Staff Report to the Planning Commission

Application Number: 06-0701

Applicant: Jennifer Estes for Peacock Associates
Owner: Ledyard Properties
APN: 026-311-65

Agenda Date: January 9, 2007

Agenda Item #: 11
Time: 7:00 p.m.

Project Description: Proposal to construct a new wireless communications facility on a site with a cold storage building and an operations building. Includes three equipment cabinets on a new concrete slab, three antennas within a SO-foot tall "flagpole" monopole with power and telco services to the equipment, and a GPS antenna.

Location: Property located on the west side of 17" Avenue approximately 450 **feet** south of the intersection with Brommer Street; at 1053 17th Avenue.

Supervisoral District: First District (District Supervisor: Janet K. Beautz)

Permits Required: Commercial Development Permit and a waiver of the requirement that the tower be set back 300 feet from residentially zoned parcels, to approximately 140 feet to the residentially zoned property and approximately 380 feet to the nearest residence.

Staff Recommendation:

- Certification that **the** proposal is exempt from further Environmental Review under the California Environmental Quality Act.
- Approval of Application 06-0701, based on the attached findings and conditions.

Exhibits

A.	Project plans	G.	NEIR Study by Hammet & Edison
B.	Findings	H.	Aerial Photos and photo-simulations
C.	Conditions	I.	Coverage maps
D.	Categorical Exemption (CEQA determination)	J.	Acoustical study
		K.	Review Agency Comments
E.	Assessor's parcel map	L.	Correspondence
F.	Location, Zoning and General Plan Maps	M.	Materials Submitted by the Public

Parcel Information

Parcel Size:	2.5 acres
Existing Land Use - Parcel:	Warehouse
Existing Land Use - Surrounding:	Warehouse & light industry
Project Access:	17'' Avenue & Kinsley Street
Planning Area:	Live *Oak*
Land Use Designation:	C-S (Service Commercial)
Zone District:	C-4 (Commercial Service) and M-1 (Light Industrial)
Coastal Zone:	___ Inside ☑ Outside

Environmental Information

Geologic Hazards:	Not mapped/no physical evidence on site
Soils:	Soils report not required
Fire Hazard:	Not a mapped constraint
Slopes:	No slopes over 30% at project site or access roads
Env. Sen. Habitat:	Not mapped/no physical evidence on site
Grading:	No grading proposed
Tree Removal:	No trees proposed to be removed
Scenic:	Not a mapped resource
Drainage:	Existing drainage adequate – no change proposed
Archeology:	Not mapped/no physical evidence on site

Services Information

Urban/Rural Services Line:	☑ Inside ___ Outside
Water Supply:	None required
Sewage Disposal:	None required
Fire District:	Central Fire Protection
Drainage District:	Zone 5 – no additional impervious area

History

The project site is one parcel that is a part of the Ledyard food services campus. The subject parcel includes a cold storage building and a plant operations building. The current cold storage building was originally constructed in 1977 (permit 50707) as a one-story warehouse and was remodeled in 1982 (permit 72652) for its current purpose. The operations buildingwas originally permitted in 1978 (78-1687-PD) as a storage and office building. What had been two parcels have been combined into one to consolidate the Ledyard operations. Another application affecting this parcel, 05-0439, is currently in process to establish a Master Occupancy Program (MOP) for the three parcels that currently make up the campus. The requested permit will not affect the MOP as the proposed use is appurtenant and accessory to the main storage, warehouse and shipping use, and accessory structures and uses will be allowed under the MOP.

Project Setting

The project site is a 2.5-acre parcel located approximately 575 feet west from 17" Avenue. Surrounding uses in the immediate vicinity include other warehouse and storage facilities, manufacturing, auto repair, a landscape maintenance business, offices, and a mini-storage. Further to the north and west are single-family dwellings and there is a rail line, Shoreline Middle School, the Simpkins Swim Center and Schwan Lake Park to the south and southwest. There is a variety of zoning designations in the area that reflect the different uses. Zoning and General Plan maps are included as Exhibit F.

The monopole and equipment cabinets are proposed to be located between the cold storage building and the operations building, in an area that is currently paved, where equipment will be screened by the existing buildings and fencing.

Proposed Project

The applicant proposed to install an unmanned telecommunications facility within a lease area of approximately 125 square feet with a concrete pad (approximately 96 square feet) on an existing paved area. The proposed equipment would consist of three, 56-inch antennas inside a 50-foot flagpole monopole, three associated equipment cabinets, two power/telco boxes and a GPS antenna. The equipment cabinets and telco boxes will be ground-mounted on the concrete pad and the GPS antenna will be mounted to the warehouse building. Because the existing area is currently paved, no trees or vegetation are proposed to be removed and no grading is necessary.

Zoning Issues

The property is an approximately 2.5 acre parcel, with a "split" zoning of Commercial Service (C-4) and Light Industrial (M-1), and a Service Commercial (C-S) General Plan designation (see Exhibit F). The proposed wireless communication facility is an allowed use in the C-4 and M-1 zone districts, as neither **of** those designations are considered to be "prohibited" or "restricted' per County Code Section 13.10.661(b) and (c).

County Code Section 13.10.661(g) requires co-location when technically feasible. There is an existing Sprint/Nextel monopole approximately 650 feet southeast **of** the proposed facility, on Assessor's .Parcel Number **(APN)** 026-311-57. However, the design of this monopole precludes additional co-location as the conditions of approval require all antennas to be maintained within a "Radome" structure and not mounted to the exterior of the pole. While there is some additional capacity on this monopole, it will only accommodate three additional antennas within an extension of the "Radome" structure which are intended to provide added capacity to Sprint/Nextel if needed in the future. Because the capacity of this monopole is limited, co-location is not technically feasible in this location.

The proposed facility meets all site standards for the C-4 zone district as it would be located a minimum of 94-feet from the nearest property line. The maximum height allowed for a free-standing tower in the C-4 zone district would be 85-feet (reference Planning Department Policy/Ordinance Interpretation WCF-01) and the proposed height is 50-feet.

County Code Section 13.10.663(a)(9) requires that the base of any new freestanding telecommunications tower be set back a minimum of 300-feet from residentially zoned parcels to minimize visual impacts that may result from a tower structure. This requirement may be waived by the decision making body, however, if it is determined that the tower will not be readily visible from neighboring residential structures or that service could not be provided to a significant area without construction of the tower. The proposed project is unique as the area where it is proposed to be located is within 300-feet of two residentially zoned (RM-6) parcels, the closest one of which in located approximately 140 feet away and contains a service commercial use (026-311-13). The other parcel does contain a single-family dwelling (026-311-12) and that dwelling is located approximately 380-feet from the base of the proposed tower See Exhibit G). Additionally, these parcels (and the one directly adjacent to the south) are subject to a site-specific General Plan Policy, 2.17.7, that allows for Service Commercial/Light Industrial use of the rear portion of the parcels if integrated into a development with access from 17'' Avenue. Although the parcels are currently zoned for residential **use,** this policy could facilitate future service commercial uses on these parcels.

The project is also unique in that the "tower" has been camouflaged and all antennas are completely contained within a flagpole/monopole. A flagpole such as the one proposed could be installed on the subject parcel with, at most, a minor administrative permit for which the **fee** would be waived. Flagpoles displaying the American flag are commonly found in commercial, service commercial or industrial developments and the proposed structure will appear to be part of a common built environment. So, while the flagpole will be visible from surrounding properties, it will not be perceived as a wireless communications tower and the wireless facility itself, consisting of panel antennas, equipment cabinets and other ancillary equipment, will not be visible from neighboring properties.

In addition, this facility is proposed to alleviate inadequate coverage in a large area generally bounded by Mattison Lane on the north, East Cliff Drive on the south, 7'' Avenue on the west and Chanticleer Avenue to the east (see Exhibit I). The applicant investigated alternative locations **(see** below) and was unable to find **a** suitable site that would provide the same level of coverage that is not located within a restricted or prohibited zone district.

County Code Section 13.10.663(b)(11) requires that all wireless communication facilities be constructed and operated to minimize the amount of disruption caused to nearby properties. Paragraph (B) of that section requires that hack-up generators only be operated during power outages and for testing and maintenance purposes and that noise attenuation measures be included to reduce noise levels at the facility to a maximum noise level of 60 Ldn at the property line and a maximum noise level of 45 Ldn within nearby residences. This is consistent with General Plan Policy 6.9.1. In addition, General Plan Policy 6.9.4 (Figure 6-2) requires that the hourly average noise level, as measured at **the** property line of the "receiving" land use not exceed 45 decibels (dB) between the hours of 10:00 pm and 7:00 **am.**

The proposed facility would include air conditioning equipment to cool the equipment but would not include a back-up generator as emergency power is provided by batteries. The temperature of the radio equipment cannot exceed 120 degrees hut, since the equipment itself produces beat, the heat exchanger begins operating at about 70 degrees, depending on factors such as air moisture, sun angle, wind, etc. The equipment also includes a rectifier, which controls the electric supply

to the heat exchanger. To address potential noise exposure from the equipment, the applicant has submitted an acoustical noise suppression test on the type of outdoor cabinet generally used for the Lucent Technologies equipment (Exhibit J). The test indicated a maximum noise generation of 61 dB at a distance Of 5 feet from the cabinet. To determine the potential sound generation at the property line of the nearest residentially-zoned property (approximately 140 feet away), it is calculated that sound levels are reduced by 6 dB every time the distance from the noise source doubles (Inverse Square Law). For example at 10 feet, 20 feet, 40 feet, etc, the sound levels will be reduced by 6 dB. At 140 feet from the noise source, at the property line, the sound levels will be below **37** dB, and will be consistent with the zoning ordinance and the County's General Plan. It should be noted that the nearest structure on any residentially zoned property is located approximately 350 feet from the proposed location of the equipment cabinets. A condition of approval (IV.E.) has been included to require consistency with the General Plan and County Code Section 13.10.663(b) to reduce noise impacts on surrounding development.

Alternative Site Analysis

An alternatives analysis was not required for this proposal as the proposed location is not within a restricted or prohibited zone district. The applicant, did, however, identify several possible alternative locations that would have potentially allowed a building-mounted or co-located facility, either of which is preferable **to** a monopole that is not a "stealth" installation. Other parcels identified included the Central Fire Protection District station at 930-17" Avenue, with no interest in leasing; Brommer Street Storage at 1300 Brommer Street, the owners of which were only interested in a short term lease; Paradise Landscape at 1358 Brommer Street, where Code Compliance issues prevent the location of a wireless communication facility; a light industrial complex at 992 17" Avenue, the owners of which were not interested in a lease; and the Sprint/Nextel facility discussed above, which is technically infeasible. The proposed facility is intended to serve the businesses and residences in the area surrounding Brommer Street and 17" Avenue, to the yacht harbor. Because the other nearby sites and one potential co-location were found not to be viable, this site was chosen as it is not in a restricted or prohibited area and the tower base could be located a minimum of 300-feet from all but one small portion of residentially zoned properties.

Visual Impacts/Design Review

Although the proposed flagpole/monopole will be visible from the surrounding area, it is located in an area that is not a designated visual resource area. The base of the proposed monopole is located more than 300-feet from all but one small portion of residentially zoned area to reduce visual impacts to surrounding residences. Please refer to the section above (Zoning Issues) for a discussion about the 300-foot separation requirement. Additionally, the structure has been designed such that the three antennas are internally mounted and are not visible, and the proposal utilizes a stealth-type design that mimics structures normally found in the built environment where the facility is located. Visual simulations are included as Exhibit H. Flagpoles displaying the American flag are commonly found in commercial, service commercial, or industrial developments and will appear to be part of a common built environment. The support facilities will be located between two existing buildings on site and will not be visible off-site.

To reduce any potential visual impacts, conditions of approval have been included to eliminate

24-hour lighting, such that the flag will be lowered and raised daily, and to limit the size of the flag to the smallest possible given the size and height of the pole.

To ensure that this project's long–term visual impact is minimized, several conditions of approval are proposed including allowing only manual lighting, requiring that the pole be maintained in good condition throughout it's life (including painting as needed), and maintaining the flag in good condition

Radio Frequency (RF) Exposure

The applicant has submitted a study by Hammett and Edison, Inc. Consulting Engineers that describes the proposed installation and the maximum RF exposure levels for surrounding land uses (Exhibit G). The applicant proposes to install three Jaybeam Wireless directional panel PCS antennas inside the top of the flagpole/monopole. **The** antennas would be mounted at an effective height of about 47 feet above ground and would be oriented at 120"spacing to provide service in all directions. The maximum effective radiated power in any direction would be 1,890 watts, representing six channels operating simultaneously at 315 watts each.

The maximum ambient RF exposure anywhere on the ground, for the proposed Metro PCS operation alone, will be 0.31% (.0031) of the applicable public exposure limit established by the Federal Communications Commission (FCC). The maximum calculated cumulative level on the ground for the simultaneous operation of both carriers (including the Sprint/Nextel facility to the southeast) would be 0.39% (.0039) of the public exposure limit. The maximum calculated cumulative level on the second floor elevation of any nearby building would be 0.63% (.0063) of the public exposure limit, and the maximum calculated cumulative level at the second-floor elevation of Shoreline Middle School would be 0.25% (.0025) of the public exposure limit. According to the study findings, the projected exposure limits include "worst-case" assumptions and are expected to overstate actual power density levels.

Due to the mounting location, in the interior of a flagpole/monopole approximately 47 feet off the ground, the antennas are not accessible to the general public and no mitigation measures are needed to comply with FCC guidelines. No access within two feet directly in front of the antennas themselves, such as might occur during maintenance activities, would be allowed while the site is in operation. Explanatory warning signs **are** required to be posted on the pole below the antennas, such that the signs are readily visible from any angle of approach to persons who might be conducting maintenance, to meet FCC-adopted guidelines.

Section 47 USC 322(c)(7)(iv) of the Telecommunications Act of 1966 forbids jurisdictions from regulating the placement, construction, or modification of Wireless Communications Facilities based on the environmental affects of RF emissions if these emissions comply with FCC standards. The RF emissions of the proposed facility, and the cumulative emissions of the facility and the nearby facility to the southeast, comply with FCC standards and are a fraction of the applicable public exposure limit.

Conclusion

As proposed and conditioned, the project is consistent with all applicable codes and policies of the Zoning Ordinance and General Plan/LCP. Please see Exhibit " B ("Findings") for a complete listing of findings and evidence related to the above discussion.

Staff Recommendation

- Certification that the proposal is exempt from further Environmental Review under the California Environmental Quality Act.
- APPROVAL of Application Number **06-0701,** based on the attached findings and conditions.

Supplementary reports and information referred to in this report are on file and available for viewing at the Santa Cruz County Planning Department, and are hereby made a part of the administrative record for the proposed project.

The County Code and General Plan, as well as hearing agendas and additional information are available online at: www.co.santa-cruz.ca.us

Report Prepared By: _____

Cathy Graves
Santa Cruz County Planning Department
701 Ocean Street, 4th Floor
Santa Cruz CA 95060
Phone Number: (831) 454-3141
E-mail: cathy.graves@co.santa-cruz.ca.us

Report Reviewed By: _____

Paia Levine
Principal Planner
Santa Cruz County Planning Department

Wireless Communication Facility Use Permit Findings

1. **The** development of the proposed wireless communications facility as conditioned will not significantly affect any designated visual resources, environmentally sensitive habitat resources (as defined in the Santa Cruz County General Plan/LCP Sections 5.1, 5.10, and 8.6.6.), and/or other significant County resources, including agricultural, open space, and community character resources; or there are no other environmentally equivalent and/or superior and technically feasible alternatives to the proposed wireless communications facility as conditioned (including alternative locations and/or designs) with **less** visual and/or other resource impacts and the proposed facility has been modified by condition and/or project design to minimize and mitigate its visual and other resource impacts.

This finding can be made, in that the proposed facility would be located in an area that is not a designated visual resource area. In addition, it will not affect any environmentally sensitive habitat, as none exists on site, and will not impact other County resources, as none exist on site or adjacent to the site. The base of the proposed monopole is located more than 300 feet from all but one small portion of residentially zoned area to reduce visual impacts to surrounding residences. Additionally, the structure has been designed such that the three antennas are internally mounted and are not visible, and the proposal utilizes a stealth-type design that mimics structures normally found in the built environment where the facility is located. The support facilities will be located between two existing buildings and will not be visible off-site.

County Code Section 13.10.663(a)(9) requires that the base of any new freestanding telecommunications tower be set back a minimum of 300-feet from residentially zoned parcels to minimize visual impacts that may result from a tower structure. This requirement may be waived by the decision making body, however, if it is determined that the tower will not be readily visible from neighboring residential structures or that service could not be provided to a significant area without construction of the tower. In this case, the antennas, equipment cabinets and other equipment associated with the wireless communications facility will not be readily visible.

The proposed project is unique in that the area where it is proposed to be located is within 300-feet of two residentially zoned (RM-6) parcels, the closest one of which in located approximately 140 feet away and contains a service commercial use (026-311-13). The other parcel does contain a single-family dwelling (026-311-12) and that dwelling is located approximately 380-feet from the base of the proposed tower. The project is also unique in that the "tower" has been camouflaged and all antennas are completely contained within a flagpole/monopole. A flagpole such as the one proposed could be installed on the subject parcel with, at most, a minor administrative permit for which the fee would be waived. Flagpoles displaying the American flag are commonly found in commercial, service commercial, or industrial developments and will appear to be part of a common built environment. So, while the flagpole itself will be visible it will not be perceived as a freestanding tower and the wireless communication facility, consisting of antennas and equipment cabinets and other ancillary equipment, will not itself be visible.

In addition, this facility is proposed to alleviate inadequate coverage in a large area generally

bounded by Mattison Lane on **the** north, East Cliff Drive on **the** south, 7" Avenue on the west and Chanticleer Avenue to the east (see Exhibit I). The applicant investigated alternative locations (see below) and was unable to find a suitable site that would provide the same level of coverage that is not located within a restricted or prohibited zone district.

