Radiofrequency (RF) Radiation Awareness Program for the Construction Industry

Overview

Based on information available May 2016
RF Radiation Work Group:
Program Materials

➢ Guide
➢ Presentation
➢ Video
➢ Toolbox Talk
➢ Hazard Alert Card
Program Elements: Video
(16 minutes)

Safe Transmission
RF Awareness for the Construction Industry
What is RF Radiation?

Radiofrequency (RF) radiation is a type of non-ionizing radiation. It is the type of radiation that is used in wireless communication systems, such as mobile phones, cordless telephones, and Wi-Fi networks. RF radiation can cause health effects, including cancer, when it is absorbed by the body. The amount of radiation that a person is exposed to depends on the type of device they use and how long they use it.

How to Protect Yourself from RF Radiation

1. **Know the basics**
   - RF radiation is invisible and cannot be detected by the naked eye.
   - RF radiation can penetrate clothing and plastic, but not metal.

2. **Follow these tips**
   - Limit your exposure to RF radiation by using your device in a well-ventilated area.
   - When using a device, keep it at least 1 inch away from your body at all times.
   - Use a hands-free device, such as a Bluetooth headset.

3. **Keep your environment safe**
   - Avoid standing or sitting directly under cell towers.
   - Do not sleep with your cell phone in your bedroom.

4. **If you think you are affected**
   - Contact the Center for Disease Control and Prevention (CDC) for more information.
   - Call the PCC at 1-800-822-9378 or visit the PCC website at www.pcc.org.

For more information on construction hazards, please call 310-578-8500 or visit the PCC website at www.pcc.org.
RF Radiation

Radiofrequency (RF) radiation is the energy used to transmit wireless information: Cellular, television, and other antennas located on roofs, stairs of buildings, news gathering trucks, and other structures can give off levels of RF radiation that are harmful to workers.

Greg's Story

Early one day when Greg was making repairs to the penthouse roof of an office building, he suddenly developed a headache. He was exposed to a cell phone signal on the side of the building. The panel Greg was working on was near a switched RF antenna.

1. What steps could have been taken to prevent Greg's symptoms and the burn? If so, what happened?

2. Have you or anyone you know worked near antennas and become sick or suffered a burn? If so, what happened?

Remember this:

- Before you begin work, ask your supervisor or the building manager if cellular or other RF antennas are present and for a copy of the current RF radiation survey results.

- Look around you to see if you can spot antennas in your work area. These antennas come in different shapes and sizes. They can be erected on poles, on rooftop areas, or in a stand-alone structure, such as a building, chimney, or flag pole.

- Look for posted signs and barriers, and follow the instructions.

- Avoid standing in front of or close to an antenna. Stay at least 10 feet away from an antenna or 30 feet away from a group of antennas.

- Ensure the antenna is energized. Touching an RF antenna can result in a burn.

- Know the warning signs of RF radiation exposure, such as headache, dizziness, blurred vision, or nausea in the skin and surrounding area.

How can we stay safe today?

What will we do here at the worksite today to prevent exposure to RF radiation?

1. ____________

2. ____________
Program Elements: Guide

➢ Detailed information that responds to key questions
➢ Links to additional information (regulations, online resources)
➢ Instructions for using online resources to find antenna locations
Program Elements: Presentation

Radiofrequency (RF) Radiation Awareness Program for the Construction Industry

- Responds to the key questions
- Summarizes Information from the Guide
- Each slide includes notes explaining the content
- Can be tailored for different audiences

Based on information available May 2016
Objectives

1. Define Radiofrequency radiation and list 5 common uses of RF radiation.

2. Identify the unit of measure commonly used to measure RF radiation power density.

3. State the thermal and non-thermal health effects associated with exposure to RF radiation.
Objectives

4. List the signs of overexposure to RF radiation.
6. Name at least 2 agencies or organizations that have regulations, guideline, or programs that address RF radiation.
Objectives

7. List at least 4 ways employees and employers can identify whether an RF radiation hazard is present.

8. Identify various methods employees can use to protect themselves from RF radiation.
What is radiofrequency (RF) radiation?

