COUNTY OF **SANTA** CRUZ

PLANNING DEPARTMENT

701 OCEAN STREET, 4TH FLOOR, SANTA CRUZ, CA 95060
(831) 454-2580 FAX: (831) 454-2131 TDD: (831) 454-2123
ALVIN **JAMES**, DIRECTOR

November 7,2001

AGENDA: November 20,2001

Board of Supervisors
County of Santa Cruz
701 Ocean Street
Santa Cruz, California 95060

INFORMATIONAL REPORT ON SAFETY AND LEGAL ISSUES REGARDING WIRELESS COMMUNICATIONS FACILITIES

Dear Members of the Board:

As you recall, on August 7, 2001, your Board extended the duration of the County's Interim Wireless Communication Facilities Ordinance an additional 10 months and 15 days (until June 25, 2002), and directed Planning Department and County Counsel staff to return with answers to a number of questions your Board had regarding safety and legal implications of wireless communication facilities (e.g., cellular phone towers/antennas) and how the County might address these and other concerns. Specifically, the questions to which your Board requested answers are as follows:

- Can the County require wireless service providers (e.g., cellular phone companies and their representatives) to measure the cumulative radio frequency radiation (RFR) emissions from all wireless communication facilities in the vicinity of proposed new towers/facilities, to ensure the new and existing facilities are in compliance with the Federal Communication Commission (FCC) RFR exposure standards?

- Can the County require that service providers measure the RFR emissions from their entire network within the County as part of the application process for new facilities?

- What are the County Government's options if health effects do indeed exist from cell tower RFR at levels below the FCC exposure standards?

- What is the status of the federal legislation to return local government control with regard to regulating base stations on the basis of RFR exposure health effects?

Planning Department and County Counsel staff have collaborated on the responses to these inquiries. County Counsel has also prepared a separate letter responding to your Board's concerns regarding the legal constraints the County faces in cell tower siting decisions, and this separate letter is included as Attachment 1 to this letter. Planning Department staffs responses to your Board's questions which are given below:

1. ***Can the County require wireless service providers (e.g., cellular phone companies and their representatives) to measure the cumulative radio frequency radiation (RFR) emissions from all wireless communication facilities in the vicinity of proposed new towers/facilities, to ensure the new and existing facilities are in compliance with the Federal Communication Commission (FCC) RFR exposure standards?***

Yes. There is nothing in the Federal Telecommunications Reform Act of 1996 that prohibits local jurisdictions from requiring wireless services providers to prove they are in compliance with the FCC RFR exposure standards, or to prove that the ambient background RFR levels at a proposed site are within FCC standards. Other local jurisdictions either require RFR monitoring of all new cell towers/antennas, or can require such monitoring in certain circumstances, including the City of San Francisco, Marin County, City of Berkeley, and several local jurisdictions in other states. In some of these jurisdictions the service providers are required to have third-party RF engineers measure the baseline or ambient RFR exposure levels prior to installation and operation of their proposed new facilities, and to calculate the additional RFR that would be produced by their proposed new facility. In some jurisdictions the service providers are required to have third-party RF engineers conduct post-installation RFR measurements as well, which measure the actual emissions from the new facility in combination with the others nearby, under normal (or peak) operating conditions.

The County's recently adopted Interim Wireless Communications Facilities Ordinance (County Code Section 13.10.650, Subdivision [g][2][ix]) requires all applications for new wireless communications facilities to calculate expected RFR exposure levels, taking into consideration existing transmission sources at or near the site. Subdivision (i) of the Interim Ordinance establishes ongoing monitoring requirements that require wireless service providers to monitor RFR once every two-years at all new cell towers/facilities. The FCC Publication entitled "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance" is attached for your Board's information (Attachment **2).**

2. ***Can the County require that service providers measure the RFR emissions from their entire network within the County as part of the application process for new facilities?***

Probably not. Requiring service providers to supply RFR monitoring results from their entire networks within the County may not be legally defensible, according to County Counsel. Requiring an applicant to produce monitoring data for their entire network would have to be based on a determination that there was a reasonable connection, or nexus, between the RFR emissions from a proposed new facility and the RFR emissions from the service provider's existing facility network. In that case, such network-wide measurements could potentially be required as part of applications for new wireless communication facilities. However, according to County Counsel, proving such a nexus would be difficult or impossible. There are no other

local jurisdictions known to staff that are enforcing such system-wide monitoring requirements upon wireless communication facility applicants.

3. What are the County Government's options if health effects do indeed exist from cell tower RFR at levels below the FCC exposure standards?

This matter is addressed in County Counsel's letter, which is included as Attachment 2 to this letter.

4. What is the status of the federal legislation to return local government control with regard to regulating base stations on the basis of RFR exposure health effects?

Section 704 of the Federal Telecommunications Reform Act of 1996 prohibits local or state jurisdictions from regulating the siting of wireless telecommunication base stations on the basis of RFR exposure-related health concerns, as long as the base stations comply with FCC's RFR exposure standards. U.S. Senators Leahy and Jeffords of Vermont (along with several other Senators) have co-sponsored legislation in each of the last three congressional sessions that would have reversed the parts of Section 704 that limit local control over cell tower siting. Corresponding legislation had been proposed concurrently in the House of Representatives as well. The Senate bills have not made it out of the Commerce, Science and Transportation Committee, headed until 2001 by Senator John McCain (R-Arizona). With the recent shift in the majority leadership, the Commerce Committee is now headed by Ernest Hollings @-South Carolina), and new bills to reverse Section 704 are to be introduced this session. However, even if this legislation passes in the U.S. Senate, it faces an uncertain future as it still would have pass in the U.S. House of Representatives and be signed into law by the President.

RECOMMENDATION

It is RECOMMENDED that your Board accept and file this informational report.

Sincerely,

Alvin D. James
Planning Director

RECOMMENDED: _____
Susan A. Mauriello, CAO

Attachments: 1. Letter of November 7, 2001 from Rahn Garcia, Assistant County Counsel, regarding legal constraints concerning wireless communication facilities siting decisions

2. FCC Publication: A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules. Procedures. and Practical Guidance

cc: California Coastal Commission
Bill Parkin
Celia Scott
Sheriff Mark Tracy
Alex Kiener, County Radio Shop

ATTACHMENT 1

0315

County of Santa Cruz

OFFICE OF THE COUNTY COUNSEL

701 OCEAN STREET, SUITE 505, SANTA CRUZ, CA 95060-4068
(831) 454-2040 FAX: (831) 454-2115

DANA McRAE, COUNTY COUNSEL

CHIEF ASSISTANT
RAHN GARCIA

Assistants

Deborah Steen
Harry A. Oberhelman III
Marie Costa
Jane M. Scott
Tarnyra Rice
Pamela Fyfe
Kim Baskett
Julia Hill
Shannon Sullivan
Sharon Carey-Stronck
Dwight L. Herr

