April 2014, by Martin Blank Phd.

Despite its length and seeming breadth of coverage, the report contains deficiencies which lead to questions about its conclusions.

Central to any study of safety is the criterion used to assess effects. It is important to note that the report relies almost entirely on SAR (Specific Absorption Rate) for its assessment of risk. The focus on SAR means that many potentially relevant studies were not included or were dismissed.

Their framing of the issues makes it almost impossible to identify any negative effects of RF. As in the discussion on sperm, they insist on significant changes in temperature being present for any health consequence. Hence, regardless of what other effects there may be, if there is no “acceptable” temperature change, any ill effects cannot be attributed to RF. Since temperature changes of the type they deem significant rarely occur with the major devices currently in use, then ipso facto, there can be no adverse effects of RF. It seems evident that this line of reasoning fails to serve both the public and the development of scientific knowledge.

In their denial of non-thermal effects, the panel inadvertently highlights weaknesses in relying on current SAR criteria. If those criteria had been used, the “*exceedingly tiny temperature increases*” would not meet the SAR threshold currently accepted as risk. In other words, despite there being an effect, the exposure would not be judged as “unsafe” regardless of how many ill effects it produced. The logical conclusion is that the restriction levels based on SAR are set too high and current criteria of risk using SAR ought to be modified to be more stringent so that they can handle even tiny temperature changes of the sort under discussion. The panel makes no mention of the need for or value of these sorts of changes. Overall, its comments suggest that their prime interest rests in “preserving” an exclusive reliance on the current levels used with SAR scales—dismissing all other possibilities and any need for modification.

The panel, like the organizations it cites in its support, (IEEE, ICNIRP) has so focused on thermal effects and SAR that it has not considered important developments in cell biology. In part, this may stem from the fact that the panel did not include any members with expertise in cell biology. Regardless of the reason, the restriction of harm to effects of SAR is a significant weakness. (In Section 8.4, biological issues are mentioned as having been raised by the public in the public discussions. However, they appear to have had little, if any, effect on the panel and the key contents of the report.)

It is not possible to determine if these issues represent a failure in organizing the different strands of the arguments, or a compromise among different members of the committee, or some other reason. Regardless of the source, it exemplifies some key problems in the report and in accepting it in its current form. Further, it seems clear that if the field is to advance and truly assess the risks of RF, and ELF, it must broaden the focus from SAR to include research using biological measures that can yield important information on the health effects and mechanisms of this powerful technology.

The arguments presented in the SC6 report are not fully responsive to the function of the panel – to protect the health of the population. Thresholds for EMF activation of the natural protective cellular mechanisms are much lower than those set on the basis of the current thermal standard, and it makes absolutely no sense to erect a complex regulatory structure on a faulty scientific foundation. SC6 must change its safety criterion and take into account the experimentally determined cellular safety limits. The failure to recognize the sensitivity of living cells is especially dangerous as environmental EMF exposures continue to increase.

Many lines of evidence have contributed to the current knowledge of how cells detect and respond to EMF:there is extensive research that shows that the critical unit to consider for health assessment is the cell and this panel does not use it

