

APPLE VALLEY TV ASSOCIATION (AVTV)

COMMUNICATIONS SITE

RF SAFETY PROCEDURES

RADIO FREQUENCY SAFETY PROGRAM

470Mhz and ABOVE

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Saddlerock Professional Services

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Policy

This program provides the minimum safety requirements for protecting employees and site users from potential injuries associated with Radio Frequencies (RF) above 300 kHz. By following these basic safety principles and maintaining proper safety awareness, employees and site users should be able to avoid serious injury or illness.

I. Purpose/Scope

The purpose of this program is to provide employees and site users with the basic information for assuring a safe and healthful workplace free from recognized radio frequency hazards, which may cause injury or illness. Each employee is expected to follow the guideline provided within this program. Supervisors shall be responsible for initiating disciplinary action against employees who do not follow the guidelines within this program.

Electromagnetic radiation consists of waves of electric and magnetic energy moving together (i.e., radiating) through space at the speed of light. Taken together, all forms of electromagnetic energy are referred to as the electromagnetic "spectrum." Radio waves and microwaves emitted by transmitting antennas are one form of electromagnetic energy. They are collectively referred to as "radiofrequency" or "RF" energy or radiation. Often the term "electromagnetic field" or "radiofrequency field" may be used to indicate the presence of electromagnetic or RF energy.

Different forms of electromagnetic energy are categorized by their wavelengths and frequencies. The RF part of the electromagnetic spectrum is generally defined as that part of the spectrum where electromagnetic waves have frequencies in the range of about 3 kilohertz (3 kHz) to 300 gigahertz (300 GHz). Microwaves are a specific category of radio waves that can be defined as radiofrequency energy where frequencies range from several hundred MHz to several GHz. The information in this program applies to all employees and site users working on or near, **470 MHz AND ABOVE** towers or antennas and associated equipment. See Appendix A for Electromagnetic spectrum diagram.

The energy levels associated with RF and microwave radiation are not great enough to cause the ionization of atoms and molecules. Other types of non-ionizing radiation include visible light, infrared radiation, and other forms of electromagnetic radiation, which also have relatively low frequencies. Often the term "radiation" is used to apply to ionizing radiation such as that associated with nuclear power plants. Ionizing radiation should not be confused with the lower-energy, non-ionizing, radiation with respect to possible biological effects, since the mechanisms of action are quite different.

"Ionization" is a process by which electrons are stripped from atoms and molecules. This process can produce molecular changes that can lead to damage in biological tissue, including effects on DNA, the genetic material. This process requires interaction with high levels of electromagnetic energy. Those types of electromagnetic radiation with enough energy to ionize biological material include X-radiation and gamma radiation. Therefore, X-rays and gamma rays are examples of ionizing radiation.

Radio frequencies constitute part of the overall electromagnetic spectrum. Cellular radio services transmit using frequencies between 800 and 900 megahertz (MHz). It should be noted that the radio towers are operating on the 470 MHz and above level and all are gated and locked and have proper signage attached. The only exceptions are the antennas at the LocalTel COLO, which are located on a secure area that is not open to the public. Signage is present at the tower base. In addition, these antennas are located high on the outside of the building and are pointed outward, which further limits access.