November 7,2001
Agenda: November 20,2001

Board of Supervisors
County of Santa Cruz
701 Ocean Street, Room 500
Santa *Cruz,* California 95060

Re: Regulation of Wireless Communication Facilities Based on Health and Safety Concerns

Dear Members of the Board:

On August **7,** 2001, your Board acted to extend an interim ordinance regulating wireless communication facilities. Your Board also directed this Office to return with a report as to what legal authority, if any, the County has to regulate the placement of such facilities on the basis of health and safety concerns associated with radio frequency radiation. It is the Opinion of this Office that local govemments would be preempted by federal law from enacting or applying its own standards regulating the siting of a wireless communication facility on the basis of radio frequency radiation related health **risks.**

BACKGROUND

As your Board is aware, the Telecommunications Reform Act of 1996 ("TRA") establishes Federal regulations which directly bear on the placement of wireless communication facilities. In enacting the TRA, Congress intended to end monopoly power in the telecommunications industry by dismantling state and local barriers to competition, and accelerating rapid private sector deployment of advanced

telecommunications and information technology and services. S.Conf. Rep. No. 104-230, 104th Cong., 2d Sess. 113 (1996). While the TRA recognizes local government authority over zoning for such facilities, it has been interpreted by the Federal Communications Commission (FCC) and federal courts in a manner which limits local government control over the siting of wireless facilities by imposing certain substantive, procedural and evidentiary standards. Significantly, the TRA provides that:

> "No state or local government or instrumentality thereof may regulate the placement, construction or modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such facilities." 47 U.S.C. Sec. 332(c)(7)(B)(iv).

This means that while state and local governments may study the effects of RF emissions, the local authorities may not regulate the siting or construction of personal wireless facilities based standards that are more stringent than those promulgated by the FCC.

CASE LAW DEVELOPMENTS

The authority of the federal government under the TRA to preempt state and local government regulation of wireless facilities on the basis of radio frequency radiation has been subject to both administrative and judicial challenge. The only reported decision comes from the U.S. Court of Appeals for the Second Circuit which affirmed the FCC's preemptive authority with regards to regulation of RF emissions. Though it is not binding on jurisdictions outside the Second Circuit, including our County, the decision does represent a useful guide as to how our courts may apply this provision.

In *Cellular Phone Task Force v. FCC, 205* F.3d 82 (2d Cir. 2000), the United States Court of Appeal for the Second Circuit upheld the legality of the TRA and FCC regulations concerning the environmental and health effects of radio frequency emissions from cellular telephone facilities. The legal action involved a challenge to certain opinions and orders issued by the FCC setting standards for human exposure to radio frequency radiation emitted from transmitters, including personal wireless service facilities. Also challenged were rules implementing Sec. 332(c)(7)(B)(iv) of the TRA (See Guidelines for Evaluating the Scientific Effects of Radio-frequency Radiation, 11

F.C.C. Rcd. 15123 (1996) ("First Report and Order"); Procedures for Reviewing Requests for Relief from State and Local Regulations Pursuant to Section 332(c)(7)(B)(v) of the Communications Act of 1934, 12 F.C.C. Rcd. 13494 (1997) (Second Memorandum Opinion and Order"). The Petitioners contended that these FCC measures were unconstitutional facially and as applied, and in particular, violated the federalism principles embodied in the Tenth Amendment. The Tenth Amendment assures a system of two, separate and independent sovereign governing entities with states exercising concurrent, and not auxiliary, authority with the federal government.

Applying a deferential standard of review, the Court of Appeals affirmed the FCC orders. The Court concluded that the Section 332(c)(7)(B)(iv) of the TRA did not violate the federalism principles of the Tenth Amendment.

> "State and local governments are not required to approve or prohibit anything. The only onus placed on state and local governments exercising their local power is that they may not regulate personal wireless service facilities that conform to the FCC Guidelines on the basis of environmental effects of RF radiation" *Cellular Phone Task Force v. FCC, 205* F.3d at p.96.

In addition, the Court found that the FCC's findings that radiation at maximum permitted exposure levels would be safe, and that some facilities could be categorically excluded from routine evaluation, were also not arbitrary or capricious. The United States Supreme Court declined to review the decision.

One other case is worthy of note. While it did not directly challenge the preemptive authority of the FCC under Section 332(c)(7)(B)(iv), the opinion in *Petersburg Cellular Partnership v. Board of Supervisors,* 205 F.3d 688 (4th Cir. 2000) did suggest the basis for a constitutional challenge of the TRA's limits on state and local government authority in general. In *Petersburg,* a divided three-judge panel of the Fourth Circuit reversed the District Court and upheld a decision of the Nottaway County, Virginia, Board of Supervisors denial of an application to build a cellular telephone tower. One of the three judges concluded that the County had acted properly in denying the application based on safety concerns (unrelated to radio frequency radiation). The other two judges ruled that the County's denial of the application was not supported by "substantial evidence". However, because one of the two majority judges also ruled that the TRA could not be applied against the County because it violated the Tenth Amendment, the District Court was reversed and the County's denial of the application was upheld.

Based on the decision in *Cellular Phone Task Force,* a local government would not have the authority to establish siting criteria and standards that are inconsistent with those established by the FCC concerning the environmental and health effects of radio frequency emissions from wireless communication facilities

IT IS THEREFORE RECOMMENDED that your Board consider this report.

very truly yours,

DANA MCRAE, COUNTY COUNSEL

By: _____
RAHN GARCIA
Chief Assistant County Counsel

RECOMMENDED:

_____
SUSAN A. MAURIELLO
County Administrative Officer

ATTACHMENT 2

0319

Federal
Communications
Commission

Local and State
Government
Advisory
Committee

A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance

June 2, 2000

51

A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance

Over the past two years, the Federal Communications Commission (FCC) and its Local and State Government Advisory Committee (LSGAC) have been working together to prepare a voluntary guide to assist state and local governments in devising efficient procedures for ensuring that the antenna facilities located in their communities comply with the FCC's limits for human exposure to radiofrequency (RF) electromagnetic fields. The attached guide is the product of this joint effort.

We encourage state and local government officials to consult this guide when addressing issues of facilities siting within their communities. This guide contains basic information, in a form accessible to officials and citizens alike, that will alleviate misunderstandings in the complex area of RF emissions safety. This guide is not intended to replace OET Bulletin 65, which contains detailed technical information regarding RF issues, and should continue to be used and consulted for complex sites. The guide contains information, tables, and a model checklist to assist state and local officials in identifying sites that do not raise concerns regarding compliance with the Commission's RF exposure limits. In many cases, the model checklist offers a quick and effective way for state and local officials to establish that particular RF facilities are unlikely to exceed specific federal guidelines that protect the public from the environmental effects of RF emissions. Thus, we believe this guide will facilitate federal, state, and local governments working together to protect the public while bringing advanced and innovative communications services to consumers as rapidly as possible. We hope and expect that use of this guide will benefit state and local governments, service providers, and, most importantly, the American public.