County Code Section 13.10.663(b)(11) requires that all wireless communication facilities be constructed and operated to minimize the amount of disruption caused to nearby properties. Paragraph (B) of that section requires that back-up generators (if utilized in the future) only be operated during power outages and for testing and maintenance purposes and that noise attenuation measures be included to reduce noise levels at the facility to a maximum noise level of 60 Ldn at the property line and a maximum noise level of 45 Ldn within nearby residences. This is consistent with General Plan Policy 6.9.1. In addition, General Plan Policy 6.9.4 (Figure 6-2) requires that the hourly average noise level, as measured at the property line of the "receiving" land use not exceed 45 decibels (dB) between the hours of 10:00 pm and 7:00 am.

The proposed facility would include air conditioning equipment to cool the equipment but would not include a back-up generator as emergency power is provided by batteries. The temperature of the radio equipment cannot exceed 120 degrees but, since the equipment itself produces heat, the heat exchanger begins operating at about 70 degrees, depending on factors such as air moisture, sun angle, wind, etc. The equipment also includes a rectifier, which controls the electric supply to **the** heat exchanger. To address potential noise exposure from the equipment, the applicant has submitted an acoustical noise suppression **test** on the **type** of outdoor cabinet generally used for the Lucent Technologies equipment (Exhibit J). The test indicated a maximum noise generation of 61 dB at a distance of 5 feet from the cabinet. To determine the potential sound generation at the property line of the nearest residentially-zoned property (approximately 140 feet away), it is calculated that sound levels are reduced by 6 dB every time the distance from the noise source doubles (Inverse Square Law). For example at 10 feet, 20 feet, 40 feet, etc, the sound Ievels will be reduced by **6** dB. **At** 140 feet from the noise source, at the property line, the sound levels will be below 37 dB, and will be consistent with the zoning ordinance and the County's General Plan. It should be noted that the nearest structure on any residentially zoned property **is** located approximately 350 feet from the proposed location of **the** equipment cabinets. **A** condition of approval (IV.E.) has been included to require consistency with the General Plan and County Code Section 13.10.663(b) to reduce noise impacts on surrounding development.

To reduce any potential visual impacts, conditions of approval have been included to eliminate 24-hour lighting, such that the flag will be lowered and raised daily, and to limit the size of the flag to an appropriate size to be reviewed and approved by the County's Urban Designer.

To ensure that this project's long–term visual impact is minimized, several conditions of approval are proposed including allowing only manual lighting requiring that the pole be maintained in good condition throughout it's life (including painting as needed), and maintaining the flag in good condition.

An alternatives analysis was not required for this proposal as the parcel is not within a restricted or prohibited zone district. The applicant, did, however, identify several possible alternative locations that would have potentially allowed a building-mounted or co-located facility, either of which is preferable to a monopole that is not a **"stealth"** installation. Other parcels identified

included the Central Fire Protection District station at 930-17" Avenue, with no interest in leasing; Brommer Street Storage at 1300 Brommer Street, the owners of which were only interested in a short term lease; Paradise Landscape at 1358 Brommer Street, where Code Compliance issues prevent the location of a wireless communication facility; a light industrial complex at 992 17th Avenue, the owners of which were not interested in a lease; and the Sprint/Nextel facility discussed elsewhere. Because **the** other nearby sites and one potential co-location were found not to be viable, this site was chosen as it is not in a restricted or prohibited area and the tower base could be located a minimum of 300-feet from all but one small portion of residentially zoned properties.

2. The site is adequate for the development of the proposed wireless communications facility and, for sites located in one of the prohibited and/or restricted areas set forth in Sections 13.10.661(b) and 13.10.661 (c), that the applicant has demonstrated that there are not environmentally equivalent or superior and technically feasible: (1) alternative sites outside the prohibited and restricted areas; and/or (2) alternative designs for the proposed facility as conditioned.

This finding can be made, in that the proposed facility meets all site standards for the C-4 zone district as it would be located a minimum of 94-feet from the nearest property line. The maximum height allowed for a free-standing tower in the C-4 zone district would be 85-feet (reference Planning Department Policy/Ordinance lnterpretation WCF-01) and the proposed height is 50-feet. Because the existing area is currently paved, no trees or vegetation are proposed to be removed and no grading is necessary. The proposed site is not located on one of theprohibited and/or restricted areas set forth in Sections 13.10.661(b) and 13.10.661 (c), so an alternatives analysis was not required.

The applicant, did, however, identify five possible alternative locations that would have potentially allowed a building-mounted or co-located facility, either of which is preferable to a monopole that is not a "stealth" installation. For a variety of reasons (see finding above) none of those sites proved to be viable. Because the other nearby sites and one potential co-location were found not to be viable, this site was chosen as it is not in a restricted or prohibited area and the tower base could be located a minimum of all but one small portion of residentially zoned area.

3. The subject property upon which the wireless communications facility is to be built is in compliance with all **rules** and regulations pertaining to zoning **uses,** subdivisions and any other applicable provisions of this title (County Code 13.10.660) and that all zoning violation abatement costs, if any, have been paid.

This finding can be made, in that the existing commercial use of the subject property is in compliance with the requirements of the zone district and General Plan designation, in which it is located. Another application, 05-0439, is currently in process to establish a Master Occupancy Program (MOP) for the **three** parcels that make up **the** campus. The requested permit will not affect the MOP as the proposed use is appurtenant and accessory to the main storage, warehouse and shipping use, and accessory structures and uses will be allowed as part of the MOP.

No zoning violation abatement fees are applicable to the subject parcel, as there are no known violations on the property.

4. The proposed wireless communication facility as conditioned will not create a hazard for aircraft in flight.

This finding can be made, in that the proposed wireless communications facility will be located on a flagpole/monopole, which will be approximately 50-feet in height, and this elevation is too low to interfere with an aircraft in flight.

5. The proposed wireless communication facility as conditioned is in compliance with all FCC and California PUC standards and requirements.

This finding can be made, in that **the** maximum ambient RF exposure anywhere on the ground, for the proposed Metro PCS operation alone, will be 0.31% of the applicable public exposure limit established by the Federal Communications Commission (FCC). The maximum calculated cumulative level on the ground for the simultaneous operation ofboth carriers (including the Sprint/Nextel facility to the southeast) would be 0.39% of the public exposure limit. The maximum calculated cumulative level on the second floor elevation of any nearby building would be 0.63% of the public exposure limit, and the maximum calculated cumulative level at the second-floor elevation of Shoreline Middle School would be 0.25% of the public exposure limit. According to the study findings, the projected exposure limits include "worst-case" assumptions and are expected to overstate actual power density levels.

6. For wireless communication facilities in the coastal zone, the proposed wireless communication facility as conditioned is consistent with the all applicable requirements of the Local Coastal Program.

This finding can be made, in that the proposed project site is not located within the coastal zone.

Development Permit Findings

1. That the proposed location of the project and the conditions under which it would be operated or maintained will not be detrimental to the health, safety, or welfare of persons residing or working in the neighborhood or the general public, and will not result in inefficient or wasteful use of energy, and will not he materially injurious to properties or improvements in the vicinity.

This finding can be made, as the proposed wireless facility and associated equipment will be required to comply with all applicable building and electrical codes, and the standards of the California Public Utilities Commission (PUC) and the Federal Communications Commission (FCC). The maximum ambient RF exposure anywhere on the ground, for the proposed Metro PCS operation alone, will be 0.31% of the applicable public exposure limit established by the Federal Communications Commission (FCC). The maximum calculated cumulative level on the ground for the simultaneous operation of both caniers (including the Sprint/Nextel facility to the southeast) would be *0.39%* of the public exposure limit. The maximum calculated cumulative level on the second floor elevation of any nearby building would be 0.63% of the public exposure limit, and the maximum calculated cumulative level at the second-floor elevation of Shoreline Middle School would be 0.25% of the public exposure limit.

Condition of Approval IV.H. requires that the most recent and efficient technology will be used and upgrades to more efficient and effective technologies will be required to occur as new technologies are developed.

The project will not be materially injurious to properties or improvements in the vicinity in that the structure has been designed such that the **three** antennas **are** internally mounted and are not visible, and the proposal utilizes a stealth-type design that mimics structures normally found in the built environment where the facility is located. Flagpoles displaying the American flag are commonly found in large service commercial or industrial developments and will appear to be part of a common built environment. The support facilities will **be** located between two existing buildings on site and will not be visible off-site.

To reduce any potential visual impacts, conditions of approval have been included to eliminate 24-hour lighting, such that the flag will be lowered and raised daily, and to limit the size of the flag to the smallest possible given the size and height of the pole. To ensure that this project's long–term visual impact is minimized, several conditions of approval are proposed including allowing only manual lighting, requiring that the pole be maintained in good condition throughout it's life (including painting as needed), and maintaining the flag in good condition.

Noise levels produced by the associated equipment **are** less than that of a residential air conditioning unit, and will **be** less that those currently generated by the refrigeration compressors on site

2. That the proposed location of the project and the conditions under which it would be operated or maintained will be consistent with all pertinent County ordinances and the purpose of the zone district in which the site is located.

This finding can be made, in that the proposed location of the wireless communications facility and the conditions under which it would be operated or maintained will be consistent with all pertinent County ordinances and the purpose of the C-4 (Commercial Service) zone district in that the primary use of the property will remain a warehouse and storage facility and the wireless communications facility, that meets all current site standards for the **zone** district, will be an accessory and ancillary use. The proposed wireless communication facility is an allowed use in the C-4 and M-I zone districts, as neither of those designations are considered to be "prohibited" or "restricted' per County Code Section 13.10.661(b) and (c), and complies with all applicable provisions of the County's Wireless Communications Facility Ordinance (Sections 13.10.660 through 13.10.668) as the proposal utilizes a stealth-type design that mimics structures normally found in the built environment where **the** facility is located. The support facilities will be located between two existing buildings and will not be visible off-site.

County Code Section 13.10.663(a)(9) requires that the base of any new freestanding telecommunications tower be set back a minimum of 300-feet from residentially zoned parcels to minimize visual impacts that may result from a tower structure. This requirement may be waived by the decision making body, however, if it is determined that the tower will not be readily visible from neighboring residential structures or that service could not be provided to a significant area without construction of the tower. The proposed project is unique in that the area where it is proposed to be located is within 300-feet of two residentially zoned (RM-6) parcels, the closest one of which in located approximately 140 feet away and contains a service commercial use (026-311-13). The other parcel does contain a single-family dwelling (026-311-12) and that dwelling is located approximately 380-feet from the base of the proposed tower. The project is also unique in that the "tower" has been camouflaged and all antennas are completely contained within a flagpole/monopole. **A** flagpole such as the one proposed could be installed on the subject parcel with, at most, a minor administrative permit for which the fee would **be** waived. Flagpoles displaying the American flag are commonly found in large service commercial or industrial developments and will appear to be part of a common built environment. So, while the flagpole will be visible it will not be perceived as a freestanding tower and the wireless communication facility, consisting of antennas and equipment cabinets and other ancillary equipment, will not itself be visible,

3. That the proposed use is consistent with all elements of the County General Plan and with any specific plan which has been adopted for **the** area.

This finding can be made, in that the proposed commercial **use** is consistent with the use and density requirements specified for the Service Commercial (C-S) land use designation in the County General Plan. The proposed facility will not adversely impact the light, solar opportunities, air and/of open space available to other structures or properties since the proposed flagpole/monopole meets all setbacks and site standards for the **C-4** zone district as specified in Objective 8.1.3 of the General Plan. The proposed development is a conditionally allowed use in the C-4 and M-1 zone districts.

The proposed wireless communications facility will not adversely impact the light, solar opportunities, air, and/or open space available to other structures or properties, and meets all current site, design, and development standards for **the** zone district as specified in Policy 8.5.2

(Commercial Compatibility with Other Uses), in that the wireless communications facility has been reviewed by the County's Urban Designer and found to be in compliance with the Site, Architectural and Design Review Ordinance.

The proposed wireless communications facility will not he improperly proportioned to the parcel size or the character of the neighborhood as specified in General Plan Policy 8.6.1 (Maintaining a Relationship Between Structure and Parcel Sizes), in that the proposed wireless communications facility will comply with the site standards for the C-4 zone district (including setbacks and height) and will result in a structure consistent with a design that could be approved on any other commercial parcel that meets the criteria of the County's Wireless Communications Facility Ordinance.

A specific plan has not been adopted for this portion of the County.

4. That the proposed use will not overload utilities and will not generate more than the acceptable level of traffic on the streets in the vicinity.

This finding can be made, in that the proposed wireless communications facility is to be constructed on an existing developed lot. The construction of the flagpole/monopole and the associated equipment will not overload utilities since no water or sewer service will be used and adequate electricity is available to the site. The project will not generate traffic on the streets in the vicinity in that the facilities are planned for unattended operation. Maintenance personnel will visit the site once per month to **ensure** that equipment is operating within regulated guidelines and the safety, efficiency and general traffic movement in **the** area will be unaffected. Parking for maintenance is provided on site. **All** access to the proposed facility will be provided on existing public streets and driveways.

5. That the proposed project will complement and harmonize with **the** existing and proposed land uses in the vicinity and will be compatible with the physical design aspects, land **use** intensities, and dwelling unit densities of the neighborhood.

This finding can be made, as the proposed facility will consist of internally mounted antennas inside a flagpole/monopole similar to those commonly found in large service commercial or industrial developments and will appear to be part of a common built environment. Equipment will be screened from public view by existing buildings and fences. Noise levels are less than that of a residential air conditioning unit, and will be less that those currently generated by the refrigeration compressors on site.

6. The proposed development project is consistent with the Design Standards and Guidelines (sections **13.1** 1.070 through 13.11.076), and any other applicable requirements of this chapter.

This finding can be made, in that the proposed wireless communications facility has been designed such that the **three** antennas are internally mounted and are not visible, and the proposal utilizes a stealth-type design that mimics structures normally found in the built environment where the facility is located. Flagpoles displaying the American flag **are** commonly found in large service commercial or industrial developments and will appear to be part of a common built

environment. The support facilities will be located between two existing buildings on site and will not be visible off-site.

To reduce any potential visual impacts, conditions of approval have been included to eliminate 24-hour lighting, such that the flag will be lowered and raised daily, and to limit the size of the flag to the smallest possible given the size and height of the pole. To ensure that this project's long-term visual impact is minimized, several conditions of approval are proposed including allowing only manual lighting, requiring that the **pole** be maintained in good condition throughout it's life (including painting as needed), and maintaining the flag in good condition.

Conditions of Approval

Exhibit A: Project plans prepared by Omni Design Group, 8 sheet, dated 11/30/06

I. This permit authorizes the construction of a new wireless communications facility including three, 56-inch antennas inside a 50-foot flagpole monopole, **three** associated equipment cabinets, two power/telco boxes and a **GPS** antenna. Prior to exercising any rights granted by this permit including, without limitation, any construction or site disturbance, the applicant/owner shall:

A. Sign, date, and return to the Planning Department one copy of the approval **to** indicate acceptance and agreement with the conditions thereof.

B. Obtain a Building Permit from the Santa Cruz County Building Official

C. The applicant shall obtain approval from the California Public Utilities Commission and the Federal Communications Commission to install and operate this facility.

II. Prior to issuance of a Building Permit the applicantiowner shall:

A. Submit proof that these conditions have been recorded in the official records of the County of Santa Cruz (Office of the County Recorder).

B. Submit final architectural plans for review and approval by the Planning Department. The final plans shall be in substantial compliance with the plans marked Exhibit "**A**" on file with the Planning Department. Any changes from the approved Exhibit "**A**" **for** this development permit on the plans submitted for the Building Permit must be clearly called out and labeled by standard architectural methods to indicate such changes. Any changes that are not properly called out and labeled will not be authorized by any Building Permit that is issued for the proposed development. The final plans shall include the following additional information:

1. Identify color and finish of exterior materials for Planning Department approval. **All** colors and materials must be non-reflective and blend with the existing infrastructure and/or provide camouflage. All roof-mounted equipment must be painted to match the existing buildings. All color boards must be no larger than 8.5"w x 11"h x 1/16"

2. Identify the height and material **of** fencing surrounding the lease area for Planning Department approval.

3. Identify the size of the flag proposed to be flown from the flagpole. The size of the flag and the relationship to the size of the flagpole shall be reviewed and approved by the County's Urban Designer.

EXHIBIT C

4. All antennas shall be located within the flagpole/monopole. No exterior antennas are permitted.

5. All new electric and telecommunications lines shall be placed underground, with the exception of one overhead telco cable routed overhead between existing buildings.

6. Details showing compliance with **fire** department requirements.

7. A lighting plan. All lighting must be manual and must not be visible from neighboring properties. No 24-hour lighting is permitted for the flag. The flag must be raised and lowered daily.

C. Obtain an Environmental Health Clearance for this project from the County Department of Environmental Health Services. To ensure that the storage of hazardous materials on the site does not result in adverse environmental impacts, the applicant shall submit a Hazardous Materials Management Plan for review and approval by the County Department of Environmental Health Services, if required.

D. To guarantee that the flagpole/monopole remains in good visual condition and to ensure the continued provision of mitigation of the visual impact of the wireless communications facility, the applicant shall submit a maintenance program prior to building permit issuance which includes the following:

1. **A** signed contract for maintenance with the company that provides the exterior paint, for annual visual inspection and follow up repair, painting, and resurfacing as necessary.

2. A signed contract for maintenance of the flag that includes raising and lowering the flag daily and as required for weather conditions, and replacement of the flag as needed.

E. Submit four copies of the approved Discretionary Permit with the Conditions of Approval attached. The Conditions of Approval shall be recorded prior to submittal, if applicable.