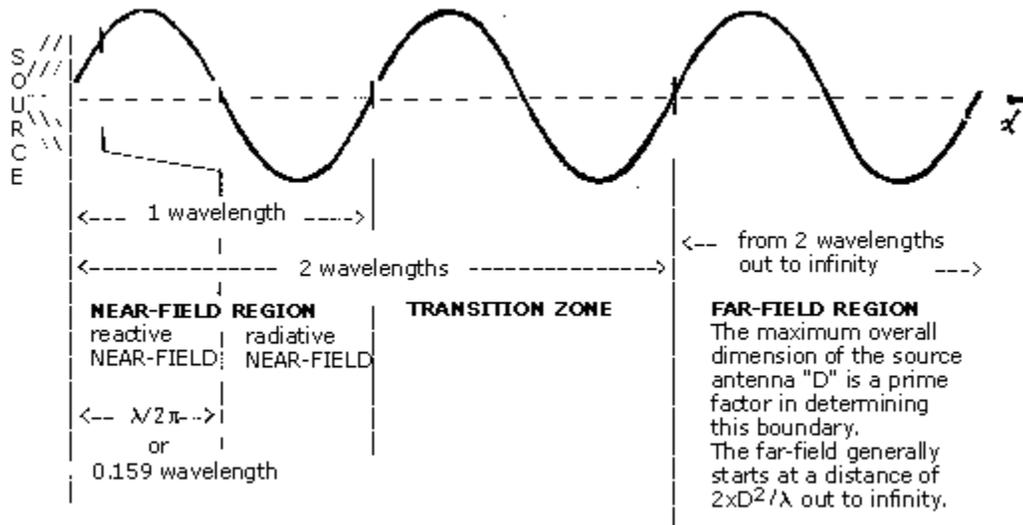
Certain behavior characteristics of Electromagnetic (EM) fields dominate at one distance from the radiating antenna, while a completely different behavior can dominate at another location. Electrical engineers define boundary regions to categorize behavior characteristics of electromagnetic fields as a function of distance from the radiating source. These regions are: the "Near-Field," "Transition Zone," and "Far-Field". The regional boundaries are usually measured as a function of the wavelength. Figure 1 shows these regions and boundaries.

Two things should be stressed: these regions categorize behaviors, which vary even within each region; and the boundaries for these regions are approximate "rules of thumb" (more precise boundaries can be defined based primarily on antenna type and antenna size).

All AVTV radio towers and antennas are so situated and secured as to keep people in the category I location under the ANSI standard(Please note:

Information was not obtained from the Division of Aviation Operations). Category I locations are areas where the RF fields are too weak to cause exposures greater than the FCC general population (public) limits. See Appendix B for Exposure diagram

Figure 1



II. References

There are numerous safety references, which pertain to radio frequency including, but not limited to:

- American National Standards Institute (ANSI) Standards, ANSI/IEEE C95.1-1992, Evaluating Effects of Radio Frequency Radiation on the Environment
- Occupational Safety and Health Administration (OSHA) Standards OSHA 29 CFR 1910.147, Lockout/Tagout
- Occupational Safety and Health Administration (OSHA) 1910.97 - Non-Ionizing Radiation
- Federal Communications Commission (FCC) Office of Engineering and Technology (OET) Bulletin - 65: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Guidance Document

III. Exposure/Effect

Biological effects can result from animal or human exposure to RF energy. Biological effects that result from heating of tissue by RF energy are often referred to as "thermal" effects.

A. Effects

1. It has been known for many years that exposure to very high levels of RF radiation can be harmful due to the ability of RF energy to heat biological tissue rapidly. This is the principle by which microwave ovens cook food.
2. Exposure to very high RF intensities can result in heating of biological tissue and an increase in body temperature. Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated.
3. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excessive heat load.
4. At relatively low levels of exposure to RF radiation, (i.e. levels lower than those that would produce significant heating) the evidence for production of harmful biological effects is ambiguous and unproven.

B. Exposure

1. The exposure limits used by the FCC are expressed in terms of Specific Absorption Rate (SAR), electric and magnetic field strength and power density for transmitters operating at frequencies from 300 kHz to 100 GHz.

a. SAR is the rate of energy absorption in tissue, measured in watts per kilogram of tissue. Limits incorporate a safety factor of 10 (Most Western Limits are 0.4 W/kg).

2. The exposure limits used by OSHA 1926.54(l) are as follows: Employees shall not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter.
3. Controlled environment for RF purposes is an area where human activity is subject to control and accountability as established by a written RF Safety Program.
4. Occupational limits (see Table 1) apply to persons who are exposed as a consequence of their employment and those persons have been made fully aware of the potential for exposure and can exercise control over their exposure. (designated as RF Safety Trained)

Table 1
Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electrical Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time Minutes
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

F = frequency in MHz * = Plane - wave equivalent power density

Table 2
Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electrical Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time Minutes
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/150	30
1500-100,000	--	--	1.0	30

Note 1 to Table 1: Occupational/Controlled limits apply in situations in which persons exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled limits apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential of exposure or cannot exercise control over their exposure. People in this group include the general public not associated with the installation and maintenance of the transmitting equipment.