We wish all of you good luck in your facilities siting endeavors.

William E. Kennard, Chairman
Federal Communications Commission

Kenneth S. Fellman, Chair
Local and State Government
Advisory Committee

A LOCAL GOVERNMENT OFFICLAL'S GUIDE TO TRANSMITTING ANTENNA RF EMISSION SAFETY: RULES, PROCEDURES, AND PRACTICAL GUIDANCE

A common question raised in discussions about the siting of wireless telecommunications and broadcast antennas is, "Will this tower create any health concerns for our citizens?" We have designed this guide to provide you with information and guidance in devising efficient procedures for assuring that the antenna facilities located in your community comply with the Federal Communication Commission's (FCC's) limits for human exposure to radiofrequency (RF) electromagnetic fields.[1]

We have included a checklist and tables to help you quickly identify siting applications that do not raise RF exposure concerns. Appendix A to this guide contains a checklist that you may use to identify "categorically excluded" facilities that are unlikely to cause RF exposures in excess of the FCC's guidelines. Appendix B contains tables and figures that set forth, for some of the most common types of facilities, "worst case" distances beyond which there is no realistic possibility that exposure could exceed the FCC's guidelines.

As discussed below, FCC rules require transmitting facilities to comply with RF exposure guidelines. The limits established in the guidelines are designed to protect the public health with a very large margin of safety. These limits have been endorsed by federal health and safety agencies such as the Environmental Protection Agency and the Food and Drug Administration. The FCC's rules have been upheld by a Federal Court of Appeals.[2] As discussed below, most facilities create maximum exposures that are only a small fraction of the limits. Moreover, the limits themselves are many times below levels that are generally accepted as having the potential to cause adverse health effects. Nonetheless, it is recognized that any instance of noncompliance with the guidelines is potentially very serious, and the FCC has therefore implemented procedures to enforce compliance with its rules. At the same time, state and local governments may wish to verify compliance with the FCC's exposure limits in order to protect their own citizens. As a state or local government official, you can play an important role in ensuring that innovative and beneficial communications services are provided in a manner that is consistent with public health and safety.

This document addresses only the issue of compliance with RF exposure limits established by the FCC. It does not address other issues such as construction, siting, permits, inspection, zoning, environmental review, and placement of antenna facilities within communities. Such issues fall generally under the jurisdiction of states and local governments, within the limits imposed for personal wireless service facilities by Section 332(c)(7) of the Communications Act.[3]

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[1] This guide is intended to complement, but not to replace, the FCC's OET Bulletin 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," August 1997. Bulletin 65 can be obtained from the FCC's Office of Engineering and Technology (phone: 202-418-2464 or e-mail: rfsafety@fcc.gov). Bulletin 65 can also be accessed and downloaded from the FCC's "RF Safety" website: http:Nwww.fcc.govloet/rfsafety.

[2] See *Cellular Phone Taskforce v. FCC*, 205 F.3d 82 (2d Cir. 2000).

This document is not intended to provide legal guidance regarding the scope of state or local government authority under Section 332(c)(7) or any other provision of law. Section 332(c)(7)[4] generally preserves state and local authority over decisions regarding the placement, construction?and modification of personal wireless service facilities,' subject to specific limitations set forth in Section 332(c)(7). Among other things, Section 332(c)(7) provides that "[n]o State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [FCC's] regulations concerning such emissions." The full text of Section 332(c)(7) is set forth in Appendix C.

State and local governments and the FCC may differ regarding the extent of state and local legal authority under Section 332(c)(7) and other provisions of law. To the extent questions arise regarding such authority, they are being addressed by the courts. Rather than address these legal questions, this document recognizes that, as a practical matter, state and local governments have a role to play in ensuring compliance with the FCC's limits, and it provides guidance to assist you in effectively fulfilling that role. The twin goals of this document are: (1) to define and promote locally-adaptable procedures that will provide you, as a local official concerned about transmitting antenna emissions, with adequate assurance of compliance, while (2), at the same time, avoiding the imposition of unnecessary burdens on either the local government process or the FCC's licensees.

First, we'll start with a summary of the FCC's RF exposure guidelines and some background information that you'll find helpful. Next, we'll review the FCC's procedures for verifying compliance with the guidelines and enforcing its rules. Finally, we'll offer you some practical guidance to help you determine if personal wireless service facilities *may* raise compliance concerns. Note, however, that this guide is only intended to help you distinguish sites that are unlikely to raise compliance concerns from those that may raise compliance concerns, not to identify sites that are out of compliance. Detailed technical information necessary to determine compliance for individual sites is contained in the FCC's OET Bulletin 65 (see footnote 1, above).

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[3] 47 U.S.C. § 332(c)(7). Under limited circumstances, the FCC also plays a role in the siting of wireless facilities. Specifically, the FCC reviews applications for facilities that fall within certain environmental categories under the National Environmental Policy Act of 1969 (NEPA), *see* 47 C.F.R. § 1.1307(a). Antenna structures that are over 200 feet in height or located near airport runways must be marked or lighted as specified by the Federal Aviation Administration and must be registered with the FCC, **see** 47 C.F.R. Part 17.

[4] Section 332(c)(7) of the Communications Act is identical to Section 704(a) of the Telecommunications Act of 1996.

[5] "Personal wireless services" generally includes wireless telecommunications services that are interconnected with the public telephone network and are offered commercially to the public. Examples include cellular and similar services (such as Personal Communications Service or "PCS"), paging and similar services, certain dispatch services, and services that use wireless technology to provide telephone service to a fixed location such as a home or office.

Before we start, however, let's take a short tour of the radiofrequency spectrum. RF signals may be transmitted over a wide range of frequencies. The frequency of an RF signal is expressed in terms of cycles per second or "Hertz," abbreviated "Hz." One kilohertz (kHz) equals one thousand Hz, one megahertz (MHz) equals one million Hz, and one gigahertz (GHz) equals one billion Hz. In the figure below, you'll see that AM radio signals are at the lower end of the RF spectrum, while other radio services, such as analog and digital TV (DTV), cellular and PCS telephony, and point-to-point microwave services are much higher in frequency.

