

UNITED STATES
DEPARTMENT OF LABOR

SEARCH

[A to Z Index](#) | [En Español](#) | [Contact Us](#) | [FAQs](#) | [About OSHA](#)

OSHA

OSHA QuickTakes

[Newsletter](#)[RSS Feeds](#)[Print This Page](#)[Text Size](#)Occupational Safety & Health Administration **We Can Help**[What's New](#) | [Offices](#)[Home](#) | [Workers](#) | [Regulations](#) | [Enforcement](#) | [Data & Statistics](#) | [Training](#) | [Publications](#) | [Newsroom](#) | [Small Business](#) | << [Back to Radiofrequency and Microwave Radiation](#)

Elements of a Comprehensive RF Protection Program: Role of RF Measurements

-Disclaimer-

This is not DOL or OSHA controlled material and is provided here for reference only. We take no responsibility for the views, content or accuracy of this information.

United States Environmental Protection Agency
Washington, D.C. 20460 April 30, 1999

Robert A. Curtis, Director
US DOL/OSHA Health Response Team

Presentation on April 12, 1995
National Association of Broadcasters
Broadcast Engineering Conference
Las Vegas, NV

ABSTRACT OSHA recognizes that its most effective activities, including inspections, are those which encourage employers to implement their own comprehensive safety and health program. For work sites involving potentially hazardous radio frequency radiation, OSHA compliance officers should evaluate the RF protection component of the overall program. This presentation outlines the elements of a comprehensive RF Protection Program. These include the implementation of appropriate protective policies based on the potential for excessive RF exposures. Therefore, RF exposure assessments, often requiring direct measurement, are performed to evaluate the effectiveness of RF controls; to ensure proper maintenance of RF radiating equipment; to develop work practices to minimize exposures; to obtain information to be used in training workers regarding their potential hazards and how they are controlled; to identify "RF Hazard" zones and other areas requiring signs and training; to determine the need for medical surveillance; as an alternative or enhancement of Lockout/Tagout procedures; to evaluate the effectiveness of RF personal protective equipment; and as a periodic audit of the effectiveness of the RF Protection Program. Based on literally hundreds of RF surveys conducted by the author, it is concluded that effective control of RF hazards depends primarily on the commitment to these Program elements, and not on sophisticated RF survey equipment or expertise.

To minimize the risk of adverse health effects, radiofrequency (RF) fields as well as induced and contact currents must be in compliance with applicable guidelines (e.g., ICNIRP, ANSI, ACGIH). Reduction in RF exposures can be accomplished through the implementation of appropriate, administrative, work practice and engineering controls. These various controls are the elements of an RF Protection Program, and part of an employer's comprehensive safety and health program. The following outlines the principal elements of the RF Protection Program, and the role of RF measurements in implementing the program.

Element 1: Utilization of RF source equipment which meet applicable RF and other safety standards when new and during the time of use, including after any modifications.

- Manufacturers of RF source equipment are responsible for making equipment that complies with applicable standards, and for providing information on the hazards of operating and servicing the equipment. The information must be sufficient to alert the end-user of potential hazards and necessary controls applicable to using the equipment. Manufacturers are therefore required to make detailed RF emission measurements of their products. Appropriate RF survey results should be provided to the end-user for comparison purposes.
- For many low-power products, such as cellular phones, no additional measurements are required by the end-user.
- For other products, the users should conduct RF "screening" measurements of equipment emissions after installation, major maintenance, and any modifications which could effect RF emissions. Significant deviations from previous measurements should be resolved.

Element 2: RF hazard identification and periodic surveillance by a competent person who can effectively assess RF exposures.

- Screening measurements are normally sufficient to identify potentially hazardous RF areas which will require some control strategy, such as to determine where a fence should be located. More complex measurements are necessary if the employer intends to allow exposures to employees approaching RF standards. For example, detailed measurements are necessary if whole-body and/or time-weighted averaging of exposures is necessary to bring exposures into compliance.
- RF fields can induce currents in nearby conducting objects, such as a metal barrier or fence used to restrict access to RF hazard areas. These must be evaluated to ensure they do not constitute RF shock and burn hazards. Although detail measurements can be made, the "measurement" of startling/annoying RI spark discharge can usually be made by a quick touch.

Element 3: Identification and Control of RF Hazard Areas.

- Controlling exposure time and the distance between the RF source and the operator are important in maintaining workers' exposures below recommended levels. When necessary due to excessive leakage, "RF hazard areas" must be identified to alert workers of areas that are not to be occupied during RF application. The location of the hazard areas must be based on exposure measurements made during maximum field generation and duty factor (i.e., ratio of RF "on" time during any 6 minute period, assuming intermittent exposure).