F. Meet all requirements and pay any applicable plan check fee of the Central Fire Protection District.

G. Submit proof of approval from the Federal Aviation Administration (FAA) for the proposed tower. Any modifications to the tower required by the FAA, such as required lights **or** painting, may require an amendment to this permit.

III. All construction shall be performed according to the approved plans for **the** Building Permit. Prior to final building inspection, **the** applicant/owner must meet the following conditions:

A. All site improvements shown on the final approved Building Permit plans shall be installed.

B. All inspections required by the building permit shall he completed to the satisfaction of the County Building Official.

C. The Hazardous Materials Management Plan, if required, shall be approved by the County Department of Environmental Health Services.

D. Pursuant to Sections 16.40.040 and 16.42.100 of the County Code, if at any time during site preparation, excavation, or other ground disturbance associated with this development, any artifact or other evidence of an historic archaeological resource or a Native American cultural site is discovered, the responsible persons shall immediately cease and desist from all further site excavation and notify the Sheriff-Coroner if **the** discovery contains human remains, or the Planning Director if the discovery contains no human remains. The procedures established in Sections 16.40.040 and 16.42.100, shall be observed.

IV. Operational Conditions

A. In the event that future County inspections of the subject property disclose noncompliance with any Conditions of this approval or any violation of the County Code, the owner shall pay to the County the full cost of such County inspections, including any follow-up inspections and/or necessary enforcement actions, up to and including permit revocation.

B. The exterior finish and materials of the wireless communication facility must be maintained on an annual basis to continue to blend with the existing utilities infrastructure. Additional paint and/or replacement materials shall be installed as necessary to blend the wireless communication facility with the existing utilities infrastructure.

C. The flag shall be maintained and replaced as necessary. It shall be raised and lowered daily and as required by weather conditions. No 24-hour lighting is allowed.

D. The operator of the wireless communication facility must submit within 90 days of commencement of normal operations (or within 90 days of any major modification of power output of the facility) a written report to the Santa Cruz County Planning Department documenting the measurements and findings with respect to compliance with the established Federal Communications Commission (FCC) Non-Ionizing Electromagnetic Radiation (NEIR) exposure standard. The wireless communication facility must remain in continued compliance with the NEIR standard established by the FCC at all times. Failure to submit required reports or to remain in continued compliance with the NEIR standard established by the FCC will **be** a violation of the terms of this permit.

E. All noise generated from the approved **use** shall comply with the standards of the County General Plan and Section 13.10.663(b) and shall not exceed the existing noise level on the site. Back-up generators shall only be operated during power outages and for testing and maintenance purposes.

F. If, in the future, the pole based utilities are relocated underground at this location, the operator of the wireless communication facility must abandon the facility and **be** responsible for the removal of all permanent structures and the restoration of the site as needed to re-establish the area consistent with the character of the surrounding development.

G. If, **as** a result of **future** scientific studies and alterations of industry-wide standards resulting from those studies, substantial evidence is presented to Santa Cruz County that radio frequency transmissions may pose a hazard to human health and/or safety, the Santa **Cruz** County Planning Department shall set a public hearing and in its sole discretion, may revoke or modify the conditions of this permit.

H. If future technological advances would allow for reduced visual impacts resulting ***from*** the proposed telecommunication facility, the operator of the wireless communication facility must make those modifications which would allow for reduced visual impact of the proposed facility as part of the normal replacement schedule. If, in the future, the facility is no longer needed, the operator of the wireless communication facility must abandon the facility and be responsible for the removal of all permanent structures and the restoration of the site as needed to re-establish the area consistent with the character of the surrounding natural landscape.

I. Any modification in the type of equipment shall be reviewed and acted on by the Planning Department staff. The County may deny or modify the conditions at this time, or the Planning Director may refer it for public hearing before the Zoning Administrator.

J. A Planning Department review that includes a public hearing shall be required for any future co-location at this wireless communications facility.

K. The access road shall be permanently maintained to allow access to emergency vehicles at all times. Any obstruction of the access road, as a result of neglect or lack of maintenance, will be in violation of the conditions of this permit.

L. The equipment cabinet area must be locked at all times except when authorized personnel are present. The antennas must not be accessible to the public.

M All site, building, security and landscape lighting shall be directed onto the lease site and away from adjacent properties. Light sources shall not be visible from adjacent properties. Building and security lighting shall be integrated into the

building design and shall be operated with a manual on/off switch. The site shall be unlit except when authorized personnel are present at night. No 24-hour lighting is permitted for the flag. The flag must be raised and lowered daily.

N. No person shall come within 2-feet of the antennas when the site is in operation. The NEIR hazard zone shall be posted with bilingual NEIR hazard warning signage, such that the signs are clearly visible from any angle of approach to persons who may need to work within that distance, including the roof of the nearby buildings on site. The signs shall indicate the facility operator and a 24-hour emergency contact who is authorized by the applicant to act on behalf of the applicant regarding an emergency situation.

V. As a condition of this development approval, the holder of this development approval ("Development Approval Holder"), is required to defend, indemnify, and hold harmless the COUNTY, its officers, employees, and agents, from and against any claim (including attorneys' fees), against the COUNTY, it officers, employees, and agents to attack, set aside, void, or annul this development approval of the COUNTY or any subsequent amendment of this development approval which is requested by the Development Approval Holder.

A, COUNTY shall promptly notify the Development Approval Holder of any claim, action, or proceeding against which the COUNTY **seeks** to be defended, indemnified, or held harmless. COUNTY shall cooperate fully in such defense. If COUNTY fails to notify the Development Approval Holder within sixty (60) days of any such claim, action, or proceeding, or fails to cooperate fully in the defense thereof, the Development Approval Holder shall not thereafter be responsible to defend, indemnify, or hold harmless the COUNTY if such failure to notify or cooperate was significantly prejudicial to the Development Approval Holder.

B. Nothing contained herein shall prohibit the COUNTY from participating in the defense of any claim, action, or proceeding if both of the following occur:

1. COUNTY bears its own attorney's fees and costs; and

2. COUNTY defends the action in good faith.

C. Settlement. The Development Approval Holder shall not be required to pay or perform any settlement unless such Development Approval Holder has approved the settlement. When representing the County, the Development Approval Holder shall not enter into any stipulation or settlement modifying or affecting the interpretation or validity of any of the terms **or** conditions of the development approval without the prior written consent of the County.

D Successors Bound. "Development Approval Holder" shall include the applicant and the successor'(s) in interest, transferee(s), and assign(s) of the applicant.

E. Within 30 days of the issuance of this development approval, the Development

Approval Holder shall record in the office of the Santa Cruz County Recorder an agreement which incorporates the provisions of this condition, or this development approval shall become null and void.

Minor variations to this permit which do not affect the overall concept or density may be approved by the Planning Director at the request of the applicant or staff in accordance with Chapter 18.10 of the County Code.

Please note: This permit expires two years from the effective date on the expiration date listed below unless you *obtain* the required permits and commence construction.

Approval Date: _____

Effective Date: _____

Expiration Date: _____

Mark Deming	Cathy Graves
Assistant Planning Director	Project Planner

Appeals: Any property owner, or other person aggrieved, or any other person whose interests are adversely affected by any act or determination of the Zoning Administrator; may appeal the act or determination to the Planning Commission in accordance with chapter 18.10 *of* the Santa **Cruz** County Code.

EXHIBIT C

CALIFORNIA ENVIRONMENTAL QUALITY ACT
NOTICE OF EXEMPTION

The Santa Cruz County Planning Department has reviewed the project described below and has determined that it is exempt from the provisions of CEQA as specified in Sections 15061 - 15332 of CEQA for the reason(s) which have been specified in this document.

Application Number: 06-0701
Assessor Parcel Number: 026-311-65
Project Location: 1053 17th Avenue, Santa Cruz

Project Description: Proposal to construct a wireless connumications facility

Person or Agency Proposing Project: Jennifer Estes for Peacock Associates

Contact Phone Number: (510) 420-5701

A. ____ The proposed activity is not a project under CEQA Guidelines Section 15378.
B. ____ The proposed activity is not subject to CEQA as specified under CEQA Guidelines Section 15060 (c).
C. ____ **Ministerial Project** involving only the use of fixed standards or objective measurements without personal judgment.
D. ____ **Statutory Exemption** other than a Ministerial Project (CEQA Guidelines Section 15260 to 15285).

Specify **type:**

E. __X__ **Categorical Exemption**

Specify type: Class 3 - New Construction of Small Structures (Section 15303)

F. Reasons why the project is exempt:

Proposal to construct wireless communications facility and site improvements at an existing commercial development in an area designated for service commercial uses.

In addition, none of the conditions described in Section 15300.2 apply to this project.

_____ Date:_____
Cathy Graves, Project Planner

EXHIBIT D

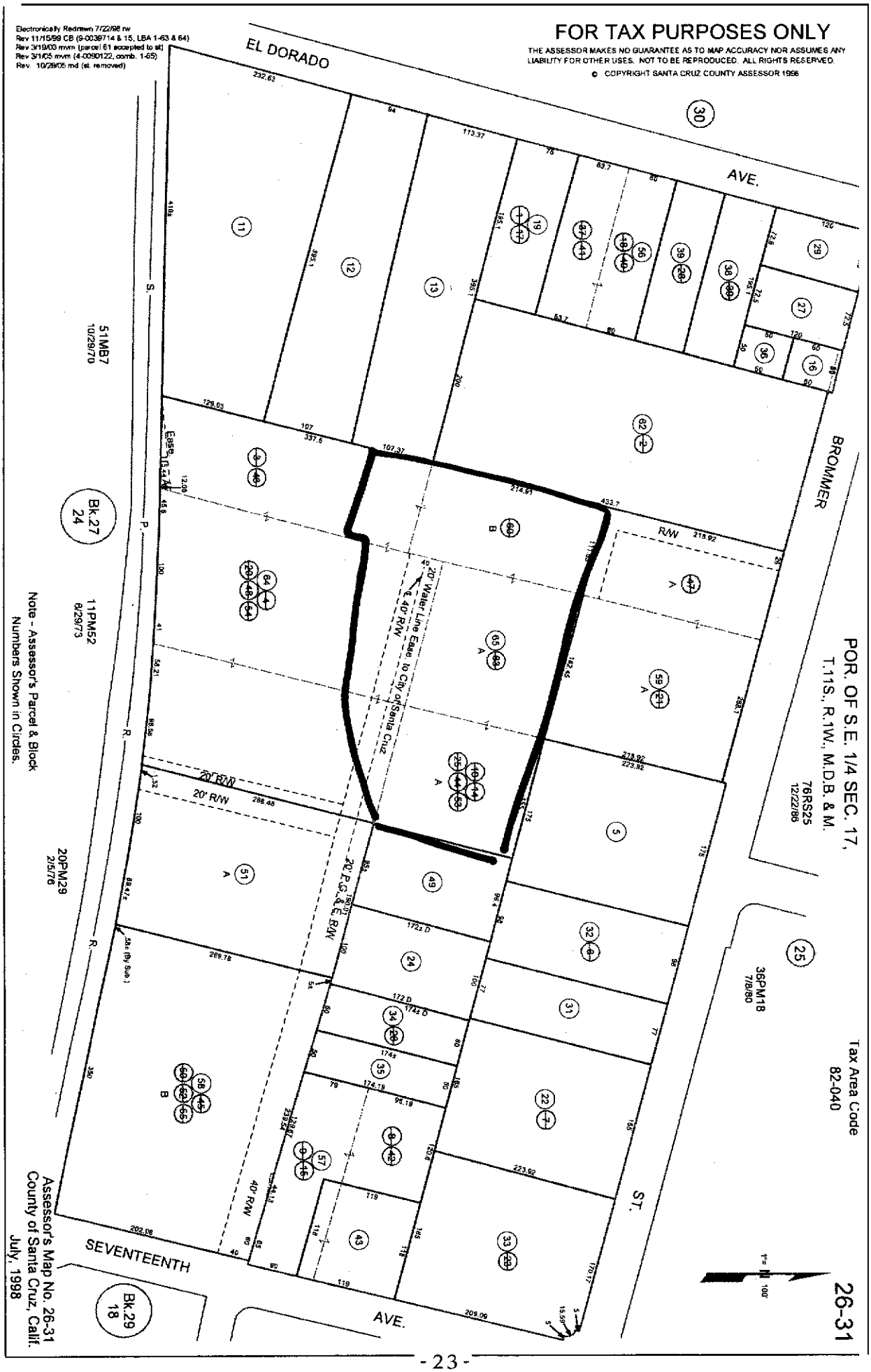

FOR TAX PURPOSES ONLY
THE ASSESSOR MAKES NO GUARANTEE AS TO MAP ACCURACY NOR ASSUMES ANY LIABILITY FOR OTHER USES. NOT TO BE REPRODUCED. ALL RIGHTS RESERVED.
© COPYRIGHT SANTA CRUZ COUNTY ASSESSOR 1998
Electronically Redrawn 7/22/98 rw
Rev 11/15/99 CB (9-0039714 & 15, LBA 1-63 & 64)
Rev 3/19/03 mvm (parcel 61 accepted to st)
Rev 3/1/05 mvm (4-0090122, comb. 1-65)
Rev. 10/28/05 md (st. removed)
EL DORADO
AVE.
BROMMER
ST.
SEVENTEENTH
AVE.
POR. OF S.E. 1/4 SEC. 17, T.11S., R.1W., M.D.B. & M.
Tax Area Code 82-040
Bk.27 24
Bk.29 18
51MB7 10/29/70
11PM52 6/29/73
20PM29 2/5/76
36PM18 7/8/80
76RS25 12/22/86
20' Water Line Ease. to City of Santa Cruz
40' R/W
20' R/W
20' P.G.&E. R/W
40' R/W
R/W
Note - Assessor's Parcel & Block Numbers Shown in Circles.
Assessor's Map No. 26-31
County of Santa Cruz, Calif.
July, 1998
26-31

EXHIBIT E

Location Map

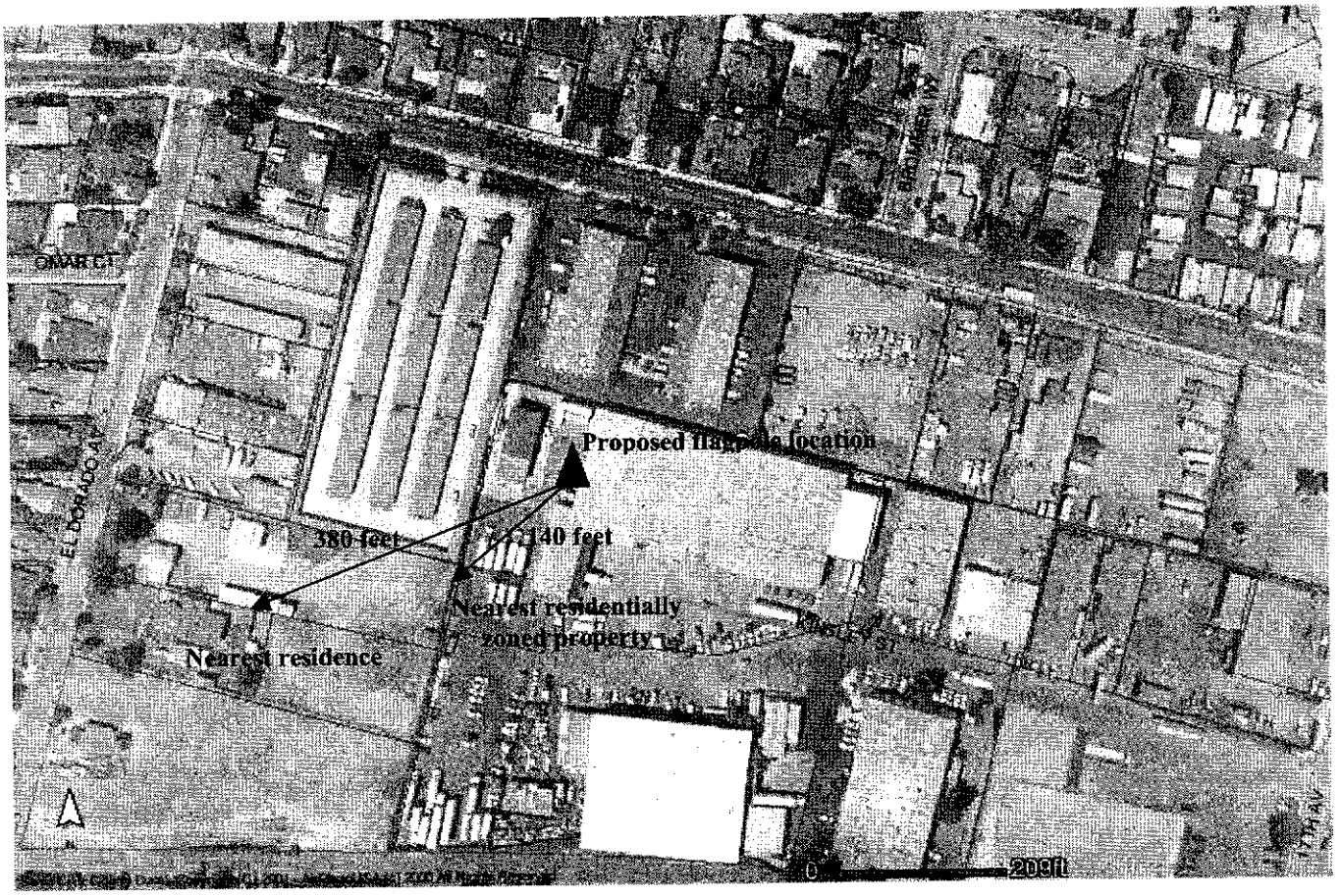
Legend

- APN 026-311-65
- Assessors Parcels
- Streets
- INTERMITTENT STREAM
- PERENNIAL STREAM
- Railroads