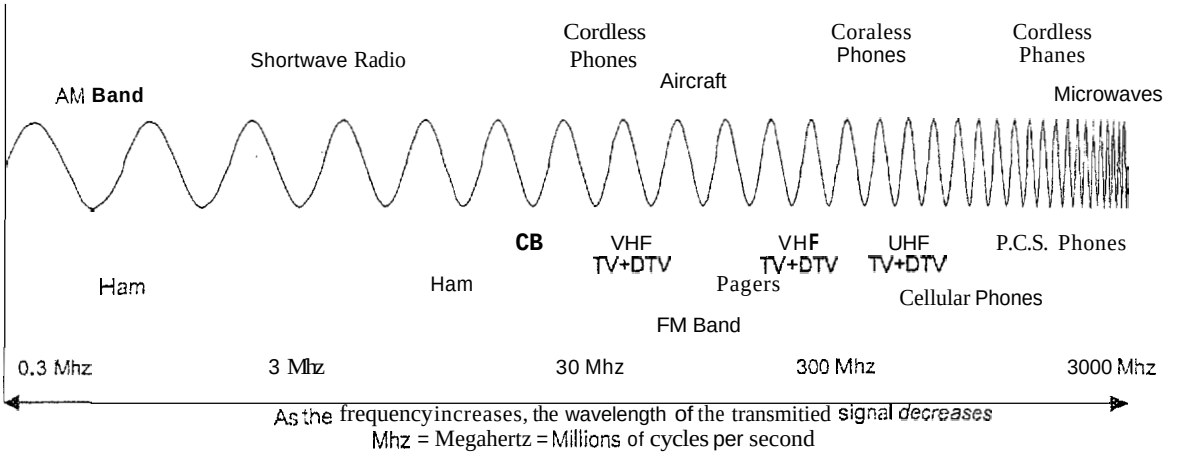

Illustration 1

The FCC's limits for maximum permissible exposure (MPE) to RF emissions depend on the frequency or frequencies that a person is exposed to. Different frequencies may have different MPE levels. Later in this document we'll show you how this relationship of frequency to MPE limit works.

I. The FCC's RF Exposure Guidelines and Rules.

Part 1 of the FCC's Rules and Regulations contains provisions implementing the National Environmental Policy Act of 1969 (NEPA). NEPA requires all federal agencies to evaluate the potential environmental significance of an agency action. Exposure to RF energy has been identified by the FCC as a potential environmental factor that must be considered before a facility, operation or transmitter can be authorized or licensed. The FCC's requirements dealing with RF exposure can be found in Part 1 of its rules at 47 C.F.R. § 1.1307(b). The exposure limits themselves are specified in 47 C.F.R. § 1.1310 in terms of frequency, field strength, power density and averaging time. Facilities and transmitters licensed and authorized by the FCC must either comply with these guidelines or else an applicant must file an Environmental Assessment (EA) with the FCC as specified in 47 C.F.R. § 1.1301 et *seq.* An EA is an official document required by the FCC's rules whenever an action may have a significant environmental impact (see discussion below). In practice, however, a potential environmental RF exposure problem is typically resolved before an EA would become necessary. Therefore, compliance with the FCC's RF guidelines constitutes a *de facto* threshold for obtaining FCC approval to construct or operate a station or transmitter. The FCC guidelines are based on exposure criteria

recommended in 1986 by the National Council on Radiation Protection and Measurements (NCRP) and on the 1991 standard developed by the Institute of Electrical and Electronics Engineers (IEEE) and later adopted as a standard by the American National Standards Institute (ANSI/IEEE C95.1-1992).

The FCC's guidelines establish separate MPE limits for "general populatioduncontrolled exposure" and for "occupational/controlled exposure." The general populatioduncontrolled limits set the maximum exposure to which most people may be subjected. People in this group include the general public not associated with the installation and maintenance of the transmitting equipment. Higher exposure limits are permitted under the "occupationalfcontrolled exposure" category, but only for persons who are exposed as a consequence of their employment (*e.g.*, wireless radio engineers, technicians). To qualify for the occupational/controlled exposure category, exposed persons must be made fully aware of the potentia1 for exposure (*e.g.*, through training), and they must be able to exercise control over their exposure. In addition, people passing through a location, who are made aware of the potential for exposure, may be exposed under the occupational/controlled criteria. The MPE limits adopted by the FCC for occupationalfcontrolled and general populatioduncontrolled exposure, incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

Determining whether a potential health hazard could exist with respect to a given transmitting antenna is not always a simple matter. Several important factors must be considered in making that determination. They include the following: (1) What is the frequency of the RF signal being transmitted? (2) What is the operating power of the transmitting station and what is the actual power radiated from the antenna? [6] (3) How long will someone be exposed to the RF signal at a given distance from the antenna? **(4)** What other antennas are located in the area, and what is the exposure from those antennas? We'll explore each of these issues in greater detail below.

For all frequency ranges a?which FCC licensees operate, Section 1.1310 of ?he FCC's rules establishes maximum permissible exposure (MPE) limits to which people may be exposed. The MPE limits vary by frequency because of the different absorptive properties of the human body at different frequencies when exposed to whole-body RF fields. Section 1.1310 establishes MPE limits in terms of "electric field strength,""magnetic field strength," and "far-field equivalent power density" ('power density). For most frequencies used by the wireless services, the most relevant measurement is power density. The MPE limits for power density are given in terms of "milliwatts per square centimeter" or mW/cm^2. One milliwatt equals one thousandth of one watt (1/1000 of a watt).[7] In terms of power density, for a given frequency the FCC MPE limits can be interpreted as specifying the maximum rate that energy can be transferred (*i.e.*, the power) to a square centimeter of a person's body over a period of time (either 6 or 30 minutes, as explained

[6] Power travels from a transmitter through cable or other connecting device to the radiating antenna. "Operating power of the transmitting station" refers to the power that is fed from the transmitter (transmitter output power) into the cable or connecting device. "Actual power radiated from the antenna" is the transmitter output power minus the power lost (power losses) in the connecting device plus an apparent increase in power (if any) due to the design of the antenna. Radiated power is often specified in terms of "effective radiated power" or "ERP" or "effective isotropic radiated power" or "EIRP" (see footnote 14).

[7] Thus, by way of illustration, it takes 100,000 milliwatts of power to fully illuminate a 100 watt light bulb,

below). In practice, however, since it is unrealistic to measure separately the exposure of each square centimeter of the body, actual compliance with the FCC limits on RF emissions should be determined by "spatially averaging" a person's exposure over the projected area of an adult human body (this concept is discussed in the FCC's OET Bulletin ***65)***.