- Access to RF hazard areas should be controlled with standard Lockout/Tagout procedures (ref. 29 CFR 1910.147) to ensure workers are not occupying these areas during the application of RF energy. It may be possible to use continuous monitors and/or personal monitors in lieu of, or to supplement, more traditional Lockout/Tagout procedures which lockout the RF power source.
- The RF hazard areas shall be clearly marked with appropriate signs, barricades, floor markings, etc. such that any worker who has access to the facility will be alerted not to occupy the hazardous locations. Signs shall be of standard design and shape (ref ANSI C95. 1), and of sufficient size to be recognizable and readable from a safe distance.
- Screening measurements can be used to determine where to locate signs to alert workers approaching an RF hazard area, including the appropriate warning message on the sign (e.g., Notice, Caution, Danger).
- The evacuation of hazard areas prior to RF application must be strictly enforced. For example, a procedure which requires an RF sealer operator to first load the sealer, step back 2 meters to get outside the RF hazard area prior to activating the RF energy, and then walk back to unload the sealer will be difficult to enforce. The additional time required and increased operator fatigue will discourage operators from following such procedures, particularly for workers who are paid on a piecework production basis.

Element 4: Implementation of controls to reduce RF exposures to levels in compliance with applicable guidelines (e.g., ANSI, ICNIRP), including the establishment of safe work practice procedures.

- Reliance on averaging is normally not "recommended when establishing basic control strategies because it obligates the employer to conduct "measurement" of employee activity to ensure the averaging is applicable, such as timing an employee's access inside an area which can not be occupied for 6 minutes without exceeding the allowable time-weighted exposure. Where possible, controls should be established under the assumption that standards are not time-weighted, i.e., assume the standards are ceiling limits which are not to be exceeded.
- Measurements are necessary during the development of work practices to ensure the practices are effective in preventing excessive exposures. Detailed measurements are required if exposures are approaching guideline limits as discussed above.
- Appropriate work practices must be followed during the repair and maintenance of RF equipment. Occasionally, cabinet panels must be removed by service personnel to allow access for maintenance. Failure to replace a panel properly may result in excessive RF leakage. RF screening measurements can be used to determine which panels can be removed during operation (assuming other hazards, such as electrical shock, are controlled), and to ensure the shielding is reinstalled properly.
- Detailed measurements must be made by the manufacturers' of RF personal protective equipment (PPE) to show its effectiveness and limitations. Limited measurements are necessary by the user to ensure the PPE is applicable and effective for the specific worksite conditions.

Element 5: RF safety and health training to ensure that all employees understand the RF hazards to which they may be exposed and the means by which the hazards are controlled.

- Measurement of worker exposures is necessary so that this information can be provided as part of employee hazard training. The scope of training, including reviews of potential biological effects, will be dependent on measured exposure levels.

Element 6: Employee involvement in the structure and operation of the program and in decisions that affect their safety and health, to make full use of their insight and to encourage their understanding and commitment to the safe work practices established.

- RF screening measurements should be made in the presence of employees to facilitate understanding and confidence in the program.

Element 7: Implementation of an appropriate medical surveillance program.

- RF measurements are necessary "to determine the need and scope of medical surveillance. For example, medical surveillance may consist of a means to report the occurrence of RF burns, implanted medical devices (e.g., copper IUD), or the sensation of non-routine heating as a means of identifying potential problem areas. A medical exam may be appropriate for "accidental" exposures defined as an exposure above some measured trigger level.
- Although not required for compliance with existing standards, RF exposure data is necessary to enhance epidemiology studies of RF biological effects.

Element 8: Periodic (e.g., annual) reviews of the effectiveness of the program so that deficiencies can be identified and resolved.

- Periodic RF screening measurements are necessary to ensure conditions have not changed and that the RF Protection Program continues to be effective in preventing excessive RF exposures.

Element 9: Assignment of responsibilities, including the necessary authority and resources to implement and enforce all aspects of the RF protection program.

- Although this element does not directly require RF measurements, it is included for completeness of the list of RF Program elements. Without the commitment to the Program, as demonstrated by the assignment of necessary responsibility, authority and resources, the previous elements will not be effective.

As described above, a variety of RF measurements are necessary for an effective RF Protection Program. Usually RF screening measurements are adequate unless control strategies allow exposures approaching RF limits. Detailed RF measurements are required of manufacturers of RF products (e.g., RF transmitters, PPE, RF meters) to document their effectiveness and limitations. The effectiveness of the RF Protection Program depends primarily on an employer's understanding and commitment to the listed Program elements, rather than on sophisticated RF survey equipment or measurement procedures.