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Presentation for proposed tower site at  
Missouri Flat Road  
on behalf of




and



Presented to  
County of El Dorado Planning Commission




Presented by : Ian Maxwell; Sr. VP Waterford Consultants LLC  
Date: January 21, 2015



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**Company Overview**

Independent Consultant of RF (Radio Frequency) Health,  
Safety and Regulatory Compliance Services


The Waterford Consultants team have:

- Surveyed over 20200 sites for RF emissions compliance in the USA, Canada, Australia and Germany
- Trained over 5,800 people in RF Health & Safety



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## Why are we here today?


Objective is to provide information regarding the radio frequency emissions for the proposed Verizon “mono-oak” tower site located in the Diamond Springs area.

RF was first used in Europe in 1897 and introduced into the US Navy in 1912. RF has been in existence for over 100 years in the USA. Wireless communications are just additional RF layers to an already existing electromagnetic spectrum.

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## Rules and Regulations


FCC has established and published in OET-65, the Rules and Regulations governing RF emissions.

Exposure limits are recommended by National Council for Radiation Protection (NCRP) with the limits being developed by the Institute of Electrical and Electronic Engineers (IEEE) and adapted by the American National Standards Institute (ANSI).

Two major standards are used in the U.S.: IEEE C95.1-1999 & ANSI C95.1-1992


- Uses *Maximum Permissible Exposure (MPE)* levels, rather than previously used *Radiation Protection Guide*.

Standards call for a required 10 year update cycle. No significant changes in latest revision – more in training and measurement techniques.



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### Rules and Regulations

Under “normal conditions”; an average person can absorb 4W/kg of mass. It should be understood that when RF is absorbed, it is converted into heat


FCC has incorporated a 10:1 safety factor to the NCRP recommendation. Therefore, the national standard for Maximum Permissible Exposure is 0.4W/kg of mass

Maximum Permissible Exposure (MPE) is expressed as a percent (%) of maximum allowable; two tiers; Occupational and General Public



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### Rules and Regulations

Every communications site is required, by law, to perform an RF study. Carriers and operators are responsible to the FCC for these site compliance audits and the facility owner is responsible to OSHA to ensure compliance with FCC rules and regulations (Bulletin 65).

Rules also dictate that any changes to a communication site, be it addition or removal of equipment, requires a new compliance study of the entire site. Only exception is towers where changes are made above 10 metres from ground height at the base of the tower

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## ELECTROMAGNETIC SPECTRUM

The diagram illustrates the electromagnetic spectrum, divided into Ionizing Radiation (left, red background) and Non-ionizing Radiation (right, green background). The x-axis represents frequency in Hz (top) and wavelength in meters (bottom), both on logarithmic scales. The visible spectrum is shown as a color bar at the bottom, with wavelengths from 400 nm (violet) to 700 nm (red).

**Ionizing Radiation:**  $10^{24}$  Hz,  $10^{22}$  Hz,  $10^{20}$  Hz,  $10^{18}$  Hz,  $10^{16}$  Hz,  $10^{14}$  Hz,  $10^{12}$  Hz. Includes  $\gamma$  rays, X rays, UV, and IR.

**Non-ionizing Radiation:**  $10^{10}$  Hz,  $10^8$  Hz,  $10^6$  Hz,  $10^4$  Hz,  $10^2$  Hz,  $10^0$  Hz. Includes Microwave, FM, AM, and Long radio waves.

Visible spectrum: 400 nm to 700 nm.

Visible light is an electromagnetic wave, consisting of oscillating electric and magnetic fields traveling through space. The frequency of the wave determines its color.

Radio waves are a type of electromagnetic radiant energy with wavelengths in the electromagnetic spectrum longer than infrared light. Radio waves have frequencies from as low as 3kHz to as high as 300GHz, and corresponding wavelengths ranging from 100 kilometers (62 mi) at low frequencies to 1 millimeter (0.039 inches) at the high end. Like all other electromagnetic waves, radio waves travel at the speed of light.

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## Where items of everyday life fit into the Electromagnetic Spectrum

This diagram maps everyday life items to their positions on the electromagnetic spectrum. The x-axis shows frequency in Hz (top) and wavelength in meters (bottom).

**Ionizing Radiation:**  $10^{24}$  Hz,  $10^{22}$  Hz,  $10^{20}$  Hz,  $10^{18}$  Hz,  $10^{16}$  Hz,  $10^{14}$  Hz,  $10^{12}$  Hz. Includes  $\gamma$  rays, X rays, UV, and IR.


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Visible spectrum: 400 nm to 700 nm.


Items of everyday life mapped to the spectrum:

- Ionizing Radiation:** Radiation Therapy, Nuclear Reactions
- UV:** Medical, Dental X-Rays
- Visible Spectrum:** Lamps, Sun tans
- IR:** Electric Heaters
- Microwave:** Microwave Ovens, Microwave, Radar
- Radio waves:** Television, Public Safety, Cellular, PCS, Radio, Aircraft navigation
- Long radio waves:** Power Lines, older cordless telephones, POCs



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### Ionizing versus Non-ionizing


The biological effects between these two types of emissions is totally different.

