TETRA
Science and Standards

Health+Safety Information

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Introduction - radio waves and health

Terrestrial Trunked Radio (TETRA) is an international standard for digital mobile radio communications for use by the emergency services and other professional users. TETRA has characteristics in common with the mobile networks that most of us use daily, with additional features to provide secure, resilient private mobile communications.

Like all wireless systems, TETRA uses radio waves in the non-ionising frequency band. Radio waves are part of our daily lives, bringing us TV, radio and communications on the move.

Questions have been raised about whether radio waves might affect the health of users or the general public, and accounts of the science can make the findings seem confusing or contradictory, so people wonder what to believe. This leaflet aims to describe in simple terms how the scientific process works, and how safety guidelines are established.

The scientific process - how does it work?

Science is empirical - it develops from observation and measurement of the real world and produces theories that can be used to predict what may happen under certain conditions. Those theories are tested using carefully designed and conducted experiments or studies. The results are peer-reviewed (explained below), and other scientists try to replicate the work to see if the same results are found. In this way, a body of scientific evidence builds up over time.

No single study should be viewed in isolation. The laws of chance mean that false positive or false negative results will occur from time to time, so individual studies can produce results inconsistent with other research. If this happens, more research is needed before conclusions can be drawn. So it is important - particularly when considering public health guidelines - that each new study is evaluated within the context of the overall body of evidence.

The only certainty in science is that there is no certainty. It is not possible to prove a negative, so no-one can prove that any product or technology is not harmful. If a number of studies find no harmful effects, even after many years, scientists can become more confident that a product is likely to be safe. While uncertainties remain, advisory bodies like the Advisory Group on Non-Ionising Radiation Protection (AGNIR) and the World Health Organisation (WHO) advocate a precautionary approach. This does not mean that radio technologies should not be used; it reaffirms the importance of science-based standards, but suggests additional measures - like keeping calls short, limiting use of mobile phones by children, and designing equipment that operates at lower power levels. For information about the WHO work on precautionary approaches, visit www.who.int/docstore/peh-emf/publications/facts_press/EMF-Precaution.htm.

Good Science & Bad Science

Some people use what appears to be science to support their arguments or simply to sell goods or services. It's not always easy to spot the difference between good and bad science. Some things to look out for are:

Bad science

- Research lacks independent verification
- Relies heavily on a few selective pieces of research that 'prove the hypothesis', but which may be out-of-date or superseded
- Uses anecdotal or emotive evidence
- Uses research that has not been, or is not capable of being, repeated
- Confuses correlation of events with proven cause and effect
- Relies on inappropriately qualified people as authorities
- Is taken direct to the media, bypassing normal checks and reviews

Good science

- Builds on previous work, using up-to-date information, incorporating the results of the latest work and accepting the advice of appropriate authorities
- Produces results that can be repeated by others
- Uses the peer review process for independent verification of results
- Presents results only after they have been thoroughly checked
- Is funded by independent sources
- Understands that individual results indicate a risk or a probability, not a certainty

Who are the experts and why?

Scientists respected by their peers, with a reputation as experts in their field, are those who follow best practice in designing and conducting studies, and adopt rigorous and well-documented scientific methodologies. Their studies use samples big enough to be reliable and repeatable, and they work hard to eliminate confounding factors. They present their work at conferences to get useful criticism and then publish the study in full in a reputable peer-reviewed scientific journal.

What is peer review?

Peer review is the way the scientific community ensures new research is scrutinised rigorously. When a paper describing the design and results of a study is submitted to a reputable scientific journal, every aspect is criticised and challenged by two or three peers - other scientists with good knowledge of the topic - before the work is published. This is why published peer-reviewed work is given greater weight than papers presented at scientific conferences, which may not have been peer-reviewed at all, or may have been looked at by only one reviewer.

Peer review is a vital piece of quality control, encouraging open, critical review of the design, method, conduct and interpretation of research. It may highlight errors of method or incorrect instrument calibration, look at how the team has tried to eliminate confounding factors (things that are not being studied but that might affect the results), or identify gaps of logic in the interpretation of results. It helps ensure that new findings are evaluated against past research that explored similar issues. But the process is not perfect and even peer-reviewed work can later turn out to be incorrect.

Who is involved in setting safety guidelines?

The safety guidelines for radio frequency emissions are recommended by the International Commission on Non-Ionising Radiation Protection (ICNIRP), based in Geneva. For more information visit www.icnirp.de.

In the UK, legal standards are set by the Government, advised by the radiation division of the Health Protection Agency (HPA). The HPA is in turn advised by AGNIR, an eminent group chaired at the time of writing by Professor Anthony Swerdlow of the Institute of Cancer Research. For a list of AGNIR members visit www.hpa.org.uk/radiation/advisory_groups/agnir.