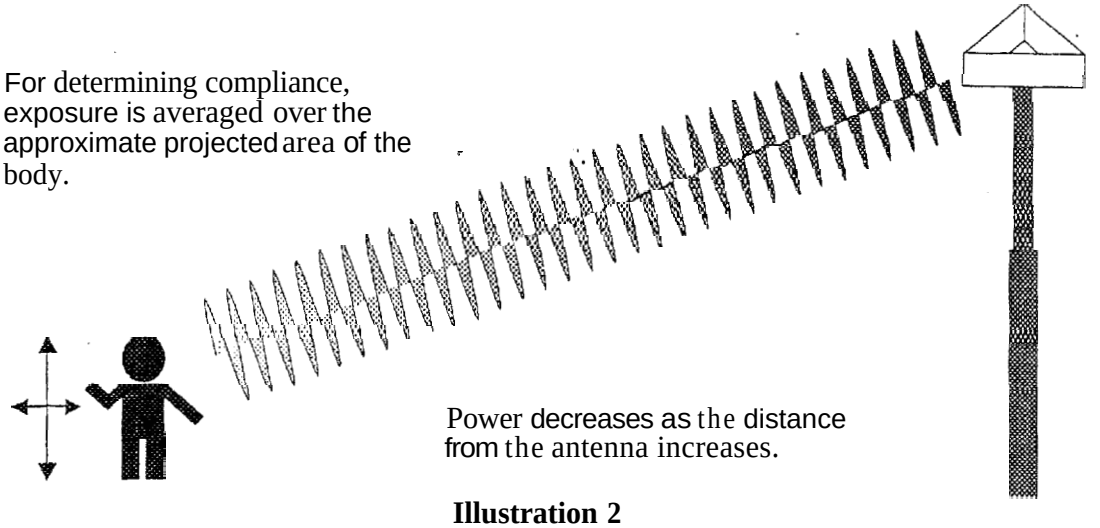

Illustration 2

Electric field strength and magnetic field strength are used to measure "near field" exposure. At frequencies below 300 MHz, these are typically the more relevant measures of exposure, and power density values are given primarily for reference purposes. However, evaluation of far-field equivalent power density exposure may still be appropriate for evaluating exposure in some such cases. For frequencies above 300 MHz, only one field component need be evaluated, and exposure is usually more easily characterized in terms of power density. Transmitters and antennas that operate at 300 MHz or lower include radio broadcast stations, some television broadcast stations, and certain personal wireless service facilities (*e.g.*, some paging stations). Most personal wireless services, including all cellular and PCS, as well as some television broadcast stations, operate at frequencies above 300 MHz. (See Illustration 1.)

As noted above, the MPE limits are specified as time-averaged exposure limits. This means that exposure can be averaged over the identified time interval (30 minutes for general populatioduncontrolled exposure or 6 minutes for occupational/controlled exposure). However, for the case of exposure of the general public, time averaging is usually not applied because of uncertainties over exact exposure conditions and difficulty in controlling time of exposure. Therefore, the typical conservative approach is to assume that any RF exposure to the general public will be continuous. The FCC's limits for exposure at different frequencies are shown in Illustration 3, below:

Illustration 3. *FCC Limits for Maximum Permissible Exposure (MPE)*

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (Vim)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (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

(B) **Limits for General Population/Uncontrolled Exposure**

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (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/1500	30
1500-100,000	--	--	1.0	30

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

NOTE 1: Occupational/controlled limits apply in situations in which persons are 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 exposure also 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: 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 for exposure or cannot exercise control over their exposure.

Finally, it is important to understand that the FCC's limits apply cumulatively to all sources of RF emissions affecting a given area. A common example is where two or more wireless operators have agreed to share the cost of building and maintaining a tower, and to place their antennas on that joint structure. In such a case, the total exposure from the two facilities taken together must be within the FCC guidelines, or else an EA will be required.

A. Categorically Excluded Facilities

The Commission has determined through calculations and technical analysis that due to their low power or height above ground level, many facilities by their very nature are highly unlikely to

cause human exposures in excess of the guideline limits, and operators of those facilities are exempt from routinely having to determine compliance. Facilities with these characteristics are considered "categorically excluded" from the requirement for routine environmental processing for RF exposure.

Section 1.1307(b)(1) of the Commission'srules sets forth which facilities are categorically excluded.' If a facility is categorically excluded, an applicant or licensee may ordinarily assume compliance with the guideline limits for exposure. However, an applicant or licensee must evaluate and determine compliance for a facility that is otherwise categorically excluded if specifically requested to do so by the FCC.[9] If potential environmental significance is found as a result, an EA must be filed with the FCC.

No radio or television broadcast facilities are categorically excluded. Thus, broadcast applicants and licensees must affirmatively determine their facility's compliance with the guidelines before construction, and upon every facility modification or license renewal application. With respect to personal wireless services, a cellular facility is categorically excluded if the total effective radiated power (ERP) of all channels operated by the licensee at a site is 1000 watts or less, If the facility uses sectorized antennas, only the total effective radiated power in each direction is considered. Examples of a 3 sector and a single sector antenna array are shown below:

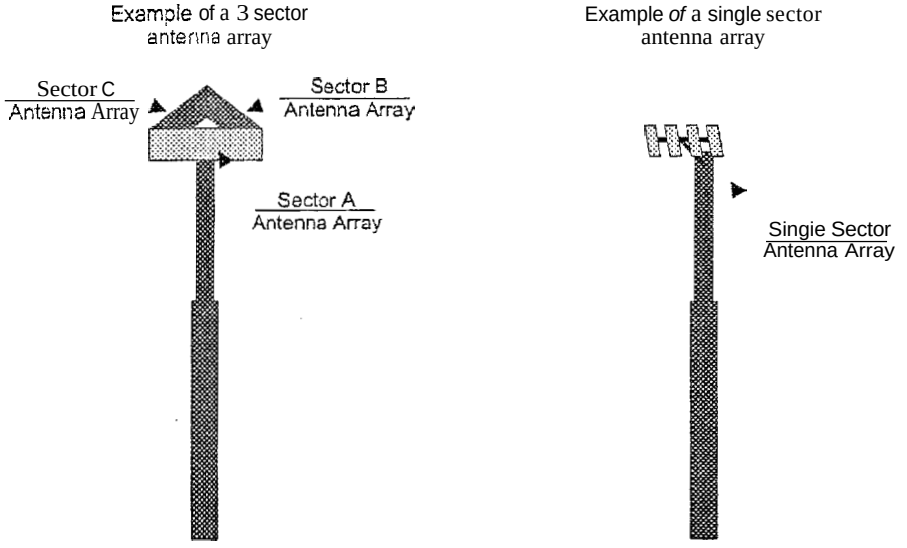

Illustration 4

[8] "The appropriate exposure limits . . . are generally applicable to all facilities, operations and transmitters regulated by the Commission. However, a determination of compliance with the exposure limits . . . (routine environmental evaluation), and preparation of an **EA** if the limits are exceeded, is necessary only for facilities, operations and transmitters that fall into the categories listed in table 1 [of §1.1307], or those specified in paragraph (b)(2) of this section. All other facilities, operations and transmitters are categorically excluded from making studies or preparing an EA. . ."

[9] See 47 C.F.R §1.1307(c) and (d).

