equipment, a Faraday cage reduces maintenance costs, increases reliability and delivers more satisfaction to the patient.

If possible, shielding for specific spaces should be part of the original architectural design. If a potential source of interference is introduced into the area then a competent consulting engineer with experience in RF compatibility should be retained immediately. His role will be to study the electromagnetic environment and provide expert guidance in achieving compatibility between the new potential source of interference and the medical office with its diagnostic equipment. Prompt attention to this will prevent surprises in medical equipment behavior and reassure the owners that RF interference is not an angry gremlin sent to make life untenable.

LBA Group provides analysis of radio frequency interference problems, and, with its strategic partner The East Group, is involved in the design and commissioning of archectural shielding solutions.

Contact www.LBAgroup.com or www.East group.com.

Is Your Facility RF Green?

By Lawrence Behr, CEO

Electromagnetic energy is an environmental issue that is often overlooked. This invisible environmental factor should be considered as carefully as air and water quality.

Standards have been set for acceptable electromagnetic energy levels in the environment. Organizations, such as the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE), have studied and identified levels and time limits above which human exposure should be restricted.

As required by the National Environmental Policy Act (NEPA) of 1969, the Federal Communications Commission (FCC) has established standards and guidelines for evaluating the level of potential human exposure to emissions from licensed transmitters. OSHA's website states "…there are national consensus standards which OSHA could consider referencing in a general duty clause citation." Policies and procedures should be put in place to reduce the potential for being challenged on these issues and for properly responding if you are challenged.

Electromagnetic energy is generated over a wide spectrum of frequencies from many different sources. The frequencies addressed in this article include extremely low frequency (ELF), radiofrequency (RF) and microwave (MW) radiation. The term "EME/RF" will be used here to refer to these frequencies.

ELF fields are produced by power lines, electrical wiring, and electrical equipment. RF and MW radiation is generated from many sources, including radios, cellular phones, the processing and cooking of foods, heat sealers, vinyl welders, high frequency welders, induction heaters, flow solder machines, communications transmitters, radar transmitters, ion implant equipment, and microwave drying equipment. These frequencies, along with visible and ultraviolet light, are known as non-ionizing radiation to distinguish them from the more dangerous X-rays, gamma rays and other higher energy level rays known as ionizing radiation. Ionizing radiation is not addressed in this article.

Establishing a policy and implementing procedures to consider, identify and document the factors that influence the electromagnetic environment will help ensure that workers and the general public are appropriately protected from any potential adverse effects resulting from excessive exposure. While most devices typically would not result in levels of exposure high enough to cause injury, it is nevertheless important to ensure that human exposures are maintained well below levels that are suspected to be potentially harmful.

Electromagnetic environment evaluation procedures should be consistent and complete. The FCC has established maximum permissible exposure (MPE) levels for human exposure to RF. They have published guidelines and procedures for evaluating RF exposure for the general public and for personnel performing occupational tasks in a controlled area.

While the focus of the FCC is strictly on transmitters that they license, OSHA is very much concerned with the workplace. OSHA has published their own guidelines, which state that they agree with those of the FCC and other standards organizations. In the area of occupational protection against EME/RF exposure, the OSHA guidelines are a very clear blueprint for the responsibilities of building facilities man-

agement. The General Duty Clause of OSHA states that an employer is required "to furnish to each of his employees, employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

It is becoming more common for building rooftops to be used as wireless base station antenna sites. A building manager should ensure that all wireless carriers located on such facilities comply with the requirements to assess and document the RF environment. These requirements are not restricted to each carrier's individual contribution to the RF environment, but mandate that they evaluate the cumulative effects of all RF sources at each site, identify areas where the MPE is exceeded in which their equipment contributes 5% or more of the MPE, and take appropriate action. That action could involve signage, barriers to restrict access, or other methods to alert people to the potential danger and prevent excessive exposure.

Forward thinking building managers might utilize internal resources or an independent third party firm to perform an EME/RF audit of any part of their facility where a potential tenant wants to install equipment that may generate EME/RF energy. This should be made a routine part of the due diligence process in evaluating the lease application and the cost included in those fees. In the case of wireless licensees, each should be provided with an updated copy of the results of the new study. The FCC rules require that each licensee consider the cumulative effects of all transmitters. Existing tenants are more willing to share the necessary information with a building manager or independent third party than with a potential new competitor.