N
W E
S

Map Created by
County of Santa Cruz
Planning Department
December 2006

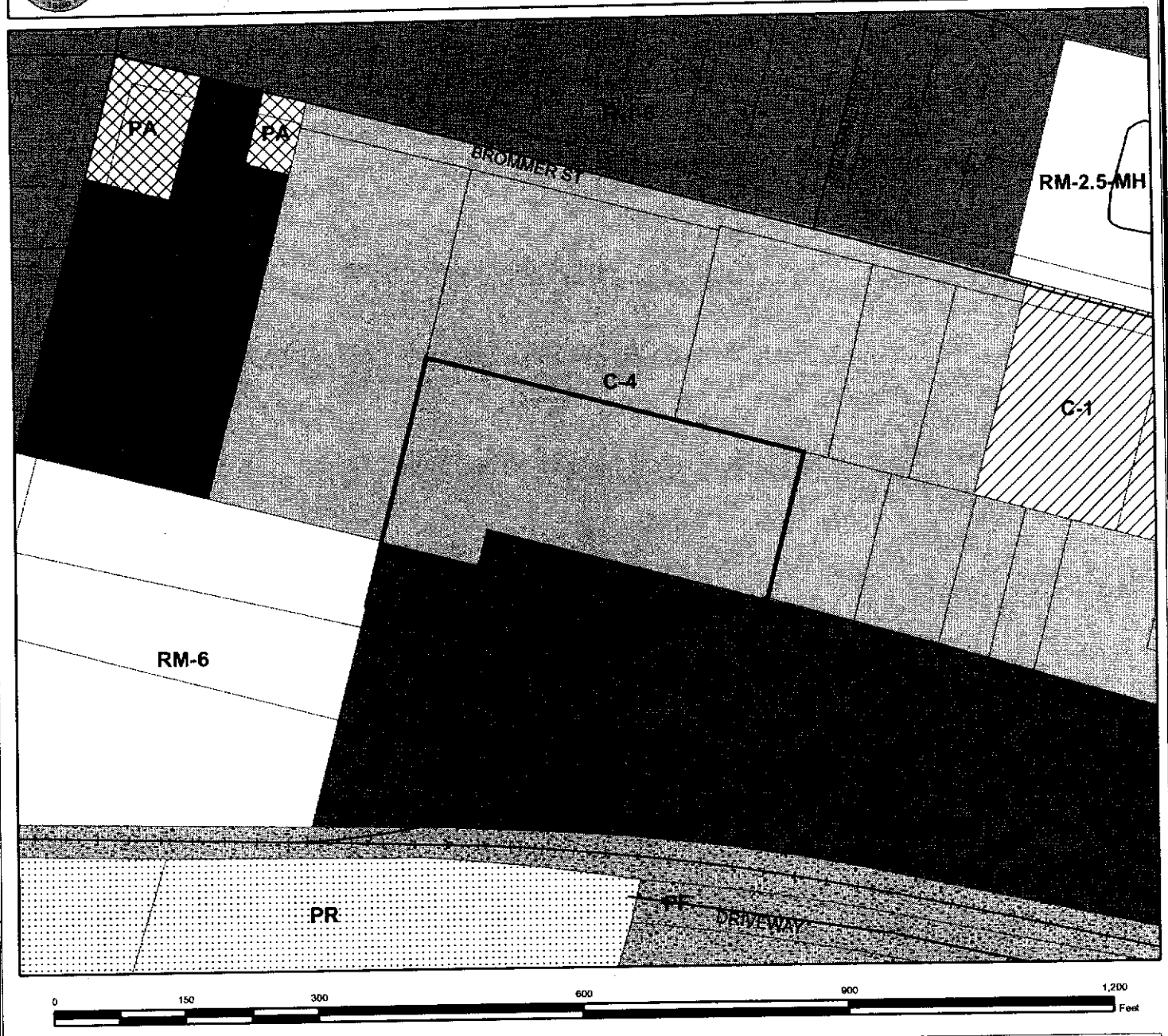
EXHIBIT F



Location of Residentially Zoned Property (140' from flagpole) and Residence (380' from flagpole)

EXHIBIT F

Zoning Map



Legend

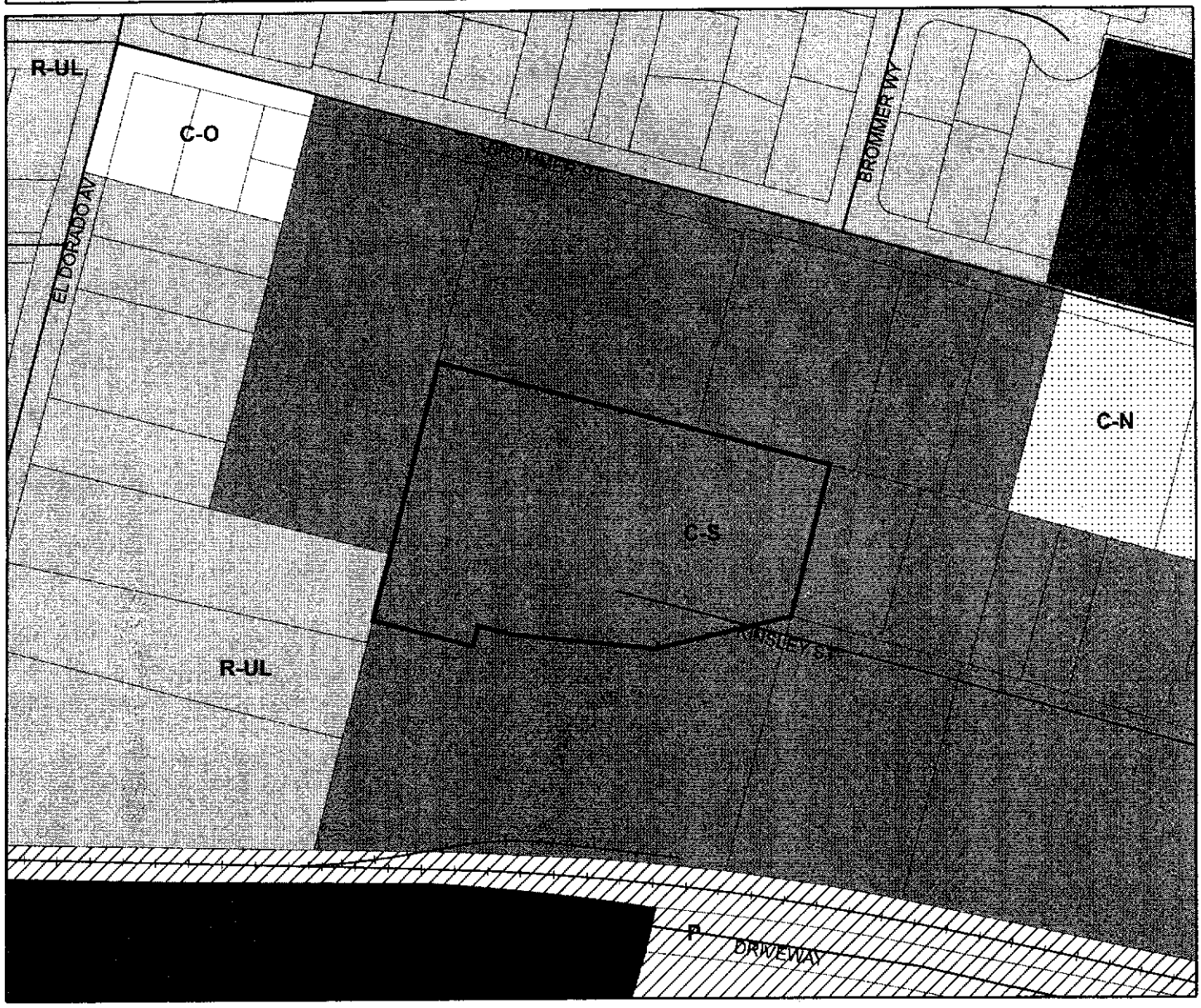
- APN 026-311-65
- Assessors Parcels
- Streets
- Railroads
- COMMERCIAL SERVICE (C-4)
- RESIDENTIAL-SINGLE FAMILY (R-1)
- LIGHT INDUSTRIAL (M-1)
- SPECIAL USE (SU)
- RESIDENTIAL-MULTI FAMILY (RM)
- COMMERCIAL-PROF OFFICE (PA)
- COMMERCIAL-NEIGHBORHOOD (C-1)
- PUBLIC FACILITY (PF)

N
W E
S

Map Created by
County of Santa Cruz
Planning Department
December 2006

EXHIBIT F

General Plan Designation Map



0 150 300 600 900 1,200 Feet

Legend

- APN 026-311-65
- Assessors Parcels
- Streets
- Railroads
- Commercial-Service (C-S)
- Residential- Urban Low Density (R-UL)
- Residential- Urban High Density (R-UH)
- Parks and Recreation (O-R)
- Commercial-Neighborhood (C-N)
- Public Facilites (P)
- Commercial-Office (C-O)

N
W E
S

Map Created by
County of Santa Cruz
Planning Department
December 2006

EXHIBIT F a

HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
RADIO AND TELEVISION

WILLIAM F. HAMMETT, P.E
DANE E. ERICKSEN, P.E.
STANLEY SALEK, P.E.
ROBERT D. WELLER, P.E.
MARK D. NEUMANN, P.E.
ROBERT P. SMITH, JR.
RAJAT MATHUR, P.E.
S. WESTON LANE

ROBERT L. HAMMETT, P.E.
1920-2002
EDWARD EDISON, P.E.

BY E-MAIL ESREIFF@PEACOCKASSOCIATES.COM

July 16,2007

Mr. Evan Shepherd Reiff
Planning and Zoning Manager
Peacock Associates
5900 Hollis Street R1
Emeryville, California **94608**

Dear Evan:

As you requested, this letter provides updated supplemental follow-up information to our report, dated July 10, 2007, of RF exposure conditions near the MetroPCS base station (Site No. SF1671 ID) proposed to be located on a new 50-foot pole to be installed at 1053 17th Avenue in Santa Cruz, California. County Supervisor Jan Beautz raises a concern in her memo, dated May 16,2007, about levels in the second-floor classrooms at Shoreline Middle School, about 1,000 feet away.

The Supervisor notes correctly from Figure **3A** that the calculated second-floor level at 1,000 feet (0.10%) is almost the same* as the ground-floor level at 50 feet (0.11%). It is important to note several additional things from that figure and its companion Figure 3B:

a) both levels are hundreds of times below the FCC limit. so a similar pole located 50 feet from a classroom would easily comply with the FCC's exposure limits (that is, by hundreds of times);

b) the levels shown in Figure 3A are those along the 1,000-foot arrow shown in Figure 3B that passes through the existing Sprint Nextel base station, located about *650* feet away;

c) therefore, the indicated levels at 1,000 feet are mostly due to that station, not the proposed MetroPCS station; and

d) in any case, calculated second-floor levels at 1,000 feet **are** less than twice the ground-floor levels at that same distance, and inside the classrooms on either floor, the levels would be lower and therefore likely to be even more comparable.

* Both figures revised from the **earlier** memo on **this** topic, dated June **12,2007.**

e-mail: **bhammett@h-e.com**
***US** Mail:* **Box 280068 • San Francisco, California 94128**
Delivery: **470 Third Street West • Sonoma, California 95476**
Telephone: **707/996-5200 San Francisco • 707/996-5280 Facsimile • *2021396-5200*D.C.**

EXHIBIT G

I trust that this information addresses the questions raised. We appreciate the opportunity to be of service and would welcome any further questions on this material.

Sincerely yours,

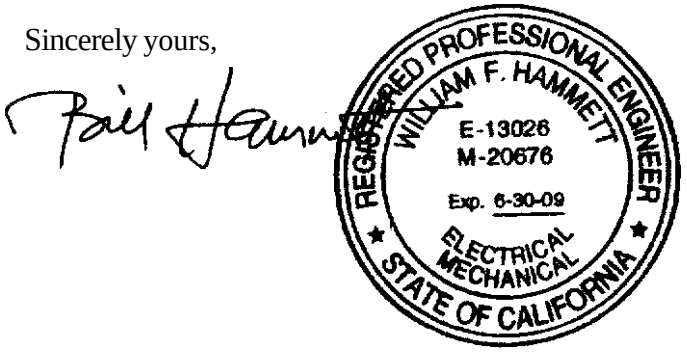


EXHIBIT G

MetroPCS • Proposed Base Station (Site No. SF16711D)
1053 17th Avenue • Santa Cruz, California

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained on behalf of MetroPCS, a personal wireless telecommunications carrier, to evaluate the base station (Site No. SF16711D) proposed to be located at 1053 17th Avenue in Santa Cruz, California, for compliance with appropriate guidelines limiting human exposure to radio frequency ("RF") electromagnetic fields.

Prevailing Exposure Standards

The U.S. Congress requires that the Federal Communications Commission ("FCC") evaluate its actions for possible significant impact on the environment. In Docket 93-62, effective October 15, 1997, the FCC adopted the human exposure limits for field strength and power density recommended in Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements ("NCRP"). Separate limits apply for occupational and public exposure conditions, with the latter limits generally five times more restrictive. The more recent Institute of Electrical and Electronics Engineers ("IEEE") Standard C95.1-2005, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," includes similar exposure limits. A summary of the FCC's exposure limits is shown in Figure 1. These limits apply for continuous exposures and are intended to provide a prudent margin of safety for all persons, regardless of age. gender. size, or health.

The most restrictive limit for exposures of unlimited duration to radio frequency energy for several personal wireless services are as follows:

Personal Wireless Service	Approx. Frequency	Occupational Limit	Public Limit
Personal Communication ("PCS")	1,950 MHz	5.00 mW/cm^2	1.00 mW/cm^2
Cellular Telephone	870	2.90	0.58
Specialized Mobile Radio	855	2.85	0.57
[most restrictive frequency range]	30–300	1.00	0.20

General Facility Requirements

Base stations typically consist of two distinct parts: the electronic transceivers (also called "radios" or "channels") that are connected to the traditional wired telephone lines, and the passive antennas that send the wireless signals created by the radios out to be received by individual subscriber units. The transceivers are often located at ground level and are connected to the antennas by coaxial cables about 1 inch thick. Because of the short wavelength of the frequencies assigned by the FCC for wireless services, the antennas require line-of-sight paths for their signals to propagate well and so are installed at some height above ground. The antennas are designed to concentrate their energy toward

the horizon, with very little energy wasted toward the sky or the ground. Along with the low power of such facilities, this means that it is generally not possible for exposure conditions to approach the maximum permissible exposure limits without being physically very near the antennas.

Computer Modeling Method

The FCC provides direction for determining compliance in its Office of Engineering and Technology Bulletin No. 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation," dated August 1997. Figure 2 attached describes the calculation methodologies, reflecting the facts that a directional antenna's radiation pattern is not fully formed at locations very close by (the "near-field" effect) and that at greater distances the power level from an energy source decreases with the square of the distance from it (the "inverse square law"). The conservative nature of this method for evaluating exposure conditions has been verified by numerous field tests.

Site and Facility Description

Based upon information provided by Metro, including zoning drawings by Omni Design Group, Inc., dated November 30, 2006, it is proposed to mount three Jaybeam Wireless Model W3X72-14-a010 directional panel PCS antennas inside the top of a new 50-foot flag pole to be installed adjacent to the commercial building located at 1053 17th Avenue in Santa **Cruz.** The antennas would be mounted at an effective height of about 47 feet above ground and would be oriented at 120" spacing. to provide service in all directions. The maximum effective radiated power in any direction would be 1,890 watts, representing six channels operating simultaneously at 315 watts each.

Presently located some 650 feet to the southeast are similar antennas for use by Sprint Nextel, another wireless telecommunications carrier. Sprint Nextel reports that it is using six EMS Model RR9017 directional panel PCS antennas mounted on a pole at effective heights of about 42 and 48 feet above ground, operating with a maximum effective radiated power in any direction of 2,400 watts.

There are reported no other wireless base stations or other sources of RF energy close enough and powerful enough to affect the condition of compliance with prevailing exposure standards in areas near the proposed site.

Study Results

For a person anywhere at ground, the maximum ambient RF exposure level due to the proposed Metro operation by itself is calculated to be 0.0031 mW/cm^2, which is 0.31% of the applicable public exposure limit. The maximum calculated cumulative level at ground for the simultaneous operation **of** both carriers is 0.39% of the public limit. The maximum calculated cumulative level on the second-

floor elevation of any nearby building would be 0.63% of the public exposure limit: the maximum calculated cumulative level at the second-floor elevation of the nearby school is 0.25% of the public exposure limit. It should be noted that these results include several "worst-case" assumptions and therefore are expected to overstate actual power density levels. Figure 3 attached provides the specific data required under Santa Cruz County Code Section 13.10.659(g)(2)(ix), for reporting the analysis of RF exposure conditions.

Recommended Mitigation Measures

Due to their mounting location, the MetroPCS antennas are not accessible to the general public and so no mitigation measures are necessary to comply with the FCC public exposure guidelines. To prevent occupational exposures in excess of the FCC guidelines, no access within 2 feet directly in front of the Metro antennas themselves, such as might occur during maintenance activities on the flag or pole, should be allowed while the site is in operation, unless other measures can be demonstrated to ensure that occupational protection requirements are met. Posting explanatory warning signs' at the antennas and/or on the pole below the antennas, such that the signs would be readily visible from any angle of approach to persons who might need to work within that distance, would be sufficient to meet FCC-adopted guidelines.

Conclusion

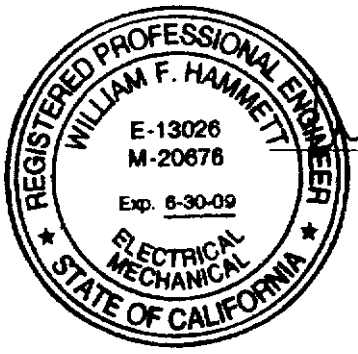
Based on the information and analysis above, it is the undersigned's professional opinion that the base station proposed by MetroPCS at 1053 17th Avenue in Santa Cruz, California, will comply with the prevailing standards for limiting public exposure to radio frequency energy and, therefore, will not for this reason cause a significant impact on the environment. The highest calculated level in publicly accessible areas is much less than the prevailing standards allow for exposures of unlimited duration. This finding is consistent with measurements of actual exposure conditions taken at other operating base stations. Posting of explanatory signs is recommended to establish compliance with occupational exposure limitations.