**Ionizing** emissions can cause permanent biological changes to molecular structure.

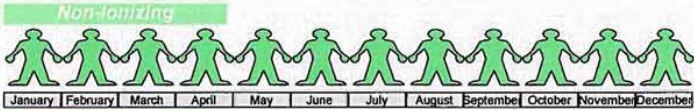
The primary concern with **Non-ionizing** emissions is tissue heating. At wireless sites, like Missouri Flats, we have these non-ionizing emissions in the "radio wave" band. Only extensive exposure above certain conditions are of concern

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### Ionizing versus Non-ionizing




*Non-ionizing*

January | February | March | April | May | June | July | August | September | October | November | December




*Ionizing*

Effects of **non-ionizing** emissions **are not** cumulative.  
Effects of ionizing emissions **are** cumulative.




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### Everyday Comparisons

- A baby monitor: 1.2% MPE at 18" away from unit
- L3 Microwave operating at "high" power (1100 Watts): 3.7% MPE when measured 12" away from door seam
- Wireless routers (D-Link DI-614+) measure 0.1%; the same levels as the GoGo Air installation
- Motorola T6500 Talkabout "walkie-talkies" measure at 4.11% (hand held 2-way radios)



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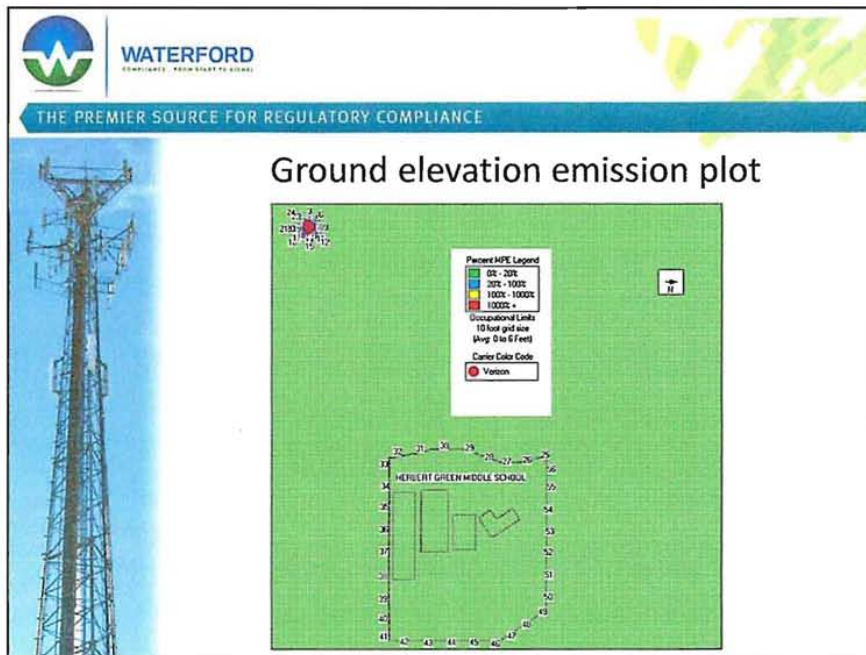
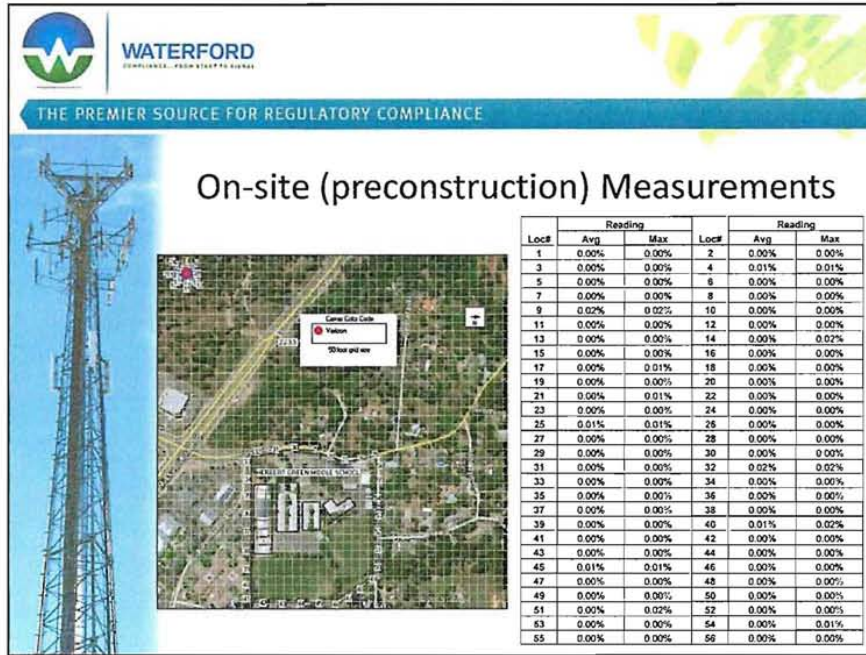