(Taken from FCC 96-326 Guidelines for Evaluating the Environmental Effects of Radiofrequency radiation ET Docket No. 93-62)

5. Ancillary Hazards – It should be noted that these additional hazards may exist at these locations: Electric shock, Ionizing Radiation, Mechanical, Eye Hazards, Fall from heights and/or through openings, Confined Space, Trip Hazards, Welding/cutting operations, Heat stress, Toxic chemicals/gases, Cooling refrigerants, Optical Radiation sources

IV. Program Elements

A. Elements

1. Identification and inventorying of exposure sources
2. Potential hazards
3. Characterization of sources
4. Ancillary hazards consideration/evaluation
5. Suitable control application
6. Training for potentially exposed individuals as well as for the RF Safety Officer

B. Signs

Per OSHA, “the RF hazard areas shall be clearly marked with appropriate signs, barricades, etc. such that any worker who has access to the facility will be alerted not to occupy the hazardous location.

1. Signs shall be of standard design and shape meeting ANSI C95.1 (see Figures 2 & 3 and Appendix B for placement)
2. Signs shall be of sufficient size to be recognizable and readable from not less than 25 feet away.
3. Signs shall be placed where there is a potential for that exposure might exceed occupational limits. See Table 1
4. Signs shall be placed anywhere exposure limits might exceed public limits. See Table 2
5. Signs shall be placed anywhere equipment is in use and under normal operation and maintenance and where there are no public or occupational exposure issues. See Tables 1 & 2

Figure 2



ANSI Standard Z535.1-1998 'Safety Yellow' for the background color of the signal word on CAUTION signs indicating a potentially hazardous situation.

Figure 3



ANSI Standard Z535.1-1998 'Safety Blue' for the background color of the signal word on NOTICE signs indicating a statement of company policy.

C. Medical Surveillance

1. A medical exam is appropriate for “accidental” exposures defined as an exposure above trigger levels identified in Tables 1 & 2. Symptoms of accidental exposure can be described as but not limited to the following: immediate sensation of intense heating of the parts of the body in the electromagnetic field followed by a variety of symptoms and signs, which included pain, headache, numbness, and parasthesiae, malaise, diarrhea, and skin erythema.
2. Medical surveillance will consist of an annual medical evaluation by a licensed healthcare professional and it must contain 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.

D. Annual Program Review

1. An annual check of all RF facilities must be completed in order to insure changes have not occurred over the past year. Periodic RF screening measurements are not necessary at the present time due to the configuration of the RF sources.
2. In cases where changes have occurred, screening measurements must be conducted, by a certified contractor, in order to insure compliance and to ensure that no employees are being over exposed.

D. Assignment of Responsibilities

1. **Lonnie England, 981 Crawford Ave, Wenatchee, WA 98801, 509-860-5485 lonnie.english@gmail.com** shall is responsible for the implementation and enforcement of all aspects of the program. Duties are as follows:
 - a) Initially evaluating RF sources
 - b) Maintaining RF source inventory
 - c) Evaluating safety procedures
 - d) Evaluating existing RF safety program documentation
 - e) Disseminating RF safety policy
 - f) Providing authoritative advice
 - g) Reviewing/authorizing RF surveys and control measures
 - h) Authorizing designated RF safety personnel
 - i) Coordinating RF safety awareness
 - j) Conducting/arranging regular site audits
 - k) Conducting annual RF hazard survey policies and procedures review
 - l) Managing policy and procedures breaches, including accidental over exposure incidents
 - m) Developing/approving RF hazard assessment
 - n) Arranging for regular survey/monitoring equipment calibration
 - o) Ensuring proper documentation control and central archiving
2. All RF contractors should have and furnish a site-specific RF program to Apple Valley TV and Risk Management in order to work in and around AVTV owned towers and antennas.