RF radiation is a form of non-ionizing radiation
- Causes molecules to vibrate, which can generate heat

It is not ionizing radiation
- Creates enough energy to cause chemical changes by breaking molecular bonds
- X-rays and gamma rays are forms of ionizing radiation
- This type of radiation is used in health care and nuclear weapons facilities
RF Radiation

Electromagnetic Spectrum: Common Terms

- RF radiation is a type of energy
- RF radiation = radio waves and microwaves
- Waves are characterized by wavelength and frequency
  - The frequency of each wave is measured in Hertz (Hz) – 1 cycle per second
  - RF radiation frequencies = 3 kilohertz (3 kHz) to 300 gigahertz (300 GHz)
  - Different frequencies affect humans differently
- RF Power is measured in watts, and RF Power Density is measured in milliwatts per square centimeter (mW/cm²)

Radiation - Electromagnetic Spectrum

Source: Environmental Protection Agency
What is RF energy used for?

- Microwave ovens
- Radar
- Industrial heating and sealing processes
- Medical applications
- Telecommunications & broadcast services:
  - Cellular antennas/base stations
  - Radio and television broadcasting
  - Radio communications for police and fire departments
  - Microwave point-to-point radio links
  - Satellite communications
Common Uses: Growth in Cellular Antenna Sites & Subscribers

57% growth in cell sites over the last 10 years.

What are the potential health effects?

➢ **Thermal effects:** heating of tissue, blindness and sterility

➢ **Non-thermal effects:** alter the human body's circadian rhythms, immune system, and the nature of the electrical and chemical signals communicated through the cell membrane

  Source: *Occupational Safety and Health Administration (OSHA)*

➢ **Group 2B - Possibly carcinogenic to humans**

  Source: *World Health Organization – International Agency for Research on Cancer (WHO/IARC)*

➢ **Pacemakers** could be susceptible to electromagnetic signals that could cause them to malfunction.

  Source: *Federal Communications Commission (FCC)*
Health Effects

Symptoms of overexposure may include:

- Labored breathing
- Perspiring
- Pain
- Headache
- Numbness
- Paresthesia
- Malaise
- Diarrhea
- Skin erythema
- Burns

*If you experience these symptoms, move to a new location*
Who’s at risk?

<table>
<thead>
<tr>
<th>Roofers</th>
<th>Painters</th>
</tr>
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<tbody>
<tr>
<td>HVAC technicians</td>
<td>Carpenters</td>
</tr>
<tr>
<td>Electricians</td>
<td>Laborers</td>
</tr>
<tr>
<td>Masons</td>
<td>Maintenance staff</td>
</tr>
<tr>
<td>Plasterers</td>
<td>Glaziers</td>
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</tbody>
</table>

Anyone who works on rooftops, sides of buildings, in and around mobile news trucks, and other locations where RF generating antennas are located
What are the applicable regulations, guidelines, and voluntary standards?

➢ FCC Guidelines
➢ OSHA Standards
➢ Voluntary Standards: 
  Institute of Electrical and Electronics Engineers (IEEE)
➢ State, Local & Other Standards & Requirements
• Jurisdiction over transmitting services licensed by the FCC
• Health and safety based on the IEEE standards and the National Council on Radiation Protection and Measurements (NCRP)
• OET Bulletin 65:
  – Exposure limits
  – Methods to determine compliance
  – Signage requirements
Two tiers:
1. General population/uncontrolled:
   - The public
   - Individuals exposed as a consequence of their employment, but who may not have been made fully aware of the potential for exposure or cannot exercise control over their exposure. According to the FCC:

   “When cellular and PCS antennas are mounted on rooftops, RF emissions could exceed higher than desirable guideline levels on the rooftop itself, even though rooftop antennas usually operate at lower power levels than free-standing power antennas. **Such levels might become an issue for maintenance or other personnel working on the rooftop.**”
2. Occupational/controlled:

- Individuals exposed as a consequence of their employment, who have been made fully aware of the potential for exposure, and can exercise control over their exposure
- “Transient” exposures
Worst-Case Scenario:

- Transmitting devices operating simultaneously and continuously at maximum power
- Working in the main transmitting beam
- Working within a few feet of an antenna for several minutes
Transmitting facilities and devices regulated by the FCC are expected to comply with RF radiation exposure guidelines.

The FCC can fine licensees for violations that create unsafe conditions for workers and the public.
No specific standards for radiofrequency and microwave radiation.

- The exposure limit in the nonionizing radiation standards (1926, Subpart D, 1926.54 and 1910.97) ruled unenforceable.
- The telecommunications standards (1910.268) do not apply to construction work.

