient who declares himself to be suffering from EHS, rather than any doctor rendering a diagnosis) make it a **subject of clinical research**. **The patients' suffering must be taken seriously.**

**Support should be lent to the setting up of a national network of coverage and research** on this issue.

Concerning **certain neurodegenerative diseases, the link is currently but a hypothesis**. France's public health authorities **must not ignore the risk**, for recent epidemiological data concerning professional populations (train drivers) have demonstrated a possible dose-effect relationship and the number of ill people is possibly quite high. The *rapporteur* therefore recommends that **an epidemiological study be carried out at SNCF and that pertinent research also be pursued**.

As for **acute juvenile leukaemias, their possible link with extremely low frequency magnetic fields of 0.4 µT has led the IARC to categorize these fields within Group 2B (in other words, as possible carcinogens)**.

**This categorization, established in 2002, was based on epidemiological data.** While these data establishing a statistical link have not been invalidated since, they **do not indicate any dose-effect relationship or threshold**.

**No mechanism of action has been demonstrated** in the laboratory or with animals. This statistical link therefore establishes a risk, but it **does not indicate any causal link**.

These acute leukaemias affect **children aged from 0 to 6 years**. It constitutes **a multifactorial disease whose causes are not well known**. In any case, power lines could only explain a fraction of the cases.

These leukaemias are **extremely rare**. Their incidence rate is such that one can estimate - taking into account the extent of the French population currently exposed to over 0.4 µT due to high and extra high voltage lines - that less than five children per year would suffer and less than one would die from the disease, if the causal link were established.

**The risk is therefore low. The anxiety surrounding this subject is, however, legitimate**, for the possibility of a **link** has been accepted as being **sufficiently solid for the IARC to include these fields in Group 2B**, even if the possibility of such a relationship was judged too weak to justify a higher classification.



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