In addition, a cellular facility is categorically excluded, regardless of its power, if it is not mounted on a building and the lowest point of the antenna is at least 10 meters (about 33 feet) above ground level. **A** broadband PCS antenna array is categorically excluded if the total effective radiated power of all channels operated by the licensee at a site (or all channels in any one direction, in the case of sectorized antennas) is 2000 watts or less. Like cellular, another way for a broadband PCS facility to be categorically excluded is if it is not mounted on a building and the lowest point of the antenna is at least 10 meters (about 33 feet) above ground level. The power threshold for categorical exclusion is higher for broadband PCS than for cellular because broadband PCS operates at a higher frequency where exposure limits are less restrictive. For categorical exclusion thresholds for other personal wireless services, consult Table 1 of Section 1.1307(b)(1).[10]

For your convenience, we have developed the checklist in Appendix **A** that may be used to streamline the process of determining whether a proposed facility is categorically excluded, You are encouraged to adopt the use of this checklist in your jurisdiction, although such use is not mandatory.

B. What If An Applicant Or Licensee Wants To Exceed The Limits Shown In Illustration 3?

Any FCC applicant or licensee who wishes to construct or operate a facility that, by itself or in combination with other sources of emissions (*i.e.*, other transmitting antennas), may cause human exposures in excess of the guideline limits must file an Environmental Assessment (EA) with the FCC. Where more than one antenna is collocated (for example, on a single tower or rooftop or at a hilltop site), the applicant must take into consideration all of the RF power transmitted by all of the antennas when determining maximum exposure levels. Compliance at an existing site is the shared responsibility of all licensees whose transmitters produce exposure levels in excess of 5% of the applicable exposure limit. **A** new applicant is responsible for compliance (or submitting an EA) at a multiple-use site if the proposed transmitter would cause non-compliance and if it would produce exposure levels in excess of 5% of the applicable limit."

An applicant or licensee is not permitted to construct or operate a facility that would result in exposure in excess of the guideline limits until the FCC has reviewed the EA and either found no significant environmental impact, or pursued further environmental processing including the preparation of a formal Environmental Impact Statement. As a practical matter, however, this process is almost never invoked for RF exposure issues because applicants and licensees normally undertake corrective actions to ensure compliance with the guidelines before submitting an application to the FCC.

Unless a facility is categorically excluded (explained above), the FCC's rules require a licensee to evaluate a proposed or existing facility's compliance with the RF exposure guidelines and to

[10] Table 1 of §1.1307(b)(1) is reproduced in Appendix **A** to this guide.

[11] For more information, see OET Bulletin 65, or see **47** CFR §1.1307(b)(3).

determine whether an EA is required. In the case of broadcast licensees, who are required to obtain a construction permit from the FCC, this evaluation is required before the application for a construction permit is filed, or the facility is constructed. In addition, if a facility requires the filing of an **EA** for any reason other than RF emissions, the RF evaluation must be performed before the EA is filed. Factors other than RF emissions that may require the filing of an EA are set out in 47 C.F.R. § 1.1307(a). Otherwise, new facilities that do not require FCC-issued construction permits should be evaluated before they are placed in operation. The FCC also requires its licensees to evaluate existing facilities and operations that are not categorically excluded if the licensee seeks to modify its facilities or renew its license. These requirements are intended to enhance public safety by requiring periodic site compliance reviews.

All facilities that were placed in service before October 15, 1997 (when the current RF exposure guidelines became effective) are expected to comply with the current guidelines no later than September 1, 2000, or the date of a license renewal, whichever is earlier." If a facility cannot meet the September 1, 2000, date, the licensee of that facility must file an EA by that date. Section 1.1307(b) of the FCC's rules requires the licensee to provide the FCC with technical information showing the basis for its determination of compliance upon request.

II. How the FCC Verifies Compliance **with and** Enforces Its Rules.

A. Procedures **Upon** Initial Construction, Modification, **and** Renewal.

The FCC's procedures for verifying that a new facility, or a facility that is the subject of a facility modification or license renewal application, will comply with the RF exposure rules vary depending upon the service involved. Applications for broadcast services (for example, AM and FM stations, and television stations) are reviewed by the FCC's Mass Media Bureau (MMB). As part of every relevant application, the MMB requires an applicant to submit an explanation of what steps will be taken to limit RF exposure and comply with FCC guidelines. The applicant must certify that RF exposure procedures will be coordinated with all collocated entities (usually other stations at a common transmitter site or hill or mountain peak). If the submitted explanation does not adequately demonstrate a facility's compliance with the guidelines, the MMB will require additional supporting data before granting the application.

The Wireless Telecommunications Bureau (WTB) reviews personal wireless service applications (for cellular, PCS, SMR, etc.). For those services that operate under blanket area licenses, including cellular and PCS, the license application and renewal form require the applicant to certify whether grant of the application would have a significant environmental impact so as to require submission of an EA. The applicant's answer to this question covers all of the facilities sites included within the area of the license.

For those services that continue to be licensed by site (*e.g.*, certain paging renewals), the WTB requires a similar certification on the application form for each site. To comply with the FCC's rules, an applicant must determine its own compliance before completing this certification for

[12] Prior to October 15, 1997, the Commission applied a different set of substantive guidelines.

every site that is not categorically excluded. The WTB does not, however, routinely require the submission of any information supporting the determination of compliance.

B. Procedures For Responding To Complaints About Existing Facilities.

The FCC frequently receives inquiries from members of the public as to whether a particular site complies with the RF exposure guidelines. Upon receiving these inquiries, FCC staff may ask the inquiring party to describe the site at issue. In many instances, the information provided by the inquiring party does not raise any concern that the site could exceed the limits in the guidelines. FCC staff will then inform the inquiring party of this determination.

In some cases, the information provided by the inquiring party does not preclude the possibility that the limits could be exceeded. Under these circumstances, FCC staff may ask the licensee who operates the facility to supply information demonstrating its compliance. FCC staff may also inspect the site to determine whether it is accessible to the public, and examine other relevant physical attributes. Usually, the information obtained in this manner is sufficient to establish compliance. If compliance is established in this way, FCC staff will inform the inquiring party of this determination.

In some instances, a licensee may be unable to provide information sufficient to establish compliance with the guideline limits. In these cases, FCC staff may test the output levels of individual facilities and evaluate the physical installation. Keep in mind, however, that instances in which physical testing is necessary to verify compliance are relatively rare.

If a site is found to be out of compliance with the RF guidelines, the FCC will require the licensees at the site to remedy the situation. Depending on the service and the nature and extent of the violation, these remedies can include, for example, an immediate reduction in power, a modification of safety barriers, or a modification of the equipment or its installation. Actions necessary to bring a site into compliance are the shared responsibility of all licensees whose facilities cause exposures in that area that exceed 5% of the applicable MPE limit. In addition, licensees may be subject to sanctions for violating the FCC's rules and/or for misrepresentation.