Other applicable standards:

- **General Duty Clause** – Section 5(a)(1) of the OSH Act
  
  *Each employer shall furnish … a place of employment … free from recognized hazards … causing or are likely to cause death or serious physical harm*

- **1926.28** – Personal Protective Equipment
Voluntary Standards: Institute of Electrical and Electronics Engineers (IEEE)

- **C95.1™** Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz

- **C95.2™** Standard for Radio Frequency Energy and Current Flow Symbols

- **C95.3™** Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz-300 GHz

- **C95.7™** Recommended Practice for Radio Frequency Safety Programs, 3kHz to 300 GHz (revision 2014)
  - Guidance for development of a Radio Frequency Safety Program
  - Explains how to characterize exposures and identify controls
States
Cities
Owners/Universities
What does a potential hazard look like?

Challenges:

- Identifying RF generating devices where work needs to be performed
- Determining if exposure limits are being exceeded and protective measures

Photo credit: deyangeorgiev/123rf.com
Photo credit: Steve Kazella/Wikimedia Commons/CC-BY-3.0
Hazard Identification

Check with the Building Owner

- Site evaluation required for compliance with FCC rules for human exposure
- Site safety plan – location of RF devices, restricted areas, steps to ensure a safe working environment

Example from Boston University: Radio Frequency Safety
Hazard Identification

Site Survey
Hazard Identification

Look for Signs

- Prominently posted
- Containing information on the risk and ways to minimize the risk
- FCC recommends the ANSI C95.2-1966 format

Example of an RF Radiation sign

Photo credit: pancaketom/123rf.com
Hazard Identification

Follow the Instructions

Photo credit: Marc Smith/Wikimedia Commons/CC-BY-2.0

Photo credit: Robert Cooper/Wikimedia Commons/CC-BY-2.0

Photo credit: FourSeasons/123RF.com

Devices of Most Concern in Construction:

- Cylindrical or rod-shaped antennas
- Rectangular panel, dish-shaped, and microwave antennas
- Hidden antennas
Hazard Identification

Cylindrical or Rod-shaped Antennas

These antennas emit RF radiation in more than one direction up to 360 degrees.
Hazard Identification

Rectangular Panel Antennas, Dish-shaped, and Microwave Antennas*

These antennas send out RF radiation in one direction

*Dish-shaped TV receivers do not generate RF radiation
Hazard Identification

Hidden or “Stealth” Antennas

These antennas are designed to blend into their surroundings, which makes them hard to identify and determine their RF radiation emitting direction.

15 antennas hidden in this chimney

Photo credit: Steve Kazella/Wikimedia Commons/CC-BY-3.0
Hazard Identification

Antennas on ENG & SNG News Gathering Trucks

Mast with antenna

Feed Horn: High RF Radiation Fields

SNG Example:

Main Antenna Beam – RF Radiation present
Transmitting Cameras

➢ Transmitters operate through Ethernet, Wi-Fi, or cellular

➢ Covered by IEEE Std. 802® Standard for Local and Metropolitan Area Networks

➢ Required to comply with FCC specific absorption rates for RF.

Photo courtesy of the International Brotherhood of Electrical Workers
Hazard Identification

Access Other Sources for Antenna Locations

- AntennaSearch.com
- FCC Universal Licensing System and Antenna Structure Registration database
- FAA Obstruction Evaluation/Airport Airspace Analysis database
- Local government agencies/offices:
  - Planning, zoning, and building departments
  - Building permit, license, and inspection offices
What can be done to work safely?

What to consider:

• Distance from antennas
• Direction and angle of antennas
• Height of antennas

Exercise caution:
1. Assume all antennas are active and operating at full power
2. Stay away from the antenna
   – *Request to have the antennas powered down or moved*
3. As *part of a safety program*:
   – *Use a personal RF (field) monitor*
   – *Use RF protective clothing*
Protective Measures

Maintain a Safe Distance

➢ Follow instructions on signs
➢ Do not cross fences/barriers set up to restrict access
➢ Pre-plan work tasks and travel routes
➢ Limit the time spent performing tasks near antennas
➢ Stay **at least** six feet away from a single antenna
➢ Stay **at least** 10 feet away from 2 or more antennas
➢ Do not come in physical contact with an active energized ("HOT") antenna
➢ If you notice symptoms of RF Radiation exposure – move to a new location
Protective Measures

Power-Down or Move the Antenna

➢ Contact the antenna owner/person listed on the warning sign(s) or provided by the site owner or manager.