---

* **Warning signs should comply with OET-65 color, symbol, and content conventions. Contact information should be prouided (*e.g.*, a telephone number) to arrange for access to restricted areas.** The **selection** of language(s) **is** not **an engineering matter, and guidance from the landlord, local zoning or health authority, or appropriate professionals may be required.**

Authorship

The undersigned author of this statement is a qualified Professional Engineer, holding California Registration Nos. E-13026 and M-20676, which expire on June 30, 2009. This work has been carried out by him or under his direction, and all statements are true and correct of his own knowledge except, where noted, when data has **been** supplied **by** others, which data he believes to be correct.



William F. Hammett, P.E.

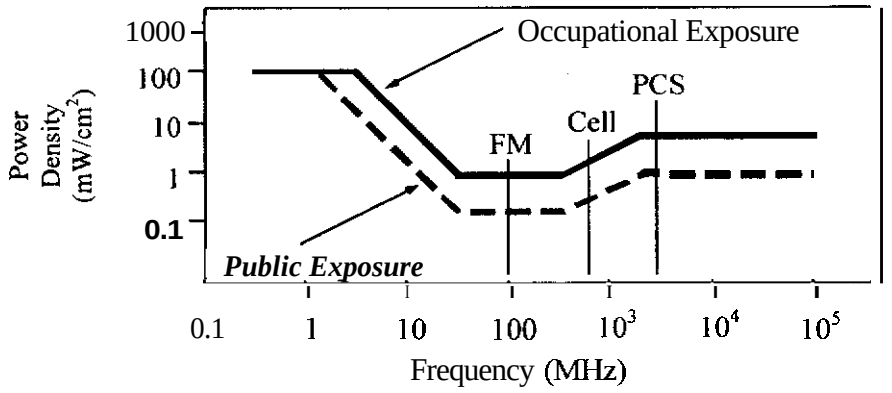
July 10, 2007

FCC Radio Frequency Protection Guide

The **U.S.** Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not; cumulatively, have a significant impact on the environment. The FCC adopted the limits from Report No. 86, "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," published in 1986 by the Congressionally chartered National Council on Radiation Protection and Measurements, which are similar to the more recent Institute of Electrical and Electronics Engineers Standard C95.1-2005, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, **3** kHz to 300 GHz." These limits apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health.

As shown in the table and chart below, separate limits apply for occupational and public exposure conditions, with the latter limits (in ***italics*** and/or dashed) up to five times more restrictive:

Frequency	Electromagnetic Fields (f is frequency of emission in MHz)					
Applicable Range (MHz)	**Electric Field Strength (V/m)**		**Magnetic Field Strength (A/m)**		**Equivalent Far-Field Power Density (mW/cm^2)**	
0.3 – 1.34	**614**	***614***	**1.63**	*1.63*	100	*100*
1.34 – 3.0	**614**	*$823.8/f$*	**1.63**	*$2.19/f$*	100	*$180/f^2$*
3.0 – 30	**18421 f**	*$823.8/f$*	4.89/ f	*$2.19/f$*	**9001 f^2**	*$180/f^2$*
30 – 300	**61.4**	**27.5**	**0.163**	*0.0729*	1.0	*0.2*
300 – 1,500	$3.54\sqrt{f}$	*$1.59\sqrt{f}$*	$\sqrt{f}/106$	*$\sqrt{f}/238$*	f/300	*f/1500*
1,500 – 100,000	137	*61.4*	**0.364**	*0.163*	**5.0**	*1.0*



Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits, and higher levels also are allowed for exposures to small areas, such that the spatially averaged levels do not exceed the limits. However, neither of these allowances is incorporated in the conservative calculation formulas in the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) for projecting field levels. Hammett & Edison has built those formulas into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radio sources. The program allows for the description of buildings and uneven terrain, if required to obtain more accurate projections.

RFR.CALC™ Calculation Methodology

Assessment by Calculation of Compliance with FCC Exposure Guidelines

The U.S. Congress required (1996 Telecom Act) the Federal Communications Commission ("FCC") to adopt a nationwide human exposure standard to ensure that its licensees do not, cumulatively, have a significant impact on the environment. The maximum permissible exposure limits adopted by the FCC (see Figure 1) apply for continuous exposures from all sources and are intended to provide a prudent margin of safety for all persons, regardless of age, gender, size, or health. Higher levels are allowed for short periods of time, such that total exposure levels averaged over six or thirty minutes, for occupational or public settings, respectively, do not exceed the limits.

Near Field.

Prediction methods have been developed for the near field zone of panel (directional) and whip (omnidirectional) antennas, typical at wireless telecommunications base stations, as well as dish (aperture) antennas, typically used for microwave links. The antenna patterns are not fully formed in the near field at these antennas, and the FCC Office of Engineering and Technology Bulletin No. 65 (August 1997) gives suitable formulas for calculating power density within such zones.

For a panel or whip antenna, power density $S = \frac{180}{\theta_{BW}} \times \frac{0.1 \times P_{net}}{\pi \times D^2 \times h}$, in mW/cm^2,

and for an aperture antenna, maximum power density $S_{max} = \frac{0.1 \times 16 \times \eta \times P_{net}}{\pi \times h^2}$, in mW/cm^2,

where θ_{BW} = half-power beamwidth of the antenna, in degrees, and
P_{net} = net power input to the antenna, in watts,
D = distance from antenna, in meters,
h = aperture height of the antenna, in meters, and
η = aperture efficiency (unitless, typically 0.5-0.8).

The factor of 0.1 in the numerators converts to the desired units of power density.

Far Field.

OET-65 gives this formula for calculating power density in the far field of an individual RF source:

$$\text{power density } S = \frac{2.56 \times 1.64 \times 100 \times RFF^2 \times ERP}{4 \times \pi \times D^2} \text{ in } mW/cm^2,$$

where ERP = total ERP (all polarizations), in kilowatts,
RFF = relative field factor at the direction to the actual point of calculation, and
D = distance from the center of radiation to the point of calculation, in meters.

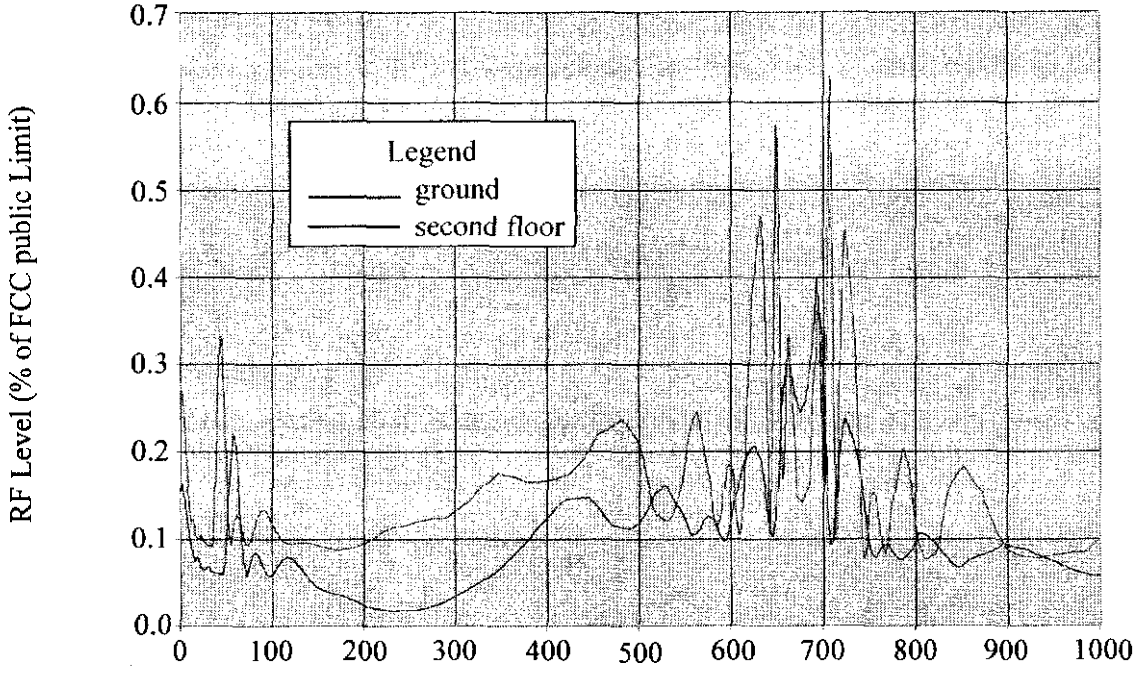
The factor of 2.56 accounts for the increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56). The factor of 1.64 is the gain of a half-wave dipole relative to an isotropic radiator. The factor of 100 in the numerator converts to the desired units of power density. This formula has been built into a proprietary program that calculates, at each location on an arbitrary rectangular grid, the total expected power density from any number of individual radiation sources. The program also allows for the description of uneven terrain in the vicinity, to obtain more accurate projections.

MetroPCS • Proposed Ease Station (Site No. SF16711D)
1053 17th Avenue • Santa Cruz, California

Compliance with Santa Cruz County Code §13.10.659(g)(2)(ix)

'Compliance with the FCCs non-ionizing electromagnetic radiation (NIER) standards or other applicable standards shall be demonstrated for any new wireless communication facility through submission, at the time of application for the necessary permit or entitlement, of NIER calculations specifying NIER levels in the area surrounding the proposed facility. Calculations shall be made of expected NIER exposure levels during peak operation periods at a range of distances from fifty (50) to one thousand (1,000) feet, taking into account cumulative NIER exposure levels from the proposed source in combination with all other existing NIER transmission sources within a one-mile radius. This should also include a plan to ensure that the public would be kept at a safe distance from any NIER transmission source associated with the proposed wireless communication facility consistent with the NIER standards of the FCC, or any potential future superceding standards."

Calculated Cumulative NIER Exposure Levels during Peak Operation Periods



RF level (% limit)

Distance (feet)	50	100	200	300	500	750	1,000
ground	0.11%	0.058%	0.023%	0.035%	0.12%	0.091%	0.057%
secondfloor	**0.16%**	**0.12%**	0.098%	0.13%	**0.21%**	0.14%	0.10%

Calculated using formulas in FCC **Office** of Engineering Technology Bulletin No. 65 (1997), considering terrain variations within 1,000 feet of site.

Maximum effective radiated power (peak operation) - 1,890 watts

Effective MetroPCS antenna height above ground - 47 feet

Other sources nearby - Sprint Nextel located at about 650 feet away

Other sources within one mile - Radio Stations **KSCO** and **KOMY** located about 0.71 miles away. No other base stations or other sources close enough to affect compliance.

Plan for restricting public access - Antennas are mounted on a **tall** flag **pole**

MetroPCS • Proposed Base Station (Site No. SF16711D)
1053 17th Avenue • Santa Cruz, California

Calculated NIER Exposure Levels
Within 1,000 Feet of Proposed Site
Including Sprint Nextel PCS

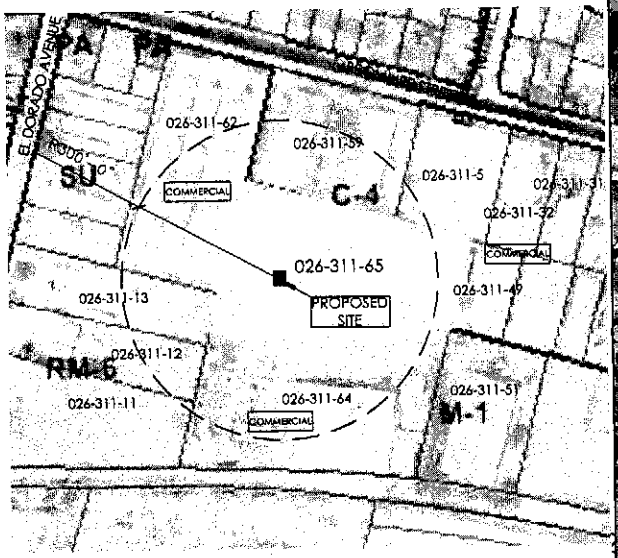
Legend
blank - less than 0.3% of FCC **public limit** (*i.e.*, more than 330 times below)
- 0.30% and above near ground level (highest level is 0.39%)
- 0.30% and above at 2nd floor level (highest level is 0.63%)

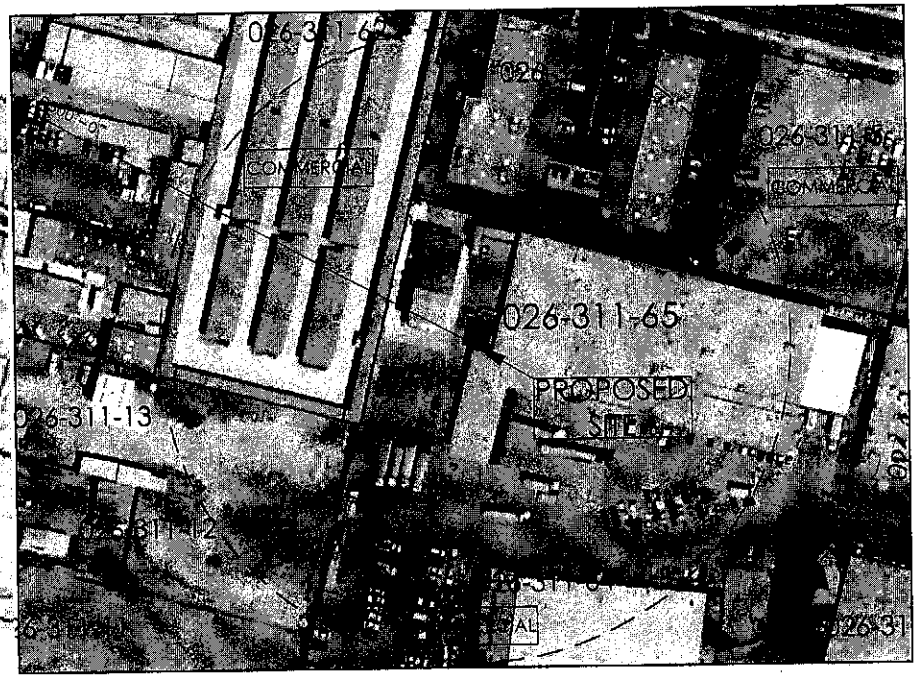
Calculated using formulas in FCC Office of Engineering Technology Bulletin No. 65 (1997), considering terrain variations within 1,000 **feet** of site. *See* text for further information.

HAMMETT & EDISON, INC
CONSULTING ENGINEERS
SAN FRANCISCO

MP16711595.2
Figure 3B

EXHIBIT G





(54) PROXIMITY MAP/AERIAL PHOTO WITH BOUNDARY (300' RADIUS)

(34) PROXIMITY MAP/AERIAL PHOTO WITH CLEAR PICTURE(300' RADIUS)

metroPCS

METRO PCS, INC.
1080 MARINA VILLAGE PARKWAY
4th FLOOR
ALAMEDA, CA 94501
PHONE: 510.523.3610
FAX: 510.748.1823

ARCHITECT:

OMNI

CONSULTANT:

CURRENT ISSUE DATE:
03/13/07

ISSUED FOR:
100% ZD's

PROJECT INFORMATION:
LEDYARD PROPERTIES
SP16711-D
1053 17TH AVE.
SANTA CRUZ, CA 95062
APN NO. 026-311-65
COUNTY OF SANTA CRUZ

SHEET TITLE:
PROXIMITY MAP/
AERIAL PHOTO (300')

SHEET NUMBER: Z-3 REVISION:

855-44A

EXHIBIT G

Aerial Photo

Site Location - The site was located by using the street address, plotted on MapQuest and confirmed by the GoogleEarth.

Viewpoint Selection - The site is located behind a large warehouse, back off of the nearby roads. Photographs were taken from the streets to the northeast, east and west. These viewpoints are considered the most representative public viewpoints.

Scale - The proposed flagpole will be located between buildings, and placed approximately midway between previous proposed site locations. Therefore, the scale pole placement from the previous surveys were used to place the correct scale for the new location in the photographs. Height scale was achieved in the previous surveys by placing a 40 ft scale pole with red balloons at 30 ft and 40 ft. The scale pole provides extremely accurate scale and placement, as the top balloon will perfectly represent the top of the flagpole.Both previous locations were photographed with the scale pole and balloons. The new location was established by setting the midpoint average off the photographs.
The dimensions and placement information were provided by 90% Zoning Drawings, supplied by the project applicant and prepared by Omni Design Group.

Equipment Information - The images were taken with a Canon 1Ds Mark II Professional Digital camera with a 1:1 conversion ratio using standard lenses. GPS equipment: Garmin GPSMAP 60CSx. Distance measured with Bushnell 1000 digital laser range finder. All image manipulation is done using Adobe Photoshop on Apple MacPro Intel workstations.