The FCC is committed to responding fully, promptly, and accurately to all inquiries regarding compliance with the RF exposure guidelines, and to taking swift and appropriate action whenever the evidence suggests potential noncompliance. To perform this function effectively, however, the FCC needs accurate information about potentially problematic situations. By applying the principles discussed in this guide about RF emissions, exposure and the FCC's guidelines, state and local officials can fulfill a vital role in identifying and winnowing out situations that merit further attention.

III. Practical Guidance Regarding Compliance.

This section is intended to provide some general guidelines that can be used to identify sites that should not raise serious questions about compliance with FCC RF exposure guidelines, Sites that don't fall into the categories described here may still meet the guidelines, but the determination

of compliance will not be as straightforward. In such cases, a detailed review may be required. The tables and graphs shown in Appendix B are intended only to assist in distinguishing sites that should not raise serious issues from sites that may require further inquiry. They are not intended for use in identifying sites that are out of compliance. As noted above, the factors that can affect exposure at any individual site, particularly a site containing multiple facilities, are too numerous and subtle to be practically encompassed within this framework.

Applying the basic principles discussed in this guide should allow you to eliminate a large number of sites from further consideration with respect tu health concerns. You may find it useful to contact a qualified radio engineer to assist you in your inquiry. Many larger cities and counties, and most states, have radio engineers on staff or under contract. In smaller jurisdictions, we recommend you seek initial assistance from other jurisdictions, universities that have RF engineering programs, or perhaps the engineer in charge of your local broadcast station(s).

We'll exclude any discussion of broadcast sites. As explained before, broadcast licensees are required to submit site-specific information on each facility to the FCC for review, and that information is publicly available at the station as long as the application is pending. The focus in this section is on personal wireless services, particularly cellular and broadband PCS, the services that currently require the largest numbers of new and modified facilities. Many other personal wireless services, however, such as paging services, operate in approximately the same frequency ranges as cellular and broadband PCS.[13] Much of the information here is broadly applicable to those services as well, and specific information is provided in Appendix B for paging and narrowband PCS operations over frequency bands between 901 and 940 MHz.

Finally, this section only addresses the general populatioduncontrolled exposure guidelines, since compliance with these guidelines generally causes the most concern to state and local governments. Compliance with occupational/controlled exposure limits should be examined independently.

A. Categorically Excluded Facilities.

As a first step in evaluating a siting application for compliance with the FCC's guidelines, you will probably want to consider whether the facility is categorically excluded under the FCC's rules from routine evaluation for compliance. The checklist in Appendix **A** will guide you in making this determination. Because categorically excluded facilities are unlikely to cause any exposure in excess of the FCC's guidelines, determination that a facility is categorically excluded should generally suffice to end the inquiry.

B. Single Facility Sites.

If a wireless telecommunications facility is not categorically excluded, you may want to evaluate potential exposure using the methods discussed below and the tables and figures in Appendix B.

[13] The major exception is fixed wireiess services, which often operate at much higher frequencies. In addition, some paging and other licensees operate at lower frequencies

If you "run the numbers" using the conservative approaches promoted in this paper and the site in question does not exceed these values, then you generally need look no further. Alternately, if the "numbers" don't pass muster, you may have a genuine concern. But remember, there may be other factors (*i.e.*, power level, height, blockages, etc.) that contribute to whether the site complies with FCC guidelines.

Where a site contains only one antenna array, the maximum exposure at any point in the horizontal plane can be predicted by calculations. The tables and graphs in Appendix B show the maximum distances in the horizontal plane from an antenna at which a person could possibly be exposed in excess of the guidelines at various levels of effective radiated power (ERP).[14] Thus. if people are not able to come closer to an antenna than the apslicable distance shown in Appendix B. there should be no cause for concern about exposure exceeding the FCC guidelines. The tables and graphs apply to the following wireless antennas: (1) cellular omni-directional antennas (Table B1-1 and Figure B1-1); (2) cellular sectorized antennas (Table B 1-2 and Figure B 1-2); (3) broadband PCS sectorized antennas (Table B1-3 and Figure B1-3);[15] and (4) high-power (900 MHz-band) paging antennas (Table B 1-4 and Figure B 1-4). Table B 1-4 and Figure B1-4 can also be used for omni-directional, narrowband (900 MHz) PCS antennas. Note that both tables and figures in Appendix B have been provided. In some cases it may be easier to use a table to estimate exposure distances, but figures may also be used when a more precise value is needed that may not be listed in a table.

It's important to note that the predicted distances set forth in Appendix B are based on a very conservative, "worst case" scenario. In other words, Appendix B identifies the furthest distance from the antenna that presents even a remote realistic possibility of RF exposure that could exceed the FCC guidelines. The power levels are based on the approximate maximum number of channels that an operator is likely to operate at one site. It is further assumed that each channel operates with the maximum power permitted under the FCC's rules and that all of these channels are "on" simultaneously, an unlikely scenario. This is a very conservative assumption. In reality, most sites operate at a fraction of the maximum permissible power and many sites use fewer than the maximum number of channels. Therefore, actual exposure levels would be expected to be well below the predicted values. Another mitigating factor could be the presence of intervening structures, such as walls, that will reduce RF exposure by variable amounts. For all these reasons, the values given in these tables and graphs are considered to be quite conservative and should over-predict actual exposure levels.

[14] ERP is the apparent effective amount of power leaving the transmit antenna. The ERP is determined by factors including but not limited to transmitter output power, coaxial line loss between the transmitter and the antenna, and the "gain" (focusing effect) of the antenna. In some cases, power may also be expressed in terms of EIRP (effective isotropically radiated power). Therefore, for convenience, the tables in Appendix B also include a column for EIRP. ERP and EIRP are related by the mathematical expression: (1.64) X ERP = EIRP.

[15] Because broadband PCS antennas are virtually always sectorized, no information is provided for omni-directional PCS antennas.