V. Training Requirements

All affected employees and site users-managers will be trained on radio frequency safety upon initial assignment and refresher training on a periodic basis. The training will consist of the information contained within this procedure. RF safety and health training will be conducted to ensure that all employees understand the RF hazard to which they are exposed and the means by which the hazard can be controlled. Retraining and/or periodic refresher will be conducted when warranted by an incident or other evidence of the employee's lack of understanding or compliance with the program.

A. General Awareness Training

Awareness Training is for "all persons" with access to areas where RF exposure may exceed applicable limits (commensurate with exposure situation). All employees/contractors are required to go through awareness training.

1. Training Program Elements

- a. Introduction to RF sources licensed by the City of Philadelphia and RF Safety (RF generation, propagation, transmission, antennas, ect.)
- b. Discussion of biological effects/hazards
- c. Explanation of standards/regulations and basis for them
- d. Information about potential excessive exposure situations and their controls
- e. RF safety program elements
- f. Instruction on how to respond to over-exposure incidents
- g. Information about potential RF susceptibility of medical devices/implants
- h. Additional information sources
- i. Personal monitoring vs. area monitoring
- j. Lock out tag out

B. Fully Aware Training

Fully Aware Training is for "all persons" working on or in close proximity (roof-mounted antennas) to areas where RF exposure may exceed applicable limits (commensurate with exposure situation (See Table 1)). Trainees will receive written and verbal information on how to control or mitigate radiation exposures.

1. Training Program Elements

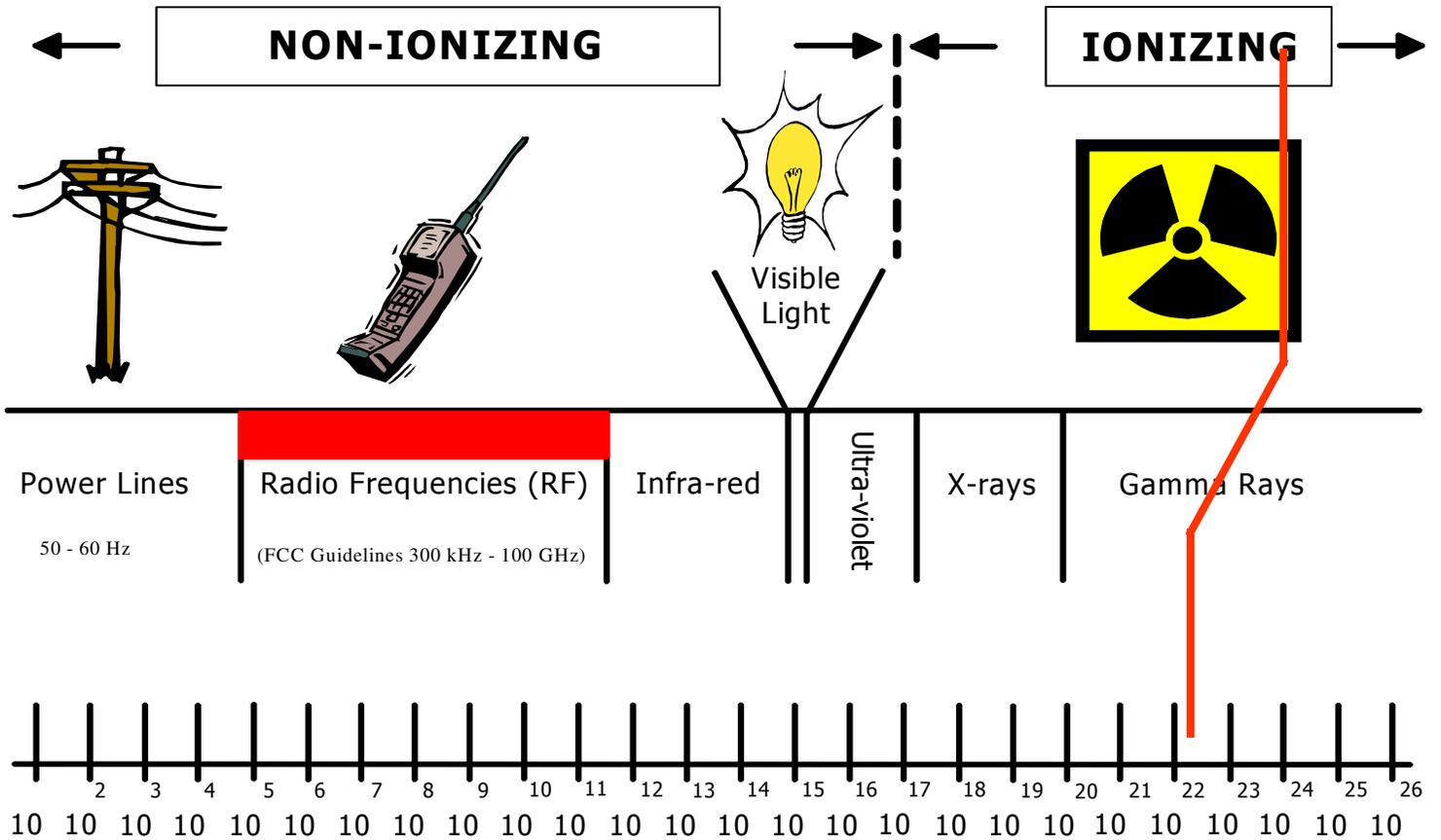
- a. Introduction to RF sources licensed and un-licensed and RF Safety (RF generation, propagation, transmission, antennas, ect.)
- b. Discussion of biological effects/hazards
- c. Explanation of standards/regulations and basis for them
- d. Information about potential excessive exposure situations and their controls
- e. RF safety program elements
- f. Instruction on how to respond to over-exposure incidents
- g. Information about potential RF susceptibility of medical devices/implants
- h. PPE training - donning, doffing, inspection
- i. How to use administrative and engineering controls to reduce exposure levels