### Missouri Flat Site Specific MPE

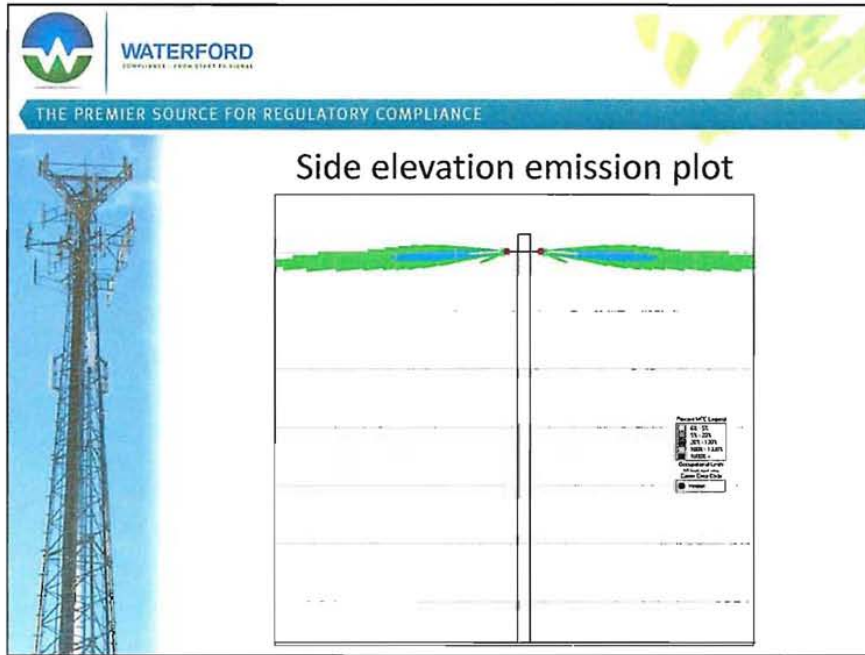
At this site, utilizing the maximum power Verizon is licensed by the FCC to use, the highest MPE value at ground level is 0.3%, which is 3/1000ths of the maximum permissible exposure for persons in the General Public classification.

This highest MPE value occurs at a distance of 20.4 metres (22.3 yds. or 67 feet) from the base of the tower. All other values are below the 0.3% MPE level, both calculated and measured.

At the southwest corner of the school yard, a distance of approximately 1160 feet away from the base of the tower, the proposed Verizon Wireless operations from the Missouri Flat site will not increase existing power density levels above 0.11% of the FCC General Public limits.







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### Quotes from various Agencies and Organizations

**World Health Organization (WHO):**  
"Tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body."


"A number of studies have investigated the effects of radiofrequency fields on brain electrical activity, cognitive function, sleep, heart rate and blood pressure in volunteers. To date, research does not suggest any consistent evidence of adverse health effects from exposure to radiofrequency fields at levels below those that cause tissue heating."





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Quotes from various Agencies and Organizations, continued

**American Cancer Society:**

“At ground level near typical cellular base stations, the amount of RF energy is thousands of times less than the limits for safe exposure set by the US Federal Communication Commission (FCC) and other regulatory authorities. It is very unlikely that a person could be exposed to RF levels in excess of these limits just by being near a cell phone tower.”

“Levels of energy from RF waves near cell phone towers are not significantly different from the background levels of RF radiation in urban areas from other sources, such as radio and television broadcast stations. For these reasons, most scientists agree that cell phone antennas or towers are unlikely to cause cancer



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Quotes from various Agencies and Organizations, continued

**US Food and Drug Administration (FDA):**


“Although research is ongoing, the Food and Drug Administration (FDA) says that available scientific evidence—including [World Health Organization \(WHO\) findings](#)<sup>4</sup> released May 17, 2012—shows no increased health risk due to radiofrequency (RF) energy, a form of electromagnetic radiation that is emitted by cell phones.”

“FDA also cites a separate National Cancer Institute program finding that, despite the dramatic increase in cell phone use, occurrences of brain cancer did not increase between 1987 and 2012.”




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Quotes from various Agencies and Organizations, continued

**The International Agency for Research on Cancer (IARC):**  
“the vast majority of scientific research to date does not support a link between RF energy exposure and human cancers”



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Conclusion

Waterford Consultant’s licensed Professional Engineer, has reviewed and signed off on the pre-construction measurements and the theoretical calculations/plots of the constructed site and deemed this site to be well within the Rules and Guidelines as established by the FCC, in accordance with OET Bulletin 65.