The WHO plays a key coordinating role, and holds an extensive research database on RF emissions with reference to more than 25,000 papers - for more information visit www.who.int/peh-emf/project.

An understanding of the potential health impact of radio frequency emissions needs substantial expertise in physics, biology and related disciplines, and expert groups who work on guidelines include the best of knowledge in all relevant disciplines.

The expert groups evaluate all the research periodically, assess the potential for health risks and decide whether to recommend changes to public health exposure guidelines. This is not a simple task. It is not just a case of counting the number of studies that have returned positive or negative results. The quality of each study has to be reviewed, and confidence levels in the results assessed. Some unreplicated studies may need to be excluded until they have been repeated.

What are the ICNIRP guidelines and how are they set?

The ICNIRP guidelines were first published in the Health Physics Journal in 1998. ICNIRP stated that it "*aims to establish guidelines for limiting exposure that will provide protection against known adverse health effects*". For information about the methodology used by ICNIRP visit www.icnirp.de/documents/emfgdl.pdf

ICNIRP looked at the scientific evidence at a wide range of exposure levels, and identified the level of intensity below which RF energy is not known to cause adverse health effects of any kind. It set exposure limits a long way below this threshold to provide a safety margin. Claims that the ICNIRP guidelines focus on thermal effects, ignoring other potential biological effects, are incorrect. ICNIRP considers all the scientific evidence, but to date has found no evidence of any non-thermal effects that would merit a change to the guidelines.

The guidelines distinguish between occupational exposure and public exposure with the guidelines for the public being more stringent. This is because the public - a population including infants, elderly people and people who are ill - may be inadvertently exposed, whereas people who work with RF are trained in correct and safe use of the equipment.

What does the science to date tell us about TETRA and health?

The consensus of scientific opinion is that there are no established health effects from exposure to RF emissions within ICNIRP guidelines. Here are some of the examples of what the experts say:

"nobody has established a medical risk and on balance there is no real reason to worry about TETRA. It is certainly no greater risk than a mobile phone…….the large body of scientific evidence to date indicates that non-ionising radiation does not have any biological effect." - Professor Colin Blakemore, Chief Executive of the Medical Research Council, member of the Stewart Inquiry and former member of AGNIR

"although areas of uncertainty remain about the biological effects of low level radiation in general, including modulated signals, current evidence suggests that it is unlikely that the special features of the signal from TETRA repeaters and terminals pose a hazard to health" - Professor Lawrie Challis, Vice Chair of the Stewart Inquiry, Chair of the Mobile Telecommunications and Health Research (MTHR) programme, and member of AGNIR

"exposure levels from living near to mobile phone base stations are extremely low and the overall evidence indicates that they are unlikely to pose a risk to health" - Statement from AGNIR January 2004

UK Defence Science and Technology Laboratory (DSTL) research team, in the International Journal of Radiation Biology: *"the results reported here do not provide support for the notion that TETRA-modulated RF fields affect intra-cellular calcium physiology in neurones or cardiac tissue"* (December 2005)

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Why is research continuing?

While public questions remain, it is appropriate that research continues although it becomes increasingly unlikely that any effects injurious to health will be established. In the UK there is a Mobile Telecommunications and Health Research programme; for more information on this visit www.mthr.org.uk. The Home Office has also commissioned a number of studies on TETRA, including long-term monitoring of the health of Airwave users, and a number of cognitive studies. Further information can be found at www.police.homeoffice.gov.uk/operational-policing/technology-equipment/tetra-terrestrial-radio/.

Glossary of Terms

AGNIR – Advisory Group on Non-Ionising Radiation Protection

Amplitude Modulation – encoding of a carrier wave by varying its amplitude or height, in accordance with an input signal, so that it carries the desired information

ETSI – European Telecommunications Standards Institute

Health Impact – a health impact can be positive or negative. A positive impact contributes to good or improving health whereas a negative one causes or contributes to ill-health

HPA – Health Protection Agency (now incorporating the National Radiological Protection Board)

ICNIRP – International Commission for Non-Ionising Radiation Protection

Non-ionising radiation – radiation that does not break chemical bonds in matter. When non-ionising radiation passes through body tissues, it does not have sufficient energy to damage DNA directly

Thermal effect – a heating effect

WHO – World Health Organisation

Where can I find out more?

Web sites

Our web site: www.tetrahealth.info has more information on this topic, and contains links to a number of useful independent sites.

Leaflets

Leaflets published by the TETRA Industry Group are available in pdf form from our web site. Other leaflets in the series include:

- TETRA Health and Safety Overview
- TETRA Base Stations
- TETRA Portable and Mobile Devices
- Compatibility and interference

Contact Us

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