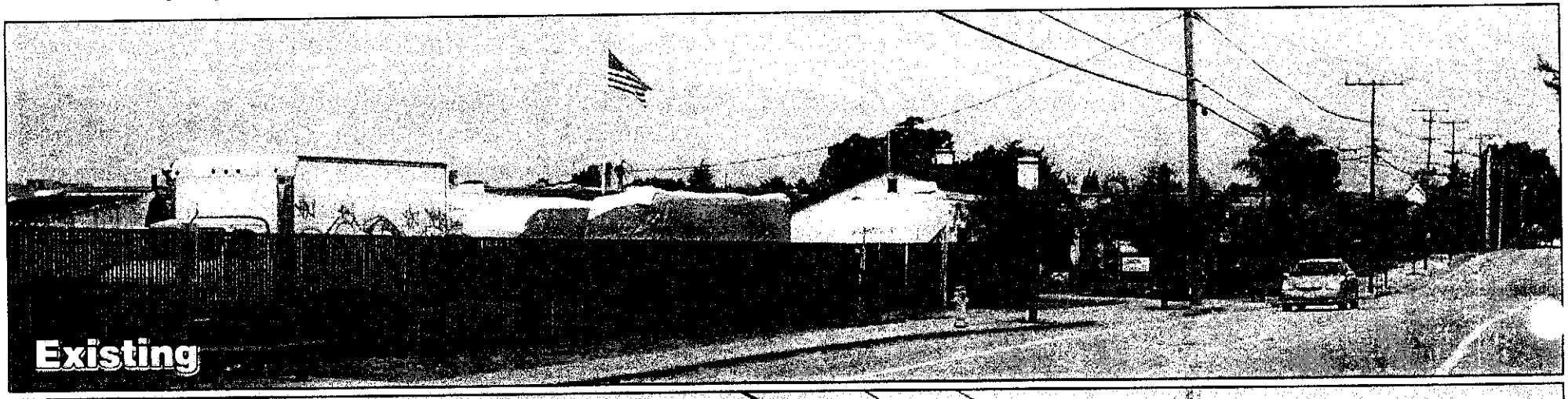
Ledyard Properties
1053 17th Ave
Santa Cruz, CA 85062
SF16711D

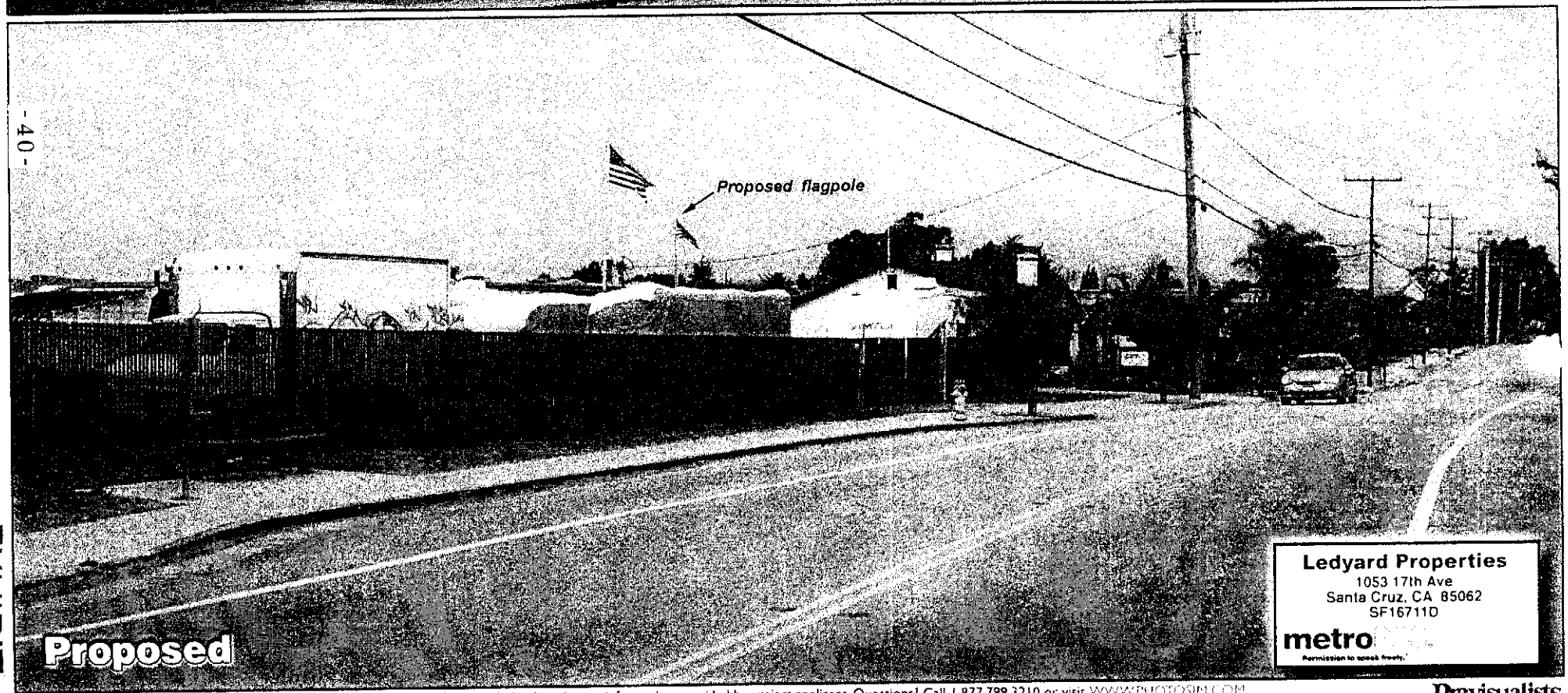
metro

Previsualists

EXHIBIT H

Photosimulation of view looking west-southwest along Brommer Street.





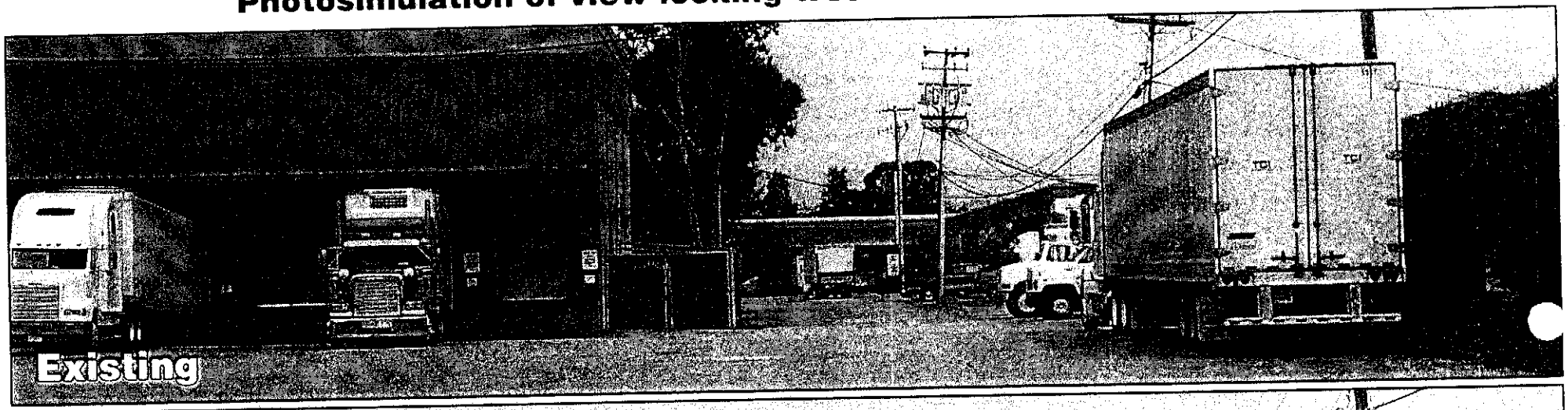
Ledyard Properties
1053 17th Ave
Santa Cruz, CA 85062
SF16711D

metro
Permission to speak freely.

EXHIBIT H

Previsualists

Photosimulation of view looking west-northwest from 17th Ave.



Ledyard Properties
1053 17th Ave
Santa Cruz, CA 85062
SF16711D

metro

Previsualists

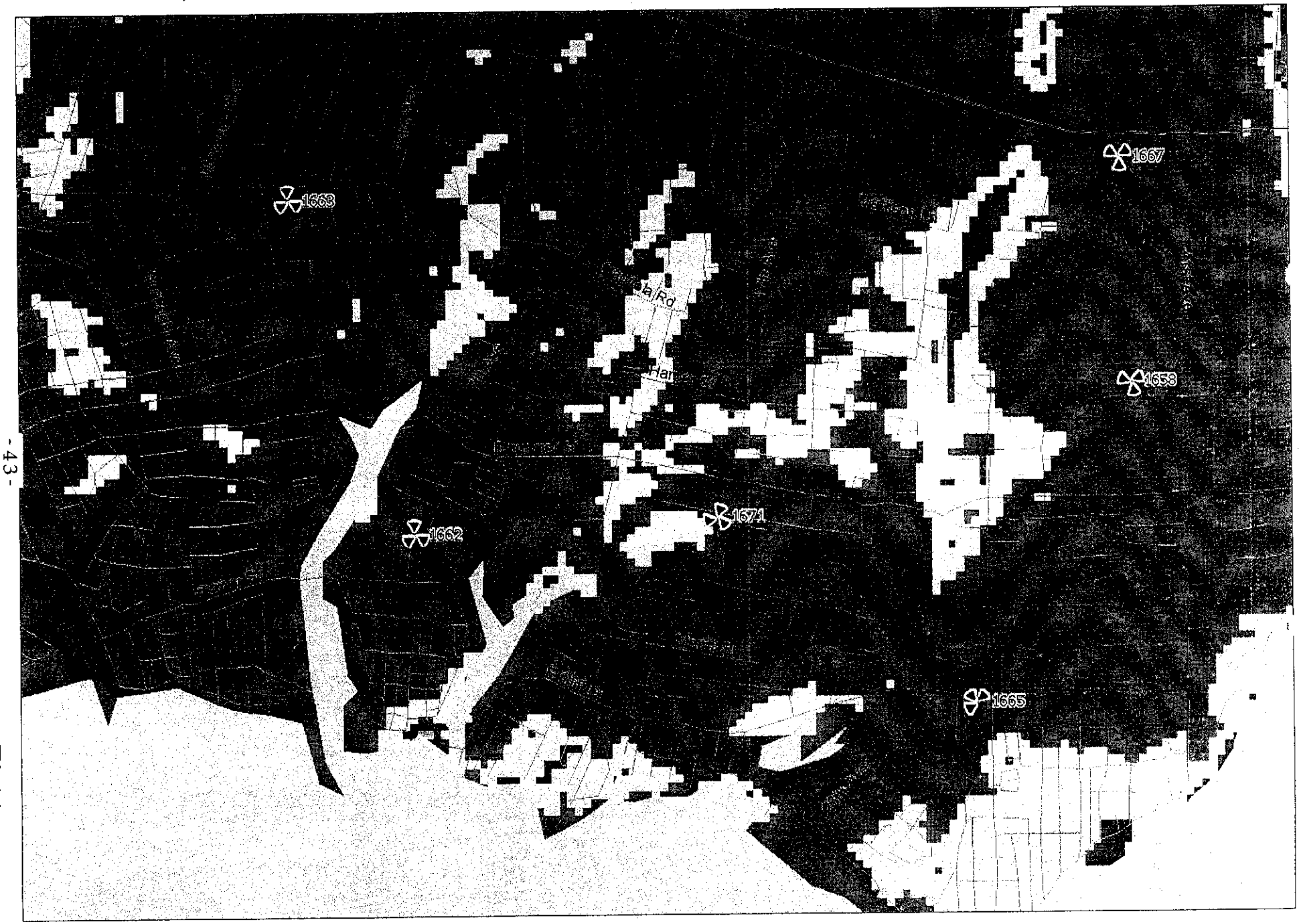
EXHIBIT H

Photosimulation of view looking east from El Dorado Ave.

Previsualists

EXHIBIT H

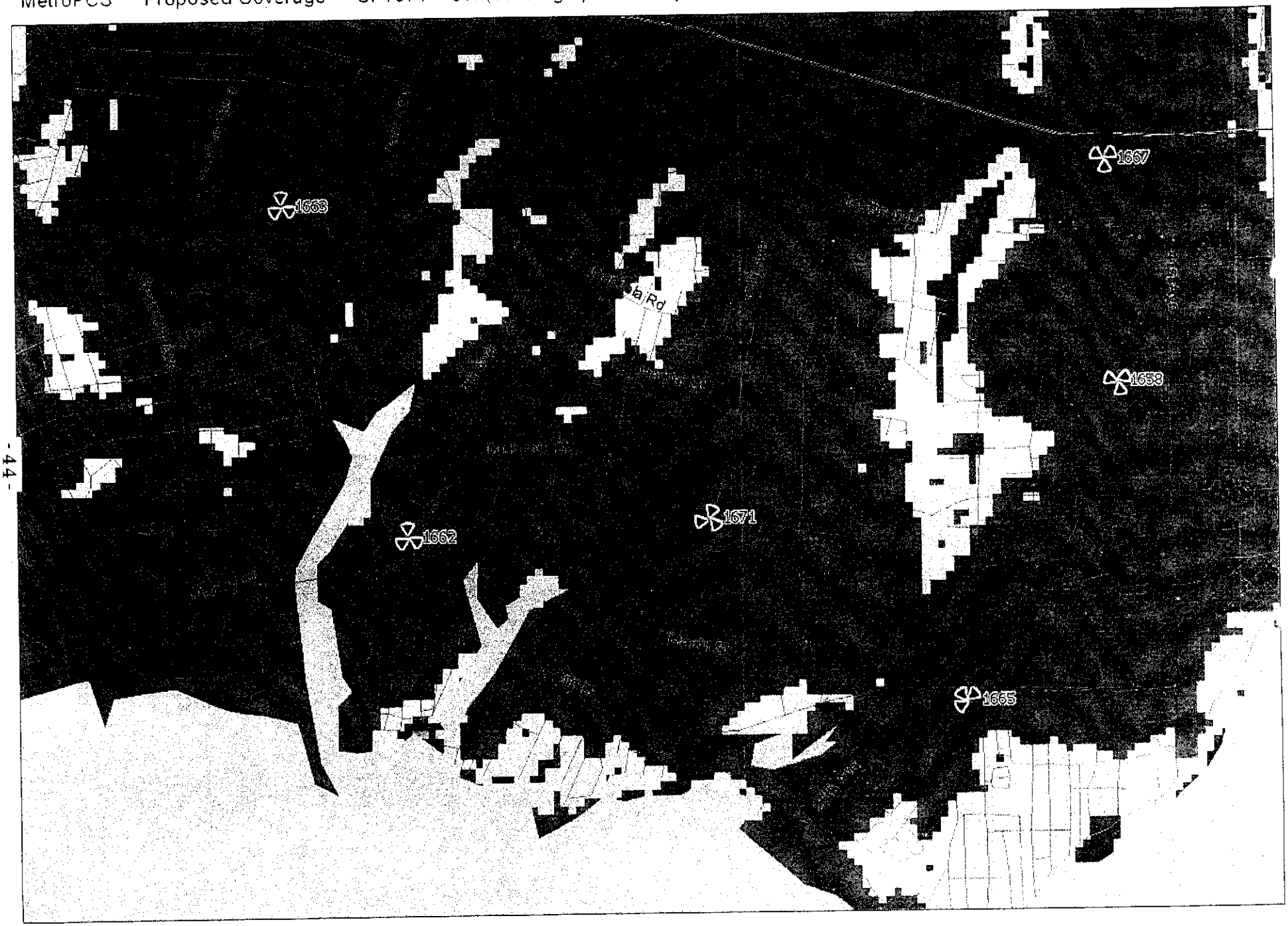
MetroPCS Proposed Coverage SF1671 - OFF (coverage prediction plot - shown with only existing sites on air)



November 21st 2006 Site offers both coverage and capacity to the area

EXHIBIT 1

MetroPCS Proposed Coverage SF1671 - ON (coverage prediction plot - shown with existing sites on air)



November 21st 2006

EXHIBIT T

subject: Bellcore Requirement GR-487-CORE
Section 3.28 (R3-157) Acoustical Noise Suppression
Test Report on Flexent Modular Cell Enclosure

date: January 24,2000

from: Gregory P. Mikus
Org. JC012E002
NJ0452, 1H3B
(973) 426-1230
gmikus@lucent.com

Memorandum for Record

Introduction

The Acoustical Noise Suppression test was performed on the **Outdoor** Flexent Modular Cell enclosure at NU laboratories located in Annandale NJ on **January** 24,2000 in order to verify compliance to the Bellcore requirement specified in section 3.28 of GR-487-CORE (Generic Requirements for Electronic Cabinets) see Noise Unlimited test report No. **9065.1.** Marvin Lowman of Noise Unlimited Inc. conducted the testing. G. Mikus and J. Stofanak of Lucent Technologies were present during **the** testing.

Bellcore Reauirement Description (R3-157)

Cabinets, equipped with telecommunications equipment and associated cooling fans, shall suppress acoustical noise to a level of 65dBA at a distance **of 1.5** m **(5 A)** from the cabinet with the doors closed during times of maximum noise generation within the cabinet.

Test Procedure:

- Sound measurements shall be made in a room or enclosure that duplicates **as** much **as** possible the acoustic properties of a network facility and the actual service environment.
- The sound level shall be measured by a sound meter meeting ANSI 1.4, and set to the A-weighting scale and the slow meter response setting.
- Measurements shall be made in accordance with ANSI **S1.18.**
- Cabinet doors shall he closed.
- Sound levels produced shall be measured at 5ft from the cabinet surfaces in all horizontal directions at a height of **3A** from the cabinet-mounting surface.

EXHIBIT J

Test Setup

The Flexent Modcell outdoor version was placed inside the acoustic room; a background noise measurement was taken. The Modcell outdoor version enclosure was then rendered operational and acoustic measurements were taken around the enclosure.

