Cancer risks seen in electro-magnetic fields

■ Powerlines implicated

■ Biological mechanism unknown

Boston

AFTER two years surveying the existing evidence, the US Environmental Protection Agency has concluded that there is a significant link between exposure to extremely low-frequency (ELF) electromagnetic radiation and the occurrence of human cancer. Although the report says that existing evidence is "insufficient" to prove that a conclusive causal link exists, its controversial conclusion is the US government's strongest statement so far on the potential link between human cancer and the nearly omnipresent ELF electromagnetic fields generated by powerlines, video display terminals (VDTs) and common household appliances.

A preliminary draft of the report's summary was leaked from the agency and made available to *Nature* after the report's existence was recorded in several US newspapers. A full version, entitled *An Evaluation of the Potential Carcinogenicity of Electromagnetic Fields*, is not expected to be released until later this month. The draft states that the biological mechanisms by which human cancer could be caused by non-ionizing radiation are unknown but, nevertheless, concludes that animal tests and epidemiological studies "are suggestive of a causal relationship".

In particular, the draft report says that "the several studies of leukemia, lymphoma and brain cancer in children exposed to magnetic fields from residential 60 Hz electrical power distribution systems, supported by similar findings in adults in several occupational studies also involving electrical power frequency exposures, show a consistent pattern of response". Those conclusions are sure to generate a major controversy and make it almost certain that the Environmental Protection Agency will resurrect its research on electromagnetic fields which was halted under the Reagan administration in 1986.

Controversy seems to exist within the EPA as well as outside it. According to information obtained by Louis Slesin, editor of the New-York-based trade newsletter *Microwave News*, a preliminary draft of the report recommended that electromagnetic fields such as those associated with 60 Hz electrical power distribution be classified as "probable human carcinogens", and given the agency's B-1 risk classification. This category, which denotes epidemiological evidence as well as animal evidence of a cancer link,

includes such chemical hazards as DDT, formaldehyde and PCBs.

William Farland, director of EPA's Office of Health and Environmental Assessment (OHEA) which prepared the report, acknowledged that he made the "personal decision" to delete the staff's highly controversial classification. Farland says that the uncertainty about the biological mechanism that could be involved, and the lack of a clear dose-response relationship, led him to treat electromagnetic radiation differently from a chemical hazard. The issue of classification, Farland says, "will be raised specifically" when the report is reviewed by the agency's scientific advisory board and by an external scientific review panel later this summer. The report itself, however, will be made public before the formal review and public comment period at the end of this month.

According to the report's draft summary, the "strongest evidence that there is an association between certain forms of cancer . . . and exposure to magnetic fields" comes from eight childhood cancer studies. "The consistently repeated pattern of lymphoma, leukemia and brain cancer in the childhood studies and the ruling out of several confounding exposure factors in the Savitz *et al.* study [*American Journal of Epidemiology* 128, 21; 1988] argue in favor of a causal link between these tumor types in children and exposure to ELF magnetic fields or electric fields", the report says. Also cited are "over 30 reports dealing with cancer incidence or mortality in workers in electrical and electronic occupations" carried out in Europe, New Zealand and the United States. While some of the data are conflicting, Farland stresses that the agency will "follow closely" the continuing epidemiological studies of occupational exposure to electromagnetic fields (see *Nature* 341; 374; 1989).

The EPA document does include discussion of three possible biological mechanisms for "interaction between tissue and electromagnetic fields", all of which involve the induction of weak currents and their effects on the flow of ions or ordered lipid bilayers. But it accepts that because the "relevant basic processes" are not understood, it is not possible to guess which aspect of EMF exposure might be relevant. For that reason, the report concludes that a dose-response assessment for carcinogenesis is not yet possible.

Seth Shulman

US-SOVIET SUMMIT

Seismic monitoring in favour

Washington

IN a successful conclusion to a joint experiment on nuclear test verification methods, Presidents George Bush and Mikhail Gorbachev signed agreements at their Washington summit last week that would for the first time allow seismic and 'hydrodynamic' monitoring of nuclear tests in each other's countries.

Previously, the United States had claimed that seismic monitoring was unreliable, arguing that the estimates of yields it produced depended on the geology of the surrounding rock and soil. But verification experiments made last August in the United States and last September in the Soviet Union proved to both nations' satisfaction that seismic methods can accurately detect nuclear explosions even as small as 50 kilotons.

Less technically controversial is the hydrodynamic method, known as CORRTEX in the United States. Electric pulses are sent down a cable planted near the weapon, reflected back at the cable's end and measured at a safe distance. When the weapon explodes, the portion of the cable nearest it is crushed at a rate proportional to the yield, providing a measure of the explosion's force.

But CORRTEX is time-consuming and expensive, and is possible only when the test is pre-announced. To monitor possible surreptitious tests, both countries have to rely on seismic networks. Allowing in-country seismic stations, which theoretically allow even unannounced tests to be detected, is expected to provide the first step towards a total test-ban treaty.

Among other scientific agreements signed at the summit is an extension of a 1973 treaty to cooperate on atomic energy research, which includes studies of the fundamental properties of matter and magnetic fusion. Additions to the original agreement include greater protection of intellectual property rights and new nuclear reactor safety initiatives based on lessons learned at Chernobyl.

A 1973 agreement to cooperate on oceanographic studies was also extended, and marine science cooperation, which had lapsed after the 1979 stationing of Soviet troops in Afghanistan, will now resume. The two leaders agreed to allow researchers to use ports in each other's countries, share research vessels and to publish joint studies openly.

Bush and Gorbachev also agreed to expand the number of undergraduate students exchanges between the two countries by 250 students (up from 750 from the United States and 250 from the Soviet Union), and to increase the target number to 1,500 students exchanged each way by 1995 or 1996 if funds are available.

G. Christopher Anderson