PPE and other Controls to Prevent RF Burns and Shock Hazards during Construction near an AM Radio Broadcast Antenna

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Why Protect from Radio Frequency Radiation?

• Effects on People
  – Excessive heating of tissues
  – Electrical shocks and/or burns
  – Involuntary muscle contractions

• Effects on Equipment
  – Interference with communication
  – Damage to control units
  – Damage from heating
  – Explosion & fire risks
THE ELECTROMAGNETIC SPECTRUM

Wavelength (in meters):
- 10^3
- 10^2
- 10^1
- 1
- 10^{-1}
- 10^{-2}
- 10^{-3}
- 10^{-4}
- 10^{-5}
- 10^{-6}
- 10^{-7}
- 10^{-8}
- 10^{-9}
- 10^{-10}
- 10^{-11}
- 10^{-12}

Size of a wavelength:
- Soccer Field
- House
- Baseball
- This Period
- Cell
- Bacteria
- Virus
- Protein
- Water Molecule

Common name of wave:
- RADIO WAVES
- INFRARED
- VISIBLE
- ULTRAVIOLET
- “SOFT” X RAYS
- “HARD” X RAYS
- GAMMA RAYS

Sources:
- AM Radio
- FM Radio
- Microwave Oven
- Radar
- People
- Light Bulb
- The ALS
- X-Ray Machines

Frequency (waves per second):
- 10^6
- 10^7
- 10^8
- 10^9
- 10^{10}
- 10^{11}
- 10^{12}
- 10^{13}
- 10^{14}
- 10^{15}
- 10^{16}
- 10^{17}
- 10^{18}
- 10^{19}
- 10^{20}

Energy of one photon (electron volts):
- 10^{-9}
- 10^{-8}
- 10^{-7}
- 10^{-6}
- 10^{-5}
- 10^{-4}
- 10^{-3}
- 10^{-2}
- 10^{-1}
- 1
- 10
- 10^2
- 10^3
- 10^4
- 10^5
- 10^6
Radio Frequency Radiation Hazards
an OSHA Historical Perspective

• Oahu Interstate H-3
  – Omega-Haiku
  Navigation Antenna
Haiku Valley Arial View

- Worker Protection
  - S&H Plan
  - Grounding
  - PPE
Radio Tower Hazards an OSHA Historical Perspective

- Maritime Operations
  - Navy leaders in RF S&H
  - Radar and communications antennas
  - Special hazards
Construction Site Adjacent to WEPN Radio Towers
Worker Complaints

- Crane operators felt tingling in the bodies
- Could hear the crane’s ball buzzing
- Felt the physical warming of their bodies
- Numerous shocks
Equipment Damage On-Site

- Crane electronic control systems
- Winding sheaves
Measured Worker Exposures

- Induced current meter
- All below standards
  - OSHA
  - IEEE
- RF Shock hazard still persisted
  - Gap in IEEE C-95.1
Control Measures

- Engineering
- Administrative
- PPE
Engineering Controls

- Isolated Ball
Engineering Controls

• Grounded Load
Administrative Controls

- Site Safety & Health Plan
  - Specifically address RF issues
- Fall protection for all above ground work
- Training
Personal Protective Equipment

- Personal fall arrest systems
- Rubber lined gloves
- Insulated crane operator controls
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