It is the policy of Apple Valley Television Association (AVTV) owned towers as well as towers used by AVTV that are NOT owned by AVTV, that RF levels in the UHF TV band 470Mhz and above or channel 14 and above be REDUCED to a safe level or just turned off before commencing any tower or site work. Tower workers are required to have a personal RF exposure monitoring system on their body at all times.

AVTV towers that broadcast at frequencies and RF power levels that can cause high RF exposure limits are closed to public access by gate, fence and signage.

APPENDIX A

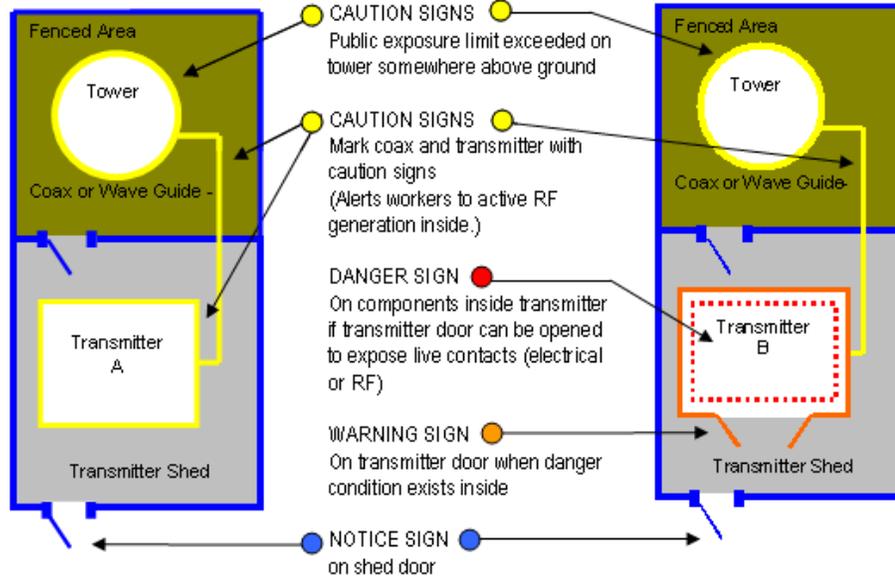
RFR Basics - The Electromagnetic Spectrum