1. *Describe the work being performed near the RF radiation generating antennas*
2. *Express your concern about an exposure hazard*
3. *Request a site power down or written confirmation that it is safe to perform work*

If there are multiple antennas, repeat this process with each antenna owner.
Protective Measures

Use a Personal RF (Field) Monitor

• Portable – attach to clothing
• Monitors the level of RF radiation in real time
• Sounds an alarm when there is a risk for overexposure

Photo courtesy of Narda Safety Test Solutions
http://www.nardalerts.us/index.php

*CPWR does not endorse any specific products
Use Protective Clothing

- RF protective coveralls, socks, gloves and hood should be worn and used in accordance with manufacturer instructions and limitations

- Use when you **must** work in areas above the RF MPE limits

- Personal monitors should be worn on the outside of RF protective clothing

*CPWR does not endorse any specific products*
Protective Measures

➢ NIOSH Health Hazard Exposure Assessment

➢ OSHA On-site Consultation Service

➢ AIHA Consultants
RF radiation is a potential hazard for construction workers because:

- It is invisible
- Antennas come in different shapes and sizes and may be concealed
- Power levels generated by these devices vary
- The risk increases with the number of devices, distance, and time
- Symptoms of overexposure are often attributed to strenuousness work or a non-occupational illness
- RF radiation may interfere with medical devices
- Limited research on the long-term health effects
To determine if RF generating devices are present:

- Look for signs and/or barriers
- Ask the building owner or site manager for the RF survey(s) required by the FCC
- Conduct your own visual pre-task safety assessment
Summary

Take protective measures:

➢ Check the site survey (plot plan) for potential exposure levels

➢ Pre-plan work tasks and travel routes

➢ Contact the building manager and the antenna licensee to have the equipment powered down or moved

➢ If the device owner and building owner are unresponsive:
  1) Contact the FCC to file a complaint
  2) Use personal monitors while work is being performed and stop work if an alarm goes off
  3) Use personal monitors and protective clothing
Workers should be trained to:

- Understand the hazard
- Recognize RF generating antennas and other devices
- Follow the instructions on signs and barriers
- Stay at least 6 feet away from a single antenna and at least 10 feet away from a cluster of antennas
- Never touch an antenna, stop in front of or close to antennas, or take breaks on the rooftop where antennas are present
- Use personal monitors and protective clothing provided
- Recognize the symptoms
Summary

If you think you are in danger:

➢ Leave the work area immediately
➢ Contact your supervisor
➢ Contact your union
➢ Contact the building owner, site manager or the antenna licensee to have the equipment powered down or moved
➢ If they are unresponsive, contact the FCC to file a complaint
To learn more and access the rest of the CPWR RF Radiation Awareness Program, visit www.cpwr.com/research/rf-radiation-awareness

✓ Radiofrequency (RF) Radiation Awareness Guide for the Construction Industry
✓ Video: Safe Transmission: RF Awareness for the Construction Industry
✓ RF Awareness Toolbox Talk
✓ Hazard Alert Card: RF Radiation – An invisible danger
RF Radiation Awareness

Workers who perform tasks on rooftops, sides of buildings, news gathering trucks, and other structures where cellular antennas and other RF (radiofrequency) generating devices are present may be at risk of exposure to hazardous levels of RF radiation.

The Radiofrequency (RF) Radiation Awareness Program for the Construction Industry was developed by the Roofing 12p Partnership* and the multi-trade labor-management RF Radiation Work Group*. The Program is intended to raise construction contractors' and workers' awareness of the potential risk, how to identify the hazard, and steps to work safely.

The program consists of the following:
- Presentation — Radiofrequency (RF) Radiation Awareness Program for the Construction Industry Overview
- Video — Safe Transmission, RF Awareness for the Construction Industry
- Hazard Alert Card — RF Radiation – An Invisible Danger (available in Spanish)
- Toolbox Talk — RF Radiation Awareness (available in Spanish)
- Guide — Radiofrequency (RF) Radiation Awareness Guide for the Construction Industry — This Guide builds on the information covered in the presentation by providing additional details on how to assess the hazard, find regulations and guidance documents, determine if an RF generating device is present, and find protective equipment.

Click on the following for quick access to specific sections of the Guide:

Sections
1. What is Radiofrequency (RF) Radiation?
2. Common Uses
3. Health Effects
4. At Risk Workers
5. Regulations & Guidelines
6. Hazard Identification
7. Protective Measures
8. Summary

Appendices
A. States with Their Own RF Requirements — Examples
B. How to Use FCC & FAA Database
C. Local Resources to Access Antenna Locations
D. Additional Resources
QUESTIONS?

For more information contact Gary Gustafson: ggustafson@cpwr.com or Eileen Betit: ebetit@cpwr.com