- Living cells react to both power (ELF) and radio frequency (RF) EMF as potentially harmful. Goodman and Blank (1998; Blank and Goodman, 2009) showed that cells synthesize stress proteins in both frequency ranges, as well as when they are exposed to a wide variety of proven harmful influences (e.g., changes in temperature, pH, oxygen, alcohol, etc.). This protective cellular response to EMF starts with an interaction with DNA, and occurs long before there is a detectable increase in temperature, attesting to the greater sensitivity of cells to EMF than to an increase in temperature. It should be clear that when stress protein synthesis is stimulated by EMF, the cell is telling us in the language of the body that exposure to non-ionizing radiation (NIR) is harmful.
- It has been shown that stress proteins can have a protective effect when induced prior to EMF exposure. DiCarlo et al. (1998) have protected developing chick eggs and increased the percentage hatched, and George et al. (2008) increased the survival rate following heart bypass surgery. These studies suggest that artificial induction of stress proteins may be a relatively simple way to develop possible therapeutic applications.
- Research on the molecular mechanism (Lin et al. 1999, 2001) has identified a DNA segment in the cell nucleus that codes for hsp70 (a major stress protein) and reacts with EMF. To test that the DNA segment was reactive, it was bonded to DNA segments that code for two different (reporter) proteins, and the two reporter proteins were synthesized after stimulation by EMF.
- Non-ionizing radiation (i.e., both ELF and RF) cause oxidative damage to DNA (Lai and Singh 1995, 1996, 1997), a process associated with the development of cancers. IARC, the International Association for Research on Cancer, declared both power frequency in 2002 and radiofrequency in 2011, to be possible carcinogens. It should be noted that the observed DNA damage occurs well below exposures that the panel considers safe.
- Biochemical electron transfer reactions of Na,K-ATPase and of cytochrome oxidase (Blank and Soo, 2001), and the Belousov-Jabotinsky reaction (Blank and Soo, 2003) are accelerated by EMF with thresholds below 0.1μT, showing an ability to influence biological oxidations. Many studies of the Barton group at Caltech (Hall et al. 1996, 1997; Wan et al. 1999, 2000) have shown that the non-localized pi electrons in DNA are mobile, and that they can be made to move along the DNA backbone. EMF can also accelerate the rate of conformation changes in proteins (Bohr and Bohr, 2000)
- Similar stress proteins are stimulated by ELF and RF despite the million fold difference in energy. This shows that the thermal criterion, based on absorbed energy, is obviously wrong and not suitable as the basis for a safety standard.
- Interaction with DNA has been the focus of the above studies on biological mechanism, and DNA damage leading to cancer has generally been the focus of most studies of EMF safety. Other biological effects due to EMF have been described and are probably due to different molecular mechanisms, although interactions with electrons are very likely because of their high charge/mass ratio. These other reactions
    - cause leakage of the blood brain barrier and damage to neurons in the brain o cause the microwave auditory effect (Frey, 1962)
    - inhibit secretion of melatonin and affect circadian rhythm (Liburdy et al., 1993)

These effects have been known for some time, and like the DNA damage, they occur at exposures well below levels currently considered safe.

By not using the unequivocal (and most relevant) biological evidence in updating SC6, the panel has continued to rely on the unproven assumption that the rate of energy absorbed, as determined by temperature increase, is a proper measure of risk to health. The absorbed energy criterion is obviously wrong, unsuitable for assessing cellular safety and leads to dangerously high exposure standards.

There may be conflict-of-interest issues arising from connections of the panel members to industry, but I think the error in judgment more likely reflects a natural tendency to be conservative. It is certainly easier to go along with previous SC6 reports and the academic bias that places physical science above biology. However, I am almost certain that the reluctance of the panel to be guided by biological evidence reflects a lack of expertise in cell biology.

Much of the biological evidence referred to here is in the BioInitiative Report (BIR) that is cited by the panel. It is difficult to justify dismissing the BIR, since it was written by scientists who did the research and understand its implications. Three Presidents of the Bioelectromagnetics Society (BEMS) contributed to the BIR, and Dr. M Stuchly and Dr. O Ghandi, two of the reviewers of SC6-1999, were also presidents of BEMS.

The above criticisms indicate that the panel has failed to update the EMF safety standards using the latest and most relevant scientific information. In fact, they have overlooked the biological data about protective cellular reactions to EMF that are critical for determining safe exposure limits. This is actually a failure of the panel to fulfill its primary function – to protect the health of the population. This failure is occurring in an environment with increasing exposure to a wide range of non-ionizing EMF frequencies, including ELF. To do the job right, the panel should be reconstituted to include members having the expertise needed to evaluate the biological research and to formulate safety standards that take into account the biological indicators of EMF danger levels.

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