

# Is the Precautionary Principle an Appropriate Mechanism for Addressing Health Concerns About Electromagnetic Fields?

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## Summary

In this conference, the World Health Organization proposes to develop a framework for applying the precautionary principle (PP) for regulation of human exposure to electromagnetic fields. However, as a mechanism for risk management, the use of the PP is constrained by policy and legal constraints of individual states, and international law.

European Commission (EC) policy and European case law have emphatically stated that application of the PP has to be based on (a) a careful analysis of the scientific literature, (b) an identified hazard, and (c) it cannot be used for risks that are speculative or not established by scientific evidence.

By these standards, the PP is not well suited as a mechanism to address citizens' concerns about possible health effects of RF fields, at least in a European context. It *may* be suitable to invoke in regulating human exposure to powerline fields. Other approaches to addressing the acceptability of electrical technologies may be more suitable than the PP. These may include better risk communication, closer involvement of community groups in siting facilities, and other measures taken outside of a health protection framework.

## Introduction

The PP is not a scientific proposition, nor is it a precisely defined proposition in international law; there is some question whether it even qualifies as being a “principle” at all (1). Rather, it is a counsel for risk aversion, expressed in varying ways in numerous treaties and other documents. In practice, its application is constrained by policies, statutes, and case law of individual states and international law.

In this conference, the World Health Organization proposes to develop a framework for applying the precautionary principle (PP) for regulation of human exposure to electromagnetic fields. It is reasonable to question whether the PP is an appropriate mechanism for addressing the public’s health concerns about electromagnetic fields. The framework of this discussion is European Commission policies and European case law as it bears on the use of the PP.

## Scientific Background

Electromagnetic fields (EMF) do not constitute one entity. Rather, the term refers to emissions from a wide range of technologies, which exist over a wide range of frequencies, with greatly different toxicological characteristics, and whose exposure characteristics to humans vary widely.

Public concerns about possible health effects of environmental electromagnetic fields have arisen many times, with reference to many different technologies. Roughly speaking, these pertain to radiofrequency (RF) and extralow frequency (ELF) fields:

- *Radiofrequency fields* are produced by a host of communications and noncommunications technologies, including broadcast facilities, radar, and wireless communications. Levels of human exposure to RF fields vary widely.

Public issues that have arisen in recent years connected with RF energy exposure include

- a. Exposures to the public from wireless base stations (chronic exposures at low levels, which are involuntarily sustained).
- b. Exposures to the head of a user of a mobile telephone (intermittent exposures, at comparatively higher levels, to limited parts of the body, voluntarily sustained).

In recent decades, a host of other issues have arisen, including injuries sustained to patients during treatments involving RF energy, hazards (proven or conjectured) from using microwave ovens, police radar sets, airport radar installations. In addition, a number of issues not directly related to biological effects of fields have arisen, including RF interference with medical equipment and traffic safety with use of mobile telephones.

- *Extralow frequency* fields from power lines, household appliances, and other electrical technologies, which occur at 50 Hz (Europe) or 60 Hz (US and Canada). The most politically sensitive issue concerns possible health effects of ELF exposure to residents near high voltage power lines; however intermittent exposure to ELF fields at far higher levels occurs commonly in everyday life when a person uses an electrical appliance or is present near electrical motors or other equipment.

These issues, from both public policy and scientific viewpoints, are diverse and complex. Public concern appears to be directed at particular technologies (eg. mobile phones, wireless base stations, high voltage power lines) that emit electromagnetic fields.

However, health concerns related to the fields are only a part of a complex of concerns. For example, there is widespread public opposition to mobile base stations (which has resulted in calls to apply the PP to regulate the placement of such installations). But the public concerns about mobile base stations also include concerns about property values, esthetic values, and perhaps also concerns as well, for example feelings of loss of local control over land use and planning.

The possible health effects of RF and ELF fields have been studied for many years, and exposure guidelines have been in place for many years. In most of the world, the most influential exposure guidelines are those of the International Commission on Nonionizing Radiation Protection (ICNIRP) [2]. In the US and other countries, the (quite similar) guidelines of the Institute of Electrical and Electronics Engineers (IEEE) are influential [3]. Public exposures to RF energy from mobile base stations are inevitably far below these exposure limits (for whole-body exposure); exposures from mobile handsets are also below the limits (for partial body exposure) but by a much smaller margin.

There has, however, been longstanding controversy about possible adverse health effects of exposure to RF or ELF energy, at levels well below ICNIRP or IEEE exposure limits. Factors include numerous reports of biological effects of such fields, sometimes at levels below recommended exposure limits for humans, and occasional reports in the medical or scientific literature about associations between some characteristic thought to indicate exposure to fields (for example, job title) and disease.