Test Results

Position	Location	DBA re: 20 uPa
I		
1	Front	61
2	Left Side	53
3	Rear	52
	Right Side	53

At the completion of the test as described in the Bellcore requirement the Flexent Modular Cell test data was reviewed and the noise levels did not exceed the specified requirement. Therefore the Outdoor Flexent Modular Cell enclosure meets the requirements set forth in Bellcore GR-487 –CORE section 3.28. This data is also in the Noise Unlimited test report No. 9065.1

Respectfully,

Gregory P. **Mikus**

EXHIBIT J

COUNTY OF SANTA CRUZ | Planning Department

INTEROFFICE MEMO

APPLICATION **NO: 06-0701** (second routing)

Date May 16,2007

To Cathy Graves, Project Planner

From Larry Kasparowitz, Urban Designer

Re Design Review for new cellular antennae at Ledyard, 1053 17th Avenue, Santa Cruz

GENERAL PLAN / ZONING CODE ISSUES

Design Review Authority

13.10.663 General development performance standards for wireless communication facilities

Evaluation Criteria	**Meets** criteria In code (✔)	Does not meet criteria (✔)	Urban Designer's Evaluation
Site location and development of wireless communications facilities shall preserve the visual character. native vegetation and aesthetic values of ,he parcei on which such facilities are proposed, the jurrounding parcels and road right-of-ways, and the surrounding land uses to the greatest extent that is echnically feasible, and shall minimize visual impacts on surrounding land and land uses to the greatest sxtent feasible	✔		
Facilities shall be integrated to the maximum extent feasible to the existing characteristics of the site, and every effort shall be made to avoid, or minimize to the maximum extent feasible, visibility of a wireless communication facility within significant public	✔		
Utilization of camouflaging and/or stealth techniques shall be encouraged where appropriate.	✔		
Support facilities shall be integrated to the existing characteristics of the site, so as to minimize visual	✔		
Co-location is generally encouraged in situations where it is the least visually obtrusive option, such as when increasing the height/bulk of an existing tower would result in less visual impact than constructing a	✔		

EXHIBIT K

Ridgeline Visual Impacts			
Wireless communication facilities proposed for visually prominent ridgeline, hillside or hilltop locations shall be sited and designed to be as visually unobtrusive as possible. Consistent with General Plan/LCP Policy 6.6.6, wireless communication facilities should be sited so the top of the proposed tower/facility is below any ridgeline when viewed from public roads in the vicinity.			**NIA**
If the tower must extend above a ridgeline the applicant must camouflage the *tower* by utilizing stealth techniques and hiding it among surrounding vegetation.			**N/A**
Site Disturbance			
Disturbance of existing topography and on-site vegetation shall be minimized, unless such disturbance would substantially reduce the visual impacts of the facility.			**NIA**
Coastal Zone Considerations			
New wireless communication facilities in any portion of the Coastal Zone shall be consistent with applicable policies of the County **Local** Coastal Program (LCP) and the California Coastal Act.	✔		
No portion of a wireless communication facility shall extend onto or impede access to a publicly used beach.	✔		
Power and telecommunication lines servicing wireless communication facilities in the Coastal Zone shall be required to be placed underground.	✔		
Consistency with Other Regulations			
All proposed wireless communication facilities shall comply with the policies of the County General Plan/Local Coastal Plan and all applicable development standards for the zoning district in which the facility is to be located, particularly policies for protection of visual resources (i.e., General Plan/LCP Section 5.10). Public vistas from scenic roads, as designated in General Plan Section 5.10.10, shall be afforded the highest level of protection.	✔		
Visual Impacts **to** Neighboring Parcels			
To minimize visual impacts to surrounding residential uses, the base of any new freestanding telecommunications tower shall be set back from any residentially zoned parcel a distance equal to five times the height of the tower, or a minimum of three hundred (300) feet, whichever is greater.	✔		

This requirement may be waived by the decision making body if the applicant can prove that the tower will not be readily visible from neighboring residential structures, or if the applicant can prove that a significant area proposed to be served would otherwise not be provided personal wireless services by the subject carrier, including proving that there are no viable, technically feasible, environmentally equivalent or superior alternative sites outside the prohibited and restricted areas designated in Section 13.10.661(b) and 13.10.661(c).	✔		

Evaluation Criteria	Meets criteria In code (✔)	Does not meet criteria (✔)	Urban Designer's Evaluation
Uon-flammable Materials			
All wireless communication facilities shall be constructed of non-flammable material, unless specifically approved and conditioned by the County to be otherwise (e.g., when a wooden structure may be necessary to minimize visual impact).	✔		
Tower Type			
All telecommunication towers shall be self-supporting monopoles except where satisfactory evidence is submitted to the appropriate decision-making body that a non-monopole (such as a guyed or lattice tower) is required or environmentally superior.	✔		
All guy wires must be sheathed for their entire length with a plastic or other suitable covering.			NIA
Support Facilities			
The County strongly encourages all support facilities, such as equipment shelters, to be placed in underground vaults, so as to minimize visual impacts.			NIA
Any support facilities not placed underground shall be located and designed to minimize their visibility and, if appropriate, disguise their purpose to make them less prominent. These structures should be no taller than twelve (12) feet in height, and shall be designed to blend with existing architecture and/or the natural surroundings in the area or shall be screened from sight by mature landscaping.	✔		
Exterior Finish			
All support facilities, poles, towers, antenna supports, antennas, and other components of communication facilities shall be of a color approved by the decision making body.	✔		
Components of a wireless communication facility which will be viewed against soils, trees, or grasslands, shall be of a color or colors consistent With these landscapes.			N/A

ll proposed stealth tree poles (e.g., "monopines") iust use bark screening that approximates natural ark for the entire height and circumference of the ionopole visible to the public, as technically feasible.			N/A
'isual Impact Mitigation			
ipecial design of wireless communication facilities iay be required to mitigate potentially significant idverse visual impacts, including appropriate amouflaging or utilization of stealth techniques.	✔		
Jse of less visually obtrusive design alternatives, such is "microcell" facility-types that can be mounted upon existing utili poles, is encouraged.			N/A
Telecommunication towers designed to look like trees e.g., 'monopines") may be favored on wooded sites with existing similar looking trees where they can be designed to adequately blend with and/or mimic the existing trees. In other cases, stealth-type structures hat mimic structures typically found in the built environment where the facility is located may be appropriate (e.g., small scale water towers, barns, and other typical farm-related structures on or near agricultural areas).			N/A
Rooftop or other building mounted antennas designed lo blend in with the building's existing architecture shall be encouraged.			NIA
Co-location of a new wireless communication facility onto an existing telecommunication tower shall generally be favored over construction of a new tower.			N/A
Owners/operators of wireless communication towers/facilities are required to maintain the appearance of the tower/facility, as approved, throughout its operational lie.	✔		
Public vistas from scenic roads, as designated in General Plan/LCP Section 5.10.10, shall be afforded the highest level of protection.			N/A
Height			
All towers shall be designed to be the shortest height possible so as to minimize visual impact.			N/A
Any applications for towers of a height more than the allowed height for structures in the zoning district must include a written justification proving the need for a tower of that height and the absence of viable alternatives that would have less visual impact, and shall, in addition to any other required findings and/or requirements, require a variance approval pursuant to County Code Section 13.10.230.			N/A
Except for as provided for under Section 13.10.663 (a)(5), all wireless communication facilities shall be unlit except when authorized personnel are present at night.	✔		

All wireless communication facilities shall be served by the minimum sized roads and parking areas feasible.	✔		
Vegetation Protection and Facility Screening			
In addition to stealth structural designs, vegetative screening may be necessary to minimize wireless communication facility visibility within public viewsheds.			N/A
All new vegetation to be used for screening shall be compatible with existing surrounding vegetation.			N/A
Vegetation used for screening purposes shall be capable of providing the required screening upon completion of the permitted facility (i.e., an applicant cannot rely on the expected future screening capabilities of the vegetation at maturity to provide the required immediate screening).			N/A
All telecommunications facilities to be located in areas of extensive natural vegetation shall be installed in such a manner so as to maintain the existing native vegetation. Where necessary, appropriate mature landscaping can be used to screen the facility. However, so as to not pose an invasive or genetic contamination threat to local gene pools, all vegetation proposed and/or required to be planted that is associated with a wireless communication facility shall be non-invasive species native to Santa Cruz County, and specifically native to the project location.			N/A
Non-native and/or invasive species shall be prohibited (such as any species listed on the California Exotic Pest Plant Council "Pest Plant List" in the categories entitled 'A','B', or 'Red Alert'). Cultivars of native plants that may cause genetic pollution (such as all manzanita, oak, monkey flower, poppy, lupine, paintbrush and ceanothus species) shall be prohibited in these relatively pristine areas.			N/A
All wireless communication facility approvals in such areas shall be conditioned for the removal of non-native invasive plants (e.g., iceplant) in the area disturbed by the facility and replanting wifh appropriate non-invasive native species capable of providing similar or better vegetated screening andlor visual enhancement of the facility unless the decision making body determines that such removal and replanting would be more environmentally damaging than leaving the existing non-native and/or invasive species in place (e.g., a eucalyptus grove that provides over wintering habitat for Monarch butterflies may be better left alone).			N/A
All applications shall provide detailed landscapelvegetation plans specifying the non-invasive native plant species to be used, including identification of sources to be used to supply seeds and/or plants for the project.			N/A

Any such landscape/vegetation plan shall be prepared by a qualified botanist experienced with the types of plants associated with the facility area. For purposes of this section, "mature landscaping" shall mean trees, shrubs or other vegetation of a size that will provide the appropriate level of visual screening immediately upon installation.			N/A
All nursery stock, construction materials and machinery, and personnel shall be free of soil, seeds, insects, or microorganisms that could pose a hazard to the native species or the natural biological processes of the areas surrounding the site (e.g., Argentine ants or microorganisms causing Sudden Oak Death or Pine Pitch Canker Disease).			N/A
Underground lines shall be routed outside of plant drip lines to avoid damage to tree and large shrub root systems to the maximum extent feasible.			N/A

CENTRAL
FIRE PROTECTION DISTRICT
of Santa Cruz County
Fire Prevention Division

930 17th Avenue, Santa Cruz, CA 95062
phone (831) 479-6843 fax (831) 479-6847

Date:	December 19,2006
To:	Ledyard Properties
Applicant:	**Evan Shepherd Reiff**
From:	Tom Wiley
Subject	**06-0701**
Address	**1053 17th Ave.**
APN:	026-311-65
OCC:	1808
Permit:	20060385

We have reviewed plans for the above subject project. District requirements appear to have been met.

The job copies of the building and fire systems plans and permits must be on-site during inspections.

Submit a check in the amount of $100.00 for this particular plan check, made payable to Central Fire Protection District. **A** $35.00 **Late Fee** may be added to your plan check fees if payment is not received within 30 days of the date of this Discretionary Letter. INVOICE MAILED TO APPLICANT. Please contact the Fire Prevention Secretary at (831) 479-6843 for total fees due for your project.

If you should have any questions regarding the plan check comments, please call me at (831) 479-6843 and leave a message, or email me at tomw@centralfDd.com. **All** other questions may be directed to Fire Prevention at (831)479-6843.

CC: File & County

As a condition of submittal of these plans, the submitter, designer and installer certify that these plans and details comply with applicable Specifications, Standards, Codes and Ordinances, agree that they are solely responsible for compliance with applicable Specifications, Standards, Codes and Ordinances, and further agree to correct any deficiencies noted by this review, subsequent review, inspection or other source. Further, the submitter, designer, and installer agrees to hold harmless from any and all alleged claims to have arisen from any compliance deficiencies, without prejudice, the reviewer and the Central FPD of Santa Cruz County.
1808-121906

EXHIBIT K

Cathy Graves

From: Paul Rodrigues
Sent: Wednesday, May 09,2007 11:10 AM
To: Cathy Graves
Cc: Melissa Allen; Betsey Lynberg
Subject: 06-0701

Cathy,

As you know Melissa Allen our Planner is still out of the office this week and so we're unable to provide our typical formal RDA comments.

I have reviewed the additional material submitted for application 06-0701, the proposed MetroPCS/ Flag Pole on the Ledyard properties. It appears that the applicant has responded to most of the concerns expressed by the RDA in previous comments - deleting the nigh! lighting of the flag, undergrounding of the overhead wires etc.

We would defer to the planning department as to a determination whether the required distance from potential residential development is appropriate.

We have only one further comment and that is that the size of the proposed flag appears rather large for this height and size pole. There appears to be nothing in the applicant's citation of the US Code which defines what size flag is to be used for this particular installation. In looking at the flag pole in front of the County Courts building, it appears that the height of that pole is about 50-60 feet and the flag is about 5'-6'x 7'-8'. The applicant's proposed flag size - 8'x12' seems quite large and may appear out of proportion to the height of the pole. We would suggest that a smaller flag be used.

We hope that you find these suggestions useful, please let me know if you have any questions. Thank you for the opportunity to comment on these plans.

Paul Rodrigues
RDA Project Manager
x2386

EXHIBIT K

COUNTY OF SANTA CRUZ

Inter-Office Correspondence

DATE: May 16, 2007

TO: Tom Bums, Planning Director
Cathy Graves, Planner

FROM: Supervisor Jan Beautz

RE: Comments on Application 06-0701, Wireless facility, 1053 17th Ave, AFN 026-311-65
Second Routing

This application is for a 50 foot tall wireless communication facility in the area of 17th Ave and Brommer St. Please take the following comments into consideration in your review of this application.

Antennas of this **type** intentionally focus their energy horizontally. Figure 3B shows that within the 1,000 ft radius of the antenna lies both the Simpkins public swimming pool and a portion of Shoreline Middle School. This is of particular concern in this case because Shoreline Middle School has both first and second story classrooms. **As** a result, these second story classrooms will be subjected to substantially more electromagnetic radiation than they would be at ground level. In fact, a review of Figure 3A shows that Shoreline's second story classrooms, at 1,000 feet from the antenna, will actually receive approximately the same radiation as if they were located just 50 feet from the antenna at ground level. It is unlikely that a facility of this type would be allowed were it to be proposed for just 50 feet from a ground level classroom.

How will the above issue **be** addressed?

EXHIBIT K

Rich Apple
1682 Colony Way
Santa Cruz, CA
95062-3066
July 24th, 2007

Zoning Administrator
County Government Center
701 Ocean Street, Room 400
Santa Cruz, CA 95060

Re: 06-0701 (Proposal Number? Hearing Number?)
APN(S): 026-311-65 (Parcel Number)

Zoning Administrator,

I am opposing the Commercial Development Permit request for the wireless communication facility at 105317th Avenue in the Live Oak Planning Area, or at least the waiver of the requirement that the tower be set back 300-feet from the residentially zoned parcels on El Dorado.

I am opposing the proposal (and if the proposal is accepted, the waiver) based on the resulting visibility of the "monopole" from residential areas I live near and walk through.

It is my understanding that federal laws protecting the telecommunications industry do not allow communities to prevent private owners from putting up cell towers based on health concerns, so it seems to me that our zoning laws are all we have to control where cell towers are placed.

In accordance with zoning rules, please accept my request that the proposal be denied, or at least the waiver to the 300 foot set-back rule denied, based on whatever the zoning considerations were to put that 300 foot rule into place to begin with.

If I'm not up on the rules of the telecommunications act and objections based on the possible health risks of cell towers are acceptable for arguments to accept or deny such proposals and/or waivers to the 300 foot zoning rule, please also accept my request that the proposal or at least the waiver be denied on the "health risk" basis as well.

It is exactly the zoning laws that many concerned communities across this country are using as a means to "not take any chances" with the health of their citizens, especially small children. Typically the zoning requirement they use to keep cell towers away from residential neighborhoods, public parks, playgrounds and schools is a 500 foot rule rather than the 300 foot rule we have.

So at the very least please do enforce the zoning rules that we have. I regret that 1 will only be able to submit these written comments because my work load and project deadlines are too pressing for me to attend this hearing on Friday, August 3rd.

Thank You,

Rich Apple

EXHIBIT L

Live Oak School District

Excellence is achieved through a caring partnership

David S. Paine, Ed.D.
Superintendent

July 30, 2007

Richard Fontana, General Manager
Ledyard Company
1005 17"Avenue
Santa Cruz, CA ***95062***

Dear Mr. Fontana,

It has recently come to my attention that a cell phone tower is being planned for installation at your site adjacent to Shoreline Middle School located at **855** 17th Avenue.

1 acknowledge that there are conflicting views and perspectives about the potential effects of exposure to the electromagnetic radiation (EMR) produced by such towers. However, when the possibility for potential negative impact on students' **health** and safety becomes a concern, it is incumbent upon the leadership of the Live Oak School District to express its concern to the parties involved.

As a result, I **am** asking that all decisions involving the installation of cell towers be put on hold and that prudent caution be exercised **until** all such towers are proven conclusively **to** be safe. I **am** asking specifically **that this item be removed from the August 3rd Santa Cruz County Zoning Administrator's meeting and delayed** to a later date when members of the school community will be available to **participate in the discussion.**

Sincerely,

David S. Paine

David S. Paine, Ed.D.
Superintendent

C: Live Oak School District Board of Trustees
Jan Beautz, Santa Cruz County Board of Supervisors
✓Pia Levine, **Santa** Cruz County Planning
John Laird, California Assembly Member
Sam Farr, U.S. Representative
Jessica **Middour** and Victoria Edgell, Live Oak Elementary Teachers' Association
Gary Wilson, California School Employees' Association
Marilyn Garrett

EXHIBIT I

Glenda Hill

From: Douglas Johnson [djcruzerl@yahoo.com]
Sent: Thursday, August 02,2007 2:16 PM
To: Don Bussey; Glenda Hill; Cathy Graves; Jan Beauh
Cc: Ellen Pine; Neal Coonerty; Tony Campos; Mark Stone
Subject: Zoning Administrator. Aug. 3 hearing

August 2,2007

Don Bussey, Glenda Hill
Zoning Administrator
Planning, County of Santa Cruz
701 Ocean Street, 4th Floor
Santa Cruz, **CA** 95060

Subject: Ledyard Application & Waiver, 06-0701

Dear Mr. Bussey & Ms. Hill -

I'm a resident **on** the southern end of El Dorado Avenue in Santa Cruz and a newcomer to the subject of cell phone towers and their impact on neighbors living near them. Since reading your August **3** hearing notice, I've been trying to learn about this Ledyard proposal and the issues regarding cell towers.

