MANAGEMENT OF RADIO FREQUENCY RADIATION EXPOSURES IN TELECOM AUSTRALIA

K.H. Joyner and B. Hocking
Telecom Australia Research Laboratories
770 Blackburn Road Clayton Victoria 3168 Australia

ABSTRACT

Telecom Australia is the largest non-military user of radio frequency radiation (RFR) in Australia and the management of risks to health from RFR exposure are discussed. The Australian RFR Exposure Standard forms the basis of risk assessment. Risk assessment and control procedures including the health surveillance of workers, other special occupational groups and members of the general public are outlined.

INTRODUCTION

Risk management principles regarding safety of workers and public were originally developed in the nuclear industry. They have been recently applied to the use of chemicals in the UK code on Control of Substances Hazardous to Health and the Worksafe Australia code on Workplace Hazardous Substances. Essentially employers are required to identify and assess risks to the health of their workforce, contractors, visitors and public arising from substances and processes, and where appropriate to control any risks. Control should mainly be by engineering or administrative actions rather than relying on protective clothing. Health surveillance is part of the control strategy. This paper extends these ideas to RFR and is based on the authors experiences in Telecom Australia, the Royal Australian Air Force and some small industries.

In order to thoughtfully assess risks from RFR it is essential to be aware of the range of possible health effects [1]; to have an understanding of the mechanisms of interaction of RFR with the human body [1] and to know the relevant safety standards that have been set. The limits permitted by the Australian RFR Exposure Standard [2] are shown in Figure 1.

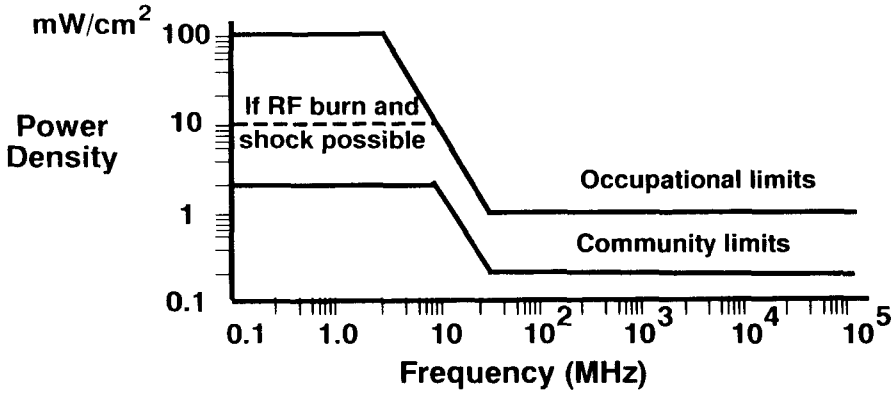

Figure 1: Australian RFR Exposure Standard

Evaluation

The first step is to measure the exposure. Appropriate measurement procedures and instrumentation are covered in detail in [3]. Any person planning to measure RFR levels should refer to this or similar publications as there are a number of issues with which the "would be surveyor" should be familiar prior to the commencement of the survey. The results of any surveys should be recorded and updated with changes to plant or equipment. The results are then compared to the occupational level of the Australian Standard.

Control Procedures

Where the Standard is exceeded, the levels of exposure should be reduced (to at or below the relevant limit) by various control procedures. Expert advice may need to be sought. Control procedures include:

- Shield or restrict access to the source.

Shielding or isolation of the source through the use of metallic enclosures is the preferred control procedure. Where shielding is not an option, such as in the case of radio and TV broadcast antennas, access restrictions are generally the only control option.

- Reduce power.

During maintenance, a reduction in transmitter power may be an option to achieve compliance with the limits. Indeed the transmitter may have to be turned off in instances where maintenance on antennas and plant is required. Specific procedures for down-power or power-off will have to be included with safe working practices (see below).

- Safe working practices.

All safe working practices such as down-power or power-off procedures, as well as a map of restricted zones should be located in a central position. All staff should be aware of the procedures and the need to up-date this record when changes are made to the site.

- Warning signs.

Warning signs should be installed to identify areas which are off limits to the general public or to personnel, and to identify sources of RFR.

- Protective clothing.

Protective clothing should only be provided where other methods have been shown to be ineffective and where it has been established that the protective clothing is effective.

- Supervision and co-ordination.

The responsibility for supervision and coordination all of these approaches should be given to a unit or person within the organization.

To complement these procedures, training is required for staff about the hazard of RFR and the safe working practices. Special training may be required for the coordinating staff and those persons involved in the survey of RFR levels. Where contractors are working on sites with RFR sources the operator has a responsibility to inform contractors of any risks and the safe working practices to be followed.

Health Surveillance

Health surveillance of workers should be instituted if there is a significant risk of exposure above the community limits. Medical surveillance has various aims:

- At pre-employment it provides a baseline on health status and detects conditions which may be adversely affected by RFR exposures. The latter include electromagnetic interference to, and heating of medical implants (see below).

- At periodic examinations it is intended to detect adverse health effects, (such as changes in the lens of the eye).
- It should also provide medical data for epidemiological studies. (This should be in parallel with documentation on work exposure).