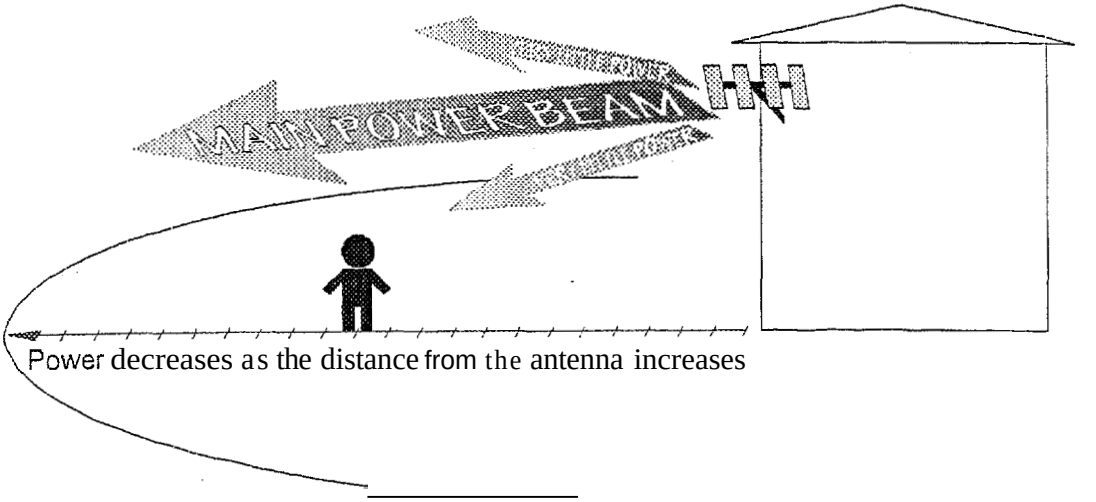

Illustration 5

Personal wireless service antennas typically do not emit high levels of RF energy directed above or below the horizontal plane of the antenna. Although the precise amount of energy transmitted outside the horizontal plane will depend upon the type of antenna used, we are aware of no wireless antennas that produce significant non-horizontal transmissions. Thus, exposures even a small distance below the horizontal plane of these antennas would be significantly less than in the horizontal plane. As discussed above, the tables and figures in Appendix B show distances in the horizontal plane from typical antennas at which exposures could potentially exceed the guidelines, assuming "worst case" operating conditions at maximum possible power levels. In any direction other than horizontal, including diagonal or straight down, these "worst case" distances would be significantly less.

Where unidirectional antennas are used, exposure levels within or outside the horizontal plane in directions other than those where the antennas are aimed will typically be insignificant. In addition, many new antennas are being designed with shielding capabilities to minimize emissions in undesired directions.

C. Multiple Facility Sites.

Where multiple facilities are located at a single site, the FCC's rules require the total exposure from all facilities to fall within the guideline limits, unless an **EA** is filed and approved. In such cases, however, calculations of predicted exposure levels and overall evaluation of the site may become much more complicated. For example, different transmitters at a site may operate different numbers of channels, or the operating power per channel may vary from transmitter to transmitter. Transmitters may also operate on different frequencies (for example, one antenna array may belong to a PCS operator, while the other belongs to a cellular operator), **A** large number of variables such as these make the calculations more time consuming, and make it difficultto apply a simple rule-of-thumb test. See the following illustration.

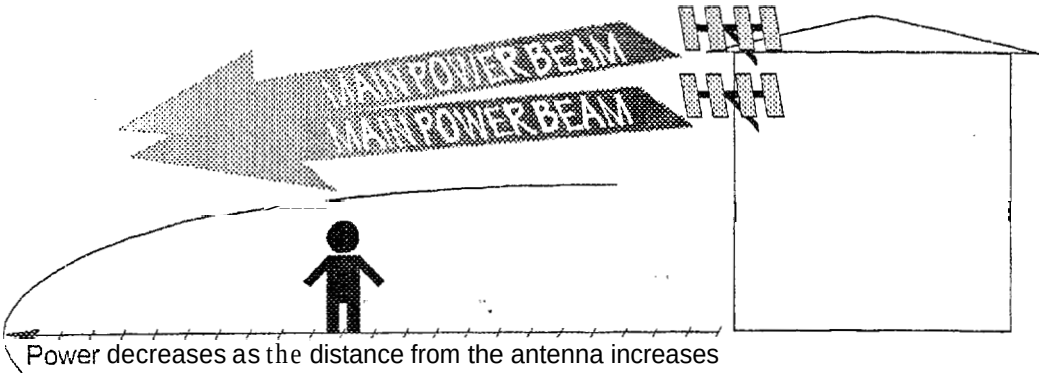

Illustration 6

However, we can be overly conservative and estimate a "worst case" exposure distance for compliance by assuming that the total power (e.g., ERP) of all transmitting antennas at the site is concentrated in the antenna that is closest to the area in question. (In the illustration above, this would be the antenna that is mounted lower on the building.) Then the values in the tables and graphs in Appendix B may be used as if this were the only antenna at the site, with radiated power equal to the sum of the actual radiated power of all antennas at the site. Actual RF exposure at any point will always be less than the exposure calculated using these assumptions. Thus, if people are not able to come closer to a group of antennas than the applicable distance shown in Appendix B using these assumptions, there should be no cause for concern about exposure exceeding the FCC guidelines. This is admittedly an extremely conservative procedure, but it may be of assistance in making a "first cut" at eliminating sites from further consideration.

IV. Conclusion.

We've highlighted many of the most common concerns and questions raised by the siting of wireless telecommunications and broadcast antennas. Applying the principles outlined in this guide will allow you to make initial conservative judgments about whether RF emissions are or should be of concern, consistent with the FCC's rules.

As we have explained, when first evaluating a siting application for compliance with the FCC's guidelines, you will probably want to consider whether the facility is categorically excluded under the FCC's rules from routine evaluation for compliance. The checklist in Appendix A will guide you in making this determination. Because categorically excluded facilities are unlikely to cause any exposure in excess of the FCC's guidelines, determination that a facility is categorically excluded should generally suffice to end the inquiry.

If a wireless telecommunications facility is not categorically excluded, you may want to evaluate potential exposure using the methods discussed in Part III of this paper and the tables and figures in Appendix B. If the site in question does not exceed the values, then you generally need look no further. Alternately, if the values don't pass muster, you may have a genuine concern. But

remember, there may be other factors (*i.e.*, power level, height, blockages, etc.) that contribute to whether the site complies with FCC guidelines.

If you have questions about compliance, your initial point of exploration should be with the facilities operator in question. That operator is required to understand the FCC's rules and to know how to apply them in specific cases at specific sites. If, after diligently pursuing answers from the operator, you still have genuine questions regarding compliance, you should contact the FCC at one of the numbers listed below.' Provision of the information identified in the checklist in Appendix A may assist the FCC in evaluating your inquiry.

General Information: Compliance and Information Bureau, (888) CALL-FCC

Concerns About RF Emissions Exposure at a Particular Site: Office of Engineering and Technology, RF Safety Program, phone (202) 418-2464, FAX (202) 418-1918, e-mail rfsafety@fcc.gov

Licensing and Site Information Regarding Wireless Telecommunications Services: Wireless Telecommunications Bureau, Commercial Wireless Division, (202) 418-0620

Licensing and Site Information Regarding Broadcast Radio Services: Mass Media Bureau, Audio Services Division, (202) 418-2700

Licensing and Site Information Regarding Television Service (Including DTV): Mass Media Bureau, Video Services Division, (202) 418-1600

Also, note that the RF Safety Program Web site is a valuable source of general information on the topic of potential biological effects and hazards of RF energy. For example, OET recently updated its OET Bulletin 56 ("Questions and Answers about Biological Effects and Potential Hazards of Radiofi-equency Electromagnetic Fields"). This latest version is available from the program and can be accessed and downloaded from the FCC's web site at:

http://www,fcc.gov/oet/rfsafetyl