1) Would this project increase the sound level generated by Ledyard at night? Would it result in Ledyard trucks being "staged" closer to my home? **The** refrigeration motors droning and restarting on the trucks often interferes with my sleep at night. Also, some studies mention continuous low intensity electromagnetic radiation (produced by cell towers) as responsible for "changes in sleep patterns." Will "humming" or other sound from **the** tower equipment be added to **the** trucks' refrigeration motor noise?

2) What community good or public good would be gained by approving this waiver from **the** county's zoning laws? Wouldn't the waiver result in putting the cell tower project closer to me and my neighbors? How would approving this waiver request accomplish a community benefit for me and my neighbors? Don't the zoning laws exist for the benefit of the entire neighborhood? Would approving this waiver request be fair to the people living near the proposed cell tower project?

3) I asked Dr. Dean Edell, "America's Doctor," on July 30,2007, if he would want a cell phone tower built a few hundred feet fiom his home. He said no. Dr. Edell would object because of the possible negative impact on nearby real estate values. Separate from **the** possible health issues posed by cell towers, if people ***believe*** cell towers **are** a health hazard to nearby residents, nearby property values may be reduced.

4) Some studies say continuous exposure to electromagnetic radiation from cell towers sustained by nearby neighbors is not healthy. Dr. Dean Edell told me there are no definitive studies yet that settle **the** health issues conclusively, but he said, "Occasionally [there's] a 'bump' [an increase in medical statistics] for people who work on **the** [cell] tower(s)." This information may interest Richard Fontana and the people who would work on **the** tower. Dr. Edell added that cell towers may be "like cigarettes" in that possible health hazards may not be proven until more scientific studies are completed.

EXHIBIT L

5) A physician familiar with leukemia research was interviewed by KGO Radio on July **30,2007,** following the death of former Forty-Niners coach Bill Walsh. **The** doctor said there **are** two **known** causes of leukemia: "benzene and radiation." I wonder if researchers will eventually discover that continuous **exposure** to cell phone tower radiation is a contributing factor to some incidences of leukemia.

6) What will the tower **and** facility actually look like? That's not clear to me

Conclusion

At *minimum,* I'd like **more time** to read the entire project application and **the** accompanying public documents before you make a decision on this matter. Would you be willing to allow neighbors **like** me who live near the proposed cell phone tower to review all of **the** proposed project's application documents before you make any decision on this project and its waiver?

Sincerely,

Douglas Johnson

P. **O. Box 5274**
Santa Cruz, CA 95063

-----Original Message-----
From: pleasure_point_I@yahoo.com [mailto:pleasure_point_I@yahoo.com]
Sent: Tuesday, August 21,2007 4:20 PM
To: Cathy Graves; Jan Beautz
Subject: Cell tower

0.1.06-0701 1053 17TH AVENUE, SANTA CRUZ
APN(S): 026-311-65

I would not grant an exemption for the placement of this tower.
The School board seems to have questions about their safety.
As it is close to the swim center, school, neighbors and a busy road, it would be wise to use the little regulatory power the County has.
This would seem to be one of the worse places to put a tower. even if it may only have health risks.
Remember DDT, lead paint, X Rays to see how shoes fit, even smoking was supposed to be good.
We have only a tiny amount *of* say over this technology, please do not test it on our kids.

Thank you
Charles Paulden

EXHIBIT L

#10.1
9-7-07

YAHOO! MAIL Classic

Print - Close Window

Date: Mon, 21 Aug 2007 17:02:17 -0700 (PDT)

From: "Douglas **Johnson**" <djcruzer1@yahoo.com>

Subject Ledyard noise

To: Jan.Beautz@co.santa-cruz.ca.us

August 27,2007

Chairperson Jan Beautz
County Board of Supervisors
701 Ocean Street, 5th Floor
Santa Cruz, California 95060

Subject: Ledyard noise

Dear Chairperson Beautz

I've been suffering lor well over a year from the night-time noise generated by the refrigeration motors droning, vibrating and periodically restarting on the Ledyard trucks till 3:00AM or 4:00AM, Sunday night through Thursday night.

Though he never returned my phone call, Ledyard president and CEO Richard Fontana was kind enough to let me speak with Ledyard day manager John Crist and night manager Manny Garbez. I appreciate that communication. A brief chronology of my efforts follows.

3/20/06 - 3/27/06: After much loss 01 sleep due to night-time Ledyard truck noise, my physician gave me his diagnosis: "I think your fatigue is due to sleep disturbance."

4/19/06: I called Sheriff at 3:30AM to report motor or generator noise restarting every hall hour and keeping me awake all night.

4/20/06: Spoke to Ledyard employee at Ledyards 17th Avenue entrance at 1:30AM to inquire about motor/generator/start-up noise. He said maybe it was freezer generators.

4/26/06: Told Ledyard day manager John Crist I was losing sleep due to start-up motor or generator noise till 2:30AM Seemed to be more noisy lately. I asked if it would abate or end. John not sure about source *of* noise.

4/27/06: Spoke to John Crist about truck noise. He said generators are tested on Mondays from 9:00AM to 10:00AM. Generators only used during power failures. No new construction. He said nothing was out of norm. John said he didn't know what would cause the late-night noise.

5/8/06: Spoke with Ledyard night manager Manny Garbez about the noise. Said he'd check refrigeration on trucks on western Ledyard boundary closest to southern El Dorado Avenue where I live. Manny said, "When temperature goes up in refrigeration truck, ["idling"] refrigeration motor restarts to make it colder."

5/8/06: Told John Crist **low,** vibrating motor noise interferes with my sleep

5/9/06: Left message for Manny Garbez. Can droning, vibrating motor noise be stopped, particularly alter midnight?

5/19/06: Got Richard Fontana's name from reference librarian. Met Mr. Fontana for a few minutes at Ledyard. He asked, "Can we meet Monday?" I said sure. He gave me his business card. Then John Crist gave me a tour of Ledyard. Santa Cruz Asphalt Company near El Dorado Avenue bought by Ledyard. It's now part of western-most Ledyard property. Trucks were moved closer to me for a while. Then on my complaint in April 2006, trucks moved more toward center of **Ledyard** property.

5/22/06: I called Mr. Fontana about "Monday meeting." Told he was "at lunch." I left him phone message. Said I met

EXHIBIT L

with John Crist to discuss motor start-up noise on refrigeration trucks. I said, "You're in a better position than I am to know the cause of the noise keeping me awake at night." I added, "I hope the noise can be stopped; particularly after midnight." Never got an answer from Richard Fontana. No "Monday meeting." No subsequent meeting.

5/31/06: Called Manny Garbez. He described three trucks in "Falcon" area closer to me. Refrigeration motor started up at end of my call at 3:30AM. Manny said, "Happy to give you a tour on a non-busy night."

Note: There's no wall between Ledyard and me. Sound from refrigeration trucks travels straight from Ledyard across Johnson Paving to hit my home.

6/13/06: Asked Manny Garbez for tour. Mentioned droning and humming motor noise

6/15/06: I drove lo Ledyard and requested tour. Manny Garbez gave me tour of Ledyard near midnight on that "non-busy" night. Maybe about 5 or 6 trucks being :'staged" and loaded with refrigerated food. One truck right on western-most boundary nearest me had its refrigeration unit running. Manny turned it off. Later, Manny reset another trucks refrigerator thermostat from *30* degrees to 38 degrees. Standing near open area on western boundary, I explained how noise was traveling through "open" fence to hit my home on El Dorado Avenue. Manny said heavy truck traffic on Monday to Thursday. Lighter Friday. Shut down on Saturday. Starts again Sunday. Manny said trucks not "staged" near western boundary near me after my April 2006 call. So, why did we *see* a truck with refrigeration unit running on western boundary near me?

Note: The refrigeration truck noise has continued. Sometimes lighter. Sometimes louder. Sometimes till 4:00AM. Sometimes abating sooner. The number of trucks making noise varies due to Ledyard's scheduling *of* deliveries. Sometimes I sleep. Sometimes I don't. Most of the time I don't sleep. At my request, Rita Winings checked for Ledyard's conditions *of* approval and found none. Rita told me on 8/15/07 that the County Planning Department has "no file" and "no **use** permit" for Ledyard.

7/31/07: Saw my physician about my health problems due to lack of sleep

8/15/07: Attended restorative sleep class taught by my physician.

Note: It seems to me one of the significant contributing factors to the noise from Ledyard hitting my home till 3:00AM or 4:00AM is the absence of a sound wall or sound barrier on Ledyards western boundary closest to El Dorado Avenue.

Whatever you can do to stop the noise from Ledyard at night would be appreciated. Thank you for your willingness to help.

Sincerely

Doug Johnson

P. O. Box 5274
Santa Cruz, California 95063
831-479-9097
djcruzerl @yahoo.com

EXHIBIT L

Glenda Hill

From: Rahn Garcia
Sent: Thursday, August 30, 2007 4:49 PM
To: 'Douglas Johnson'
Cc: Glenda Hill; Cathy Graves; Don Bussey; Jan Beauh
Subject: RE: RE: Planner's Justification for Waiver (06-0701)

Dear Mr. Johnson.

I'm sorry for the delay in responding to you, however I just reviewed your email having been out of the office since the 8th of this month. I'm afraid that I am unable to respond to your particular questions as this Office does not provide individual members of the public with legal advice.

As you may be aware: the legal and policy issues associated with the siting of wireless communication facilities has been a matter of significant public interest and debate in our county over the past few years. You may consider reading some of the staff reports and materials submitted to the Board of Supervisors during the development of the County's regulations on wireless communication facilities. These materials may be of use to you in addressing your questions. and can be accessed through the internet in the archives of the Board (see http://www.co.santa-cruz.ca.us/).

Sincerely. Rahn Garcia

[Rahn Garcia] -----Original Message-----
From: Douglas Johnson [mailto:djcruzerl@yahoo.com]
Sent: Friday, August 10, 2007 3:39 PM
To: Rahn Garcia
Cc: Glenda Hill; Cathy Graves; Don Bussey; Jan Beautz
Subject: Fwd: RE: Planner's Justification for Waiver (06-0701)

August 10, 2007

Rahn Garcia
Assistant County Counsel
County of Santa Cruz
701 Ocean Street, 5th Floor
Santa Cruz. California 95060

Dear Mr. Garcia -

The Zoning Administrator will hear an Aug. 3, 2007, item continued to Sept. 7, 2007, at 8:30AM regarding a possible waiver for a proposed cell phone tower near my home. The tower would be 140 feet from residential **property.** I'm opposed to this proposal.

I would like to read your reply to some of the questions I raised in my Aug. 5, 2007, email to the Zoning Administrator in "forwarded message attached" below.

2-E. Is the purpose of our zoning laws to accomplish public good for the community and its "needs." **or** to accomplish private good for one private corporation and its "needs"?

EXHIBIT I

4. Does the federal Telecom Act quoted by the Zoning Administrator during the Aug. 3, 2007, hearing supersede, prevent or nullify any Santa Cruz County Planning Department public hearing prompted **by future** scientific studies presenting evidence that RF transmissions "may **pose** a hazard to human health and/or safety"? (Conditions of Approval, IV, G, p. 25)

5. On what basis, in addition to visual impact, can this proposed waiver be denied? Cathy Graves, the project planner, does "not believe there is another reason that the waiver can be denied." In **your** opinion, are there other legally admissible reasons this requested waiver can be denied?

I look forward to your reply.

Sincerely,

Douglas Johnson

P. **O. Box** 5274
Santa Cruz. California 95063

Note: forwarded message attached

EXHIBIT L

9-1-07

Dear Zoning Administrator,

I am writing out of concern about the proposed cell tower planned for Live Oak. I urge you to not allow the zoning waiver. The zoning laws are there to protect the residents + this is a good example of how this zoning law can protect us, the people living off 17th St in Live Oak, against the ill health effects of having a cell tower in our neighborhood. Please for the health of our families - children uphold the zoning requirements.

Sincerely,
Robin Everest
1555 Merrill St

EXHIBIT L

Glenda Hill

From: Don Bussey
Sent: Wednesday, September 05,2007 7:39 AM
To: Glenda Hill
Subject: FW: Ledyard/MetroPCS Tower

_____Original Message-----
From: sherman [mailto:smul23@earthlink.netl
Sent: Wednesday, September 05, 2007 7:11 AM
To: Don Bussey
Subject: re: Ledyard/MetroPCS Tower

Dear Mr. Bussey,

As a neighbor of the proposed installation(I live on Dougmar Dr.) I believe that the tower would be better located away from residential/school/business facilities, possibly in an area that is isolated away from human habitation, e.g., the mountainous area in the rural section of the county. Conceivably, the same concept of electromagnetic fields likened to that of second handsnoke as being injurious to one's good health.

Sincerely,
Sherman Unell

EXHIBIT L

9/5/07

Ms. Glenda Hill
Santa Cruz County Planning Department

Dear Ms. Hill.
I am writing this letter to express my concern about the proposed cell tower that may be installed off of 17th Avenue near Shoreline Middle School. I am a parent of an 8th grade student at Shoreline Middle School, a resident of the immediate vicinity (Silvana Lane), and I am employed full time at the end of El Dorado Avenue.

I am very concerned not only about the health and well-being of myself, my son, my family, my co-workers, friends and neighbors, but about the neighborhood compatibility of a cell tower being erected in this neighborhood. This has been a small, safe community for the many years I have lived here (off and on for 30 + years), raising my family. There are a few businesses in the neighborhood, but putting in a cell tower is an extreme for this area. It is mostly a residential community with a lot of families living in the immediate vicinity.

Please consider the area and the people who live here and make the decision NOT to allow the cell tower be installed.

Thank you for your time.

Sincerely,

Niko Takaoka Shattuck
(831) 464-5458

EXHIBIT I,

peacock
ASSOCIATES INC

September 6. 2007

Cathy Graves
Development **Review Planner**
County **of Santa Cruz** Planning Department
701 Ocean Street. 4th **Floor**
Santa Cruz, **CA** 95060

Via Facsimile: (831) 454-2131 & e-mail: PLN810@co.santa-cruz.ca.us

RE: Continuance for 06-0701 – Agenda Item #: 0.1 on September 7.2007

Dear **Ms.** Graves.

MetroPCS has been **informed** that the property owners **of Ledyard Properties at** 105317th Ave. **in** Santa **Cruz** are requesting **a** one-month continuance of item 06-0701 **which** was **scheduled** lo be heard at 8:30am **on** Friday September 7.2007 MetroPCS is in suppon of **their** request and respectfully **requests the continuance** on **behalf** *of* the property owner

Ihank you for your **time and** consideration in this **matter.**

Sincerely,

Jennifer Estes
Representing metroPCS

CC: John Christ – Ledyard **Properties**
Kersten Rutherford - metroPCS

5900 HOLLIS ST SUITE R1 EMERYVILLE CA 94608 TEC 510 420 5701 FAX 510 420 5702

EXHIBIT L

September 6, 2007

Cathy Graves
Development Review Planner
County of Santa Cruz Planning Department
701 Ocean Street, 4th Floor
Santa Cruz, CA 95060

Via Facsimile: (831) 454-2131 & e-mail: PLN810@co.santa-cruz.ca.us

RE: Continuance for 06-0701-Agenda Item #: 0.1 on September 7, 2007

Dear Ms. Graves,

As the property owners of Ledyard Properties at 1053 17th Avenue in Santa Cruz, **we** respectfully request a continuance of item 06-0701 for a minimum of a month to allow us to review materials submitted to the County of Santa Cruz Board of Supervisors which may have bearing on this application.

We appreciate your cooperation in this matter.

Sincerely,

John M. Christ
Vice President
Ledyard Company

EXHIBIT L

Neil **Sulborski**

From: Ellen Wood [editor@cruzio.com]
Sent: Thursday, September 06, 2007 6:41 **PM**
To: Nell Sulborski
Subject: Re: 0.1.06-0701 --- 1053 17TH AVENUE, SANTA CRUZ APN(S): 026-311-65

Attn: Nell Sulborski

Re: 0.1. 06-0701 1053 17TH AVENUE, SANTA **CRUZ** APN(S): 026-311-65

Dear Planners:

I am remiss in getting this to you late, but am hoping you will still hear my plea that this proposal (see below) NOT be granted. **I** believe this type of installation WILL be a health hazard to those in the area. Furthermore, to have this type of facility constructed so close to schools, in my estimation, shows lack of forethought on the part of developer. Surely, something not as potentially dangerous to the health/well being of all, could be recommended for this site.

Due to physical limitations, I'm unable to attend tomorrow's meeting. However, I DO HOPE MY VOICE WILL BE HEARD!

Thank you,

Ellen M. Wood

357 - 13th Avenue,

Santa Cruz, CA

Proposal to construct **a** new wireless communications facility on a site with a cold storage building and operations building. Includes three equipment cabinets on a new concrete slab and three antennas within a 50-foot tall "flagpole" monopole with power and telco services to the equipment, and a GPS antenna. Requires a Commercial Development Permit and a waiver of the requirement that the tower be set back 300-feet from residentially zoned parcels to minimize visual impacts. Property located on **the** west side of 17th Avenue approximately 450 feet south of the intersection with Brommer Street (1053 17th Avenue) in the Live Oak Planning Area.

OWNER: LEDYARD PROPERTIES

APPLICANT: EVAN SHEPHERD REIFFl

SUPERVISORIAL DIST: 1

PROJECT PLANNER: CATHY GRAVES, 454-3141

EMAIL: pln810@co.santa-cruz.ca.us
(CONTINUED FROM 8/3/07)

EXHIBIT I.

Glenda Hill

From: Diana Susoy [didi@susoy.com]
Sent: Thursday, September 06,2007 10:43 PM
To: Glenda Hill
Subject: Cell Tower Zoning Meeting

Dear Glenda,

I am a parent of a child in the Live Oak School District, at Shoreline Middle School, as well as an employee of the district, a librarian who is