The Australia Standard [2] details the medical examination required for RFR workers. The records of examination need to be stored for durations set by regulatory authorities. Special occupational groups may require further management. Such groups include workers with medical implants, pregnant workers and staff accidentally over-exposed. RFR workers who have medical implants should be evaluated prior to commencing, or on resuming work [4]. Devices such as cochlear implants or pacemakers may be subject to EMI in high field strengths or at certain frequencies. Other devices such as orthopaedic prosthesis or skull plates may act as antennas and cause heating of adjacent tissue. Individual advice should be provided regarding any restrictions on duties or alterations to the work environment.

The specific absorption rate of the foetus may exceed community exposure levels when a pregnant worker is exposed to the occupational exposure limits at certain frequencies [5]. Therefore, it is prudent to reduce exposure of pregnant RFR workers to below the community exposure limit as soon as reasonably practicable for the duration of the pregnancy to ensure maximal protection of the unborn child and to ensure potential legal liabilities are met.

In the event of accidental over-exposure to RFR the following should occur:

- The circumstances causing the over-exposure should be determined and corrected.
- A biophysical investigation should proceed to determine the extent of over-exposure.
- Medical examination should be conducted utilising data on the over-exposure to direct detailed examination [6].

Good occupational risk management requires monitoring all of the above to ensure documentation of exposure levels, auditing of work practices and integration of health surveillance and accident data.

RISK ASSESSMENT AND CONTROL - PUBLIC EXPOSURES

The community may be exposed to RFR due to their proximity to transmitting antennas, industrial sources of RFR, or their use of radiocommunications products. Possible exposures should be measured and evaluated, and where required appropriate control procedures introduced.

- Community Exposure Limits

At the boundary of transmitting sites and areas within transmitting sites open to visitors the RFR levels must comply with the community exposure limits (see Fig. 1). For industrial sources of RFR (eg RF welding) barriers and warnings should be place at the boundaries where community exposure limits may be exceeded.

- RFR Products.

Radiocommunication devices or equipment, where required, will also have to comply with the community exposure limits (see Fig. 1). Clear instructions on the appropriate use of the equipment and the placement of antennas will need to be included.

- Electromagnetic Interference (EMI)

EMI generally manifests itself as the visible or audible degradation of TV or radio reception. EMI is irritating but in general, not life threatening. However, there are instances where EMI may have serious consequences, such as the disruption of air navigation services and electronic systems of aircraft, the inadvertent detonation of electro-explosive devices and ignition of flammable atmospheres. In hospitals where patients may have susceptible medical devices it is particularly important RFR fields be controlled to avoid EMI.

- Town Planning

In Australia some State Government Departments have developed guidelines for town planners in order to protect the public and to avoid disruption of RFR transmissions. These require that where development is proposed it should be critically assessed if it is within 500 m of VHF, UHF broadcast services and 1000 m of radar and HF sources, or if transmission paths may be interrupted. In addition, it has been recommended that planning authorities not approve new transmission sources which would expose the surrounding community to levels in excess of relevant Australian Standards.

- Education and Information

In addition it is desirable the public be provided with information on RFR and good public relations be fostered through the use of videos [7] booklets [8] and the lay and scientific media. McKlveen & Blitz have described a community consultation process for ionising radiation concerns [9] and Morgan & colleagues [10] have outlined the level of knowledge of lay groups about extremely low frequency radiation as a starting point for education programs. These approaches should be considered when communicating about safety of RFR between the public, generators and regulators of RFR.

CONCLUSION

Health risk management for RFR requires a coherent approach to the safety of workers and public. It is desirable that users of RFR adopt a high standard of management and risk mitigation and that personnel are aware of, and adhere to safe working practices. This paper sets out the authors experiences within Telecom and other industries. It is suggested that this paper could form a basis of a code of practice. However, it is recognised that the authors own experience is limited to certain aspects of RFR usage and therefore a wider input is needed for a code to be formed. It is also noted that the above paper is broader than some existing codes, (by inclusion of information on the management of pregnancy or accidents) and thereby indicates ways other codes may be extended to improve risk management.

ACKNOWLEDGEMENT

This paper is published by permission of the Executive General Manager Telecom Australia Research Laboratories.

REFERENCES

1. NCRP Rep. No. 6, 1986. Bethesda, MD.
2. AS2772.1-1990. Standards Australia, North Sydney, NSW.
3. AS2772.2-1988. Standards Australia, North Sydney, NSW.
4. Hocking B., Joyner K. H. and Fleming A. H., Scan. J. Work Environ. Hlth.1991:17:1-6.
5. Fleming A. H. and Joyner K. H., Telecom Australia Res.Labs. Report RLR7996,1990.
6. Hocking B. and Joyner K.H., J. Microwave Power. 1988:23:75-80.
7. Radio Base Stations - Are They Safe? Mobile Comms. Services. Telecom Australia ,1991.
8. Yost M. Non-ionizing Radiation Questions & Answers. San Francisco Press. 1988. San Francisco.
9. McKlveen J. and Blitz P., J. Occup. Hlth.Saf.:ANZ. 1990:6(6):491-501.
10 Morgan M. et al., Bioelectromagnetics, 1990:11:313-35.