APPENDIX B

FM, TV, or Wireless Building with Tower

When all exposure levels at ground are within public exposure limits

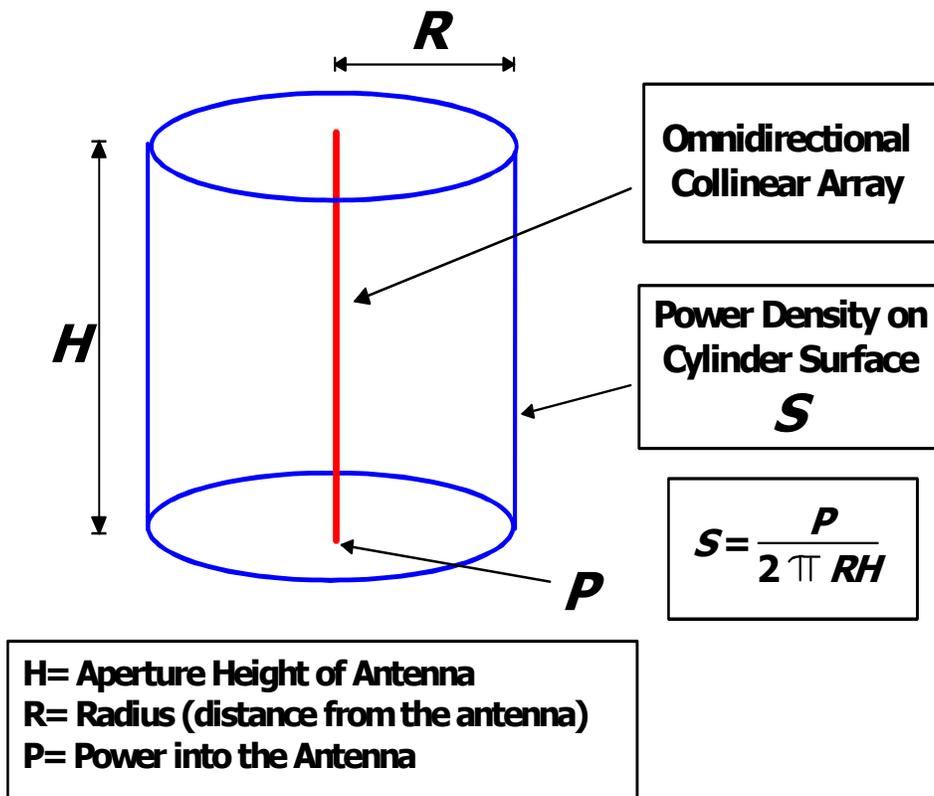


- CAUTION SIGNS
Public exposure limit exceeded on tower somewhere above ground
- CAUTION SIGNS
Mark coax and transmitter with caution signs (Alerts workers to active RF generation inside.)
- DANGER SIGN
On components inside transmitter if transmitter door can be opened to expose live contacts (electrical or RF)
- WARNING SIGN
On transmitter door when danger condition exists inside
- NOTICE SIGN
on shed door

KEY
 — Positive Envelope
 Passive Envelope

APPENDIX C

Cylindrical Model



APPENDIX D

RFR Action Thresholds		
Controlled MPE Limit >2000%		NO WORKERS ALLOWED!
1000%		HIGHLY TRAINED WORKERS WITH SPECIALIZED EQUIPMENT
200%		RFR TRAINED WORKERS
100%		GENERAL SITE WORKER
20%		GENERAL PUBLIC
		No Procedures Required

APPENDIX E

AM Broadcasting Tower without **Base Potential**

Grounded Base – No High Voltage at Base (Assumes feed line is not exposed and presents no danger)