The liability that results from an unknown or undocumented electromagnetic environment presents a unique risk-management problem. An innovative solution to the problem, using the rooftop example, is to perform an audit of RF sources. A RF sweep of the rooftop using industry-accepted test equipment can identify "hot spots" where high levels of RF are of concern. Then, a computer modeling study of the roof can be used to predict a "worst case scenario" and generate a color-coded map of the rooftop, with the safe, "green" areas in green, and other colors to alert personnel to any areas of concern. This map should be laminated and stored in a weather-resistant enclosure that is well marked and placed where anyone entering the roof will see it, so that they will be aware of the environment.

Tens of thousands of occupational situations involve potentially hazardous exposure to non-ionizing radiation that could be at, near, or above recognized safety standards. Commercial and industrial uses outside the electronics industry continue to grow. High electromagnetic levels can affect the general population and, specifically, at-risk individuals.

While it is important to recognize that most facilities are safely within the MPE limits, it is also important to be able to provide some documentation to show how that was determined for your facility if you are asked to do so. For most buildings, this is easy and low cost. For facilities with more complex EME/RF environments, more detailed analysis is required; however, documenting the environment there is more important because challenges are more likely in such cases.

People with implanted pacemakers are of particular concern. The manufacturers of pacemakers usually provide specifications relative to the electromagnetic environmental levels where the device should not be used. Those responsible for environmental issues should be aware of workers and others who may have pacemakers and ensure that they are not allowed to enter an area where the electromagnetic environment is not compatible with the pacemaker. RF energy can also affect the operation of hearing aids.

In addition to effects on humans, sufficiently high levels of RF energy can interfere with other electronic equipment such as computer systems, wireless devices, medical equipment (defibrillators), and RFID systems. Often, these types of equipment are vital to providing workplace safety. As with all environmental concerns, the electromagnetic environment must be managed with knowledge and responsibility.

Electromagnetic environmental safety is a risk management issue. By recognizing it as such, facility management is taking positive steps to protect employees and visitors as well as avoiding potential litigation should an incident occur. The guidelines established by OSHA provide a clear blueprint for the responsibility of building facilities' managers. The first step is to establish a written policy for documenting and dealing with these issues.

It is also important to establish a procedure for

documenting all potential sources of electromagnetic energy at and nearby the facility. Conducting periodic reviews will ensure that the information is current. Obtaining an expert evaluation and opinion as to the need for a detailed electromagnetic/RF environment audit is a prudent step. If recommended, study of the electromagnetic environment should be performed. Depending on the facility, this may include measurements, theoretical modeling, or a combination of the two. It is vital to correct any deficiencies noted, post signage where appropriate, and restrict access where needed. OSHA's policy states that employers who have people working around devices which produce radiofrequency/microwave radiation need to be sure that those devices are properly shielded to prevent leakage of radiation.

The FCC sets forth two tiers of MPE levels, one for general population/uncontrolled environments and another for occupational/controlled environments. Where electromagnetic hazards may exist, awareness training should be provided to personnel who find it necessary to enter the area. In facilities where RF exposure is high, specific areas of concern can be identified and access to those areas can be restricted or controlled.

In facilities where it is more desirable to utilize the less restrictive occupational/controlled exposure limits, certain requirements must be met. These include RF safety awareness training for anyone entering such facilities. Procedures should be instituted for working in the vicinity of the RF sources that will prevent exposures in excess of the guidelines. Since the MPE limits are based on time averaging, restricting the time an individual could be near an RF source is one example of a policy that could prevent excessive exposure to RF radiation. It is necessary to inquire of prospective new tenants regarding planned equipment that may contribute to the EME/RF environment and evaluate the cumulative threat thereof.

Management should also determine if prospective new tenants plan to use equipment that may be negatively impacted by the existing EME/RF environment. EME/RF emissions can cause potential hazards to both humans and the operation of equipment. In addition to the impact on personnel, the emissions from one device may have a deleterious effect on other devices in the area. In medical-related facilities or other facilities used for sensitive testing, there may also be adverse effects on test results.

Just as there are safety precautions for operating a microwave oven, such as not operating it when empty, checking to see that the door seal is tight and using extreme caution if you have a pacemaker, there are safety precautions for the operation of business, industry and health-related facilities. While it is important to know what the precautions are, it is also important to take action to protect the environment and those who work within the environment from the potential hazardous effects of EME/RF emissions. EME/RF radiation is an important safety aspect of facility management. By using professionals to survey the facility and determine the levels of EME/RF radiation, providing formal training of employees and adequate posting of hazardous areas, all personnel within the facility can be protected against excessive levels of EME/RF.

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