For many years, such reports have created some level of public controversy. However, they have not been considered to be persuasive evidence of hazard by expert groups that have examined the literature. Such groups characteristically employ a “weight

of evidence” approach, and assessing the totality of relevant evidence while giving little weight to studies that are technically flawed or inconsistent with the larger body of evidence.

#### EC Policy on Use of PP

The Treaty on European Union simply states “community policy shall be based on the precautionary principle” – without any further definition or elaboration of the principle. However, within a European context the meaning and application of the PP have been established by an important Commentary by the European Commission [4, 5], together with a growing body of case law from European courts, some of which directly pertain to electromagnetic fields.

The application of the PP by European states has provoked complaints in some quarters that “precautionary” measures were motivated by concerns other than health or environmental protection, and there have been several important cases in European courts on the issue. In part to address the need to avoid arbitrary application of the PP, the European Commission issued in 2000 an important Commentary on the PP. This, together with the growing body of case law in European courts, provides an operational definition of the use of the PP in the European setting.

The EC Commentary and European case law have sent clear messages on the proper use of the PP, at least regarding the minimum requirements for invoking it. Three major points emerge:

1. *“Precautionary” measures must be applied to address identified risks.* For example, the EC commentary says “one factor logically and chronologically precedes the decision to act, namely identification of the potentially negative effects of a

phenomenon.”

2. *“Precautionary” measures must be based on “as best as possible” a review of the scientific evidence.* The Commentary says “A scientific evaluation of the potential adverse effects should be undertaken based on the available data ... [t]his requires reliable scientific data and logical reasoning, leading to a conclusion which expresses the possibility of occurrence and the severity of a hazard's impact on the environment, or health of a given population ...”

3. *“Precautionary” measures must not be applied to address conjectured risks.* European case law echoes this view. For example, in a judgment (in a case involving antibiotics for use in animal feed) the Court of First Instance pointed out

“It is necessary, first, to define the 'risk' which must be assessed when the precautionary principle is applied... A preventive measure cannot properly be based on a purely hypothetical approach to the risk, founded on mere conjecture which has not been scientifically verified” ... Rather, it follows from the Community Courts' interpretation of the precautionary principle that a preventive measure may be taken only if the risk, although the reality and extent thereof have not been 'fully' demonstrated by conclusive scientific evidence, appears nevertheless to be adequately backed up by the scientific data available at the time when the measure was taken. (6).

Is Evidence Sufficient To Trigger “Precautionary” Measures Against

## Electromagnetic Fields?

This question has to be addressed with respect to the first two items above: has there been a careful review of the scientific evidence, and has it uncovered a hazard for which precautionary measures are warranted? For RF fields, the answer to the first question is certainly yes, and the answer to the second is a clear no. The answer for ELF fields is more complicated.

### RF Fields

The WHO has not conducted a risk analysis of RF fields. However, in recent years a number of European states have appointed expert groups to examine the scientific literature for possible health effects of RF energy, largely motivated by public concerns about the safety of RF emissions from mobile phones or their base stations. The results of all these independent investigations have been very similar. For example:

- The Independent Expert Group on Mobile Phones (IEGMP), often referred to as the Stewart Expert Group (UK, 2000): “Balance of evidence is that exposures to RF energy below [present safety limits] do not cause health effects to the general population.”
- The Zmirou report (France, 2001): “no risk has yet been demonstrated, in spite of the considerable amount of work done over the past several years”
- The Health Council of the Netherlands Report (January, 2002): “The Committee comes to the conclusion that there is at present no reason for concern.”

At the same time, these and other expert groups acknowledge that the

scientific evidence is incomplete and, in places, inconsistent, and all agree that more research is warranted.

Moreover, these committee reports all fall short of proclaiming that mobile phone emissions are “safe”. For example, the Stewart Expert Group, in its final report, said ““it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects”.

In part, this reluctance to proclaim mobile phones “safe” reflects the impossibility of “proving the negative” (i.e. proving the absence of risk). Health agencies in any event normally refrain from pronouncing technologies or chemicals “safe”. Also, in part, this may reflect the inconsistency in the RF bioeffects literature. In any event, the Stewart Expert Group did not specify the nature of the additional scientific evidence that they would require to declare that RF fields are “totally without potential adverse effects”.

In short, the most careful reviews of the scientific literature, by expert panels appointed by European states, have failed to identify a hazard from either mobile phones or their base stations or, more generally, from exposure to RF fields at levels below ICNIRP limits. But they have also refrained from proclaiming such exposures “safe”.

Some of these reports did recommend precautionary measures nevertheless. For example, the Zmirou report recommended precautionary measures in the siting of mobile base stations – not for health reasons but to reassure the public. On August 22, 2002 the Conseil d'Etat, which is the French



supreme Court in the administrative order, suspended municipal ordinances prohibiting the installation of mobile antennas, citing the lack of finding of risk by the Zmirou report.

### ELF Fields

Unlike the case of RF fields, health agencies have expressed a specific health concern relating to exposure to ELF magnetic fields. In 2001, IARC conducted a review of the extensive epidemiology and animal studies related to the issue of 50/60 Hz magnetic fields and cancer, and decided that ELF magnetic fields are possibly carcinogenic to humans (Group 2B), based on a weak statistical association between residential ELF magnetic fields and increased risk for childhood leukaemia (7).

ELF fields are an interesting test case of the PP, because of the subtlety of assessing the “possibility of occurrence and the severity of a hazard's impact on the environment, or health of a given population”. IARC did not conclude that ELF fields *do* cause childhood cancer, but rather that there is some level of suspicion that they might.

Indeed, because of the weak nature of the evidence, views of individual scientists are likely to diverge broadly on the issue. Health agencies are likely to express their conclusions in terms of level of suspicion rather than issue firm pronouncements that such fields actually cause disease. For example, the epidemiological evidence linking ELF magnetic fields and childhood leukemia has been summarized by two recent meta-analyses. Each reported statistically significant associations between exposure and childhood leukemia . But the associations were weak (relative risks of approximately 2) and were found in only one exposure group in each study, each with a rather small number of cases (100 or less). Whether this association is causal is questionable on

grounds of biological plausibility (relevant animal studies are negative, and no defensible hypothesis has been proposed how such fields might cause toxic effects of any sort at the exposure levels involved). There is, nevertheless, some level of suspicion that ELF magnetic fields are a cause of human illness.

Thus, ELF fields near high voltage powerlines *might* meet the criteria for “triggering” the PP. The nature of precautionary measures to be taken, if any, would be constrained by other recommendations of the EC in its Commentary. The situation is further complicated by the fact that little research is currently being done on this issue. Absent some unexpected breakthrough, the scientific basis of the issue is not likely to become clearer. This mitigates against the use of the PP for management of risks on a temporary basis pending the availability of additional data, which is the clear preference of the EC as represented in its commentary.

#### Are There Other Ways To Address Public Concerns?

In its Commentary, the EC has defined a robust and careful formulation of the PP that clearly serves the public interest, and reduces the very real danger of using it as an ad-hoc political response to public controversy. For reasons discussed above, RF fields do not meet EC criteria for invoking the PP.

“Precautionary” responses developed in response to concerns about mobile base stations (for example) may both fail to address important concerns of the public, and lead to unexpected difficulties down the road. In recent years Italy has experienced a national controversy related to emissions from a Vatican-owned radio station, whose emissions are well below international limits (ICNIRP) but above “precautionary” limits that were adopted chiefly in response to public concerns about mobile base stations (8). Nobody

has been well served by that controversy.

There *are* real problems with electrical technologies, but these need to be addressed outside of a “precautionary” framework of health protection. Public concerns about wireless base stations (for example) span a range of issues, many of which are not related to health at all (esthetics and property values, for example). Industry should be encouraged to locate its facilities in a way that minimizes public concerns, and both industry and government would benefit by improved practices in risk communication. In the absence of foreseeable health benefit, “precautionary” measures are both scientifically unjustified and legally problematic.

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1 D. L. Weed, Is the Precautionary Principle a principle? IEEE Technology and Society Magazine 21:45-48, 2002.

2 International Commission on Non-Ionizing Radiation Protection. ICNIRP Guidelines: Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), *Health Phys.* 74:494-522, 1998.

3 IEEE Std C95.1-1991 - 1999 Edition. IEEE Standard for Safety Levels With Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz (available from the Institute of Electrical and Electronics Engineers, Inc., Service Center, 445 Hoes Lane, Piscataway, NJ 08854-1331, U.S.A.)

4 Commission of the European Communities, Communication on the Precautionary Principle, Brussels 02 February 2000. See [http://europa.eu.int/comm/off/com/health\\_consumer/precaution.htm](http://europa.eu.int/comm/off/com/health_consumer/precaution.htm).

5 K. R. Foster, P. Vecchia, M. H. Repacholi, Science and the precautionary principle. *Science* 288: 979-980, 2000.

6 JUDGMENT OF THE COURT OF FIRST INSTANCE (Third Chamber), Alpharma v Council (T-70/99), 2002-09-11

7 IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Static and Extremely Low Frequency Electric and Magnetic Fields (Vol. 80) (19–26 June 2001)

8 P. Vecchia and K. R. Foster, Prevention and controversies: Regulating radiofrequency fields in Italy. IEEE Technology and Society Magazine, 21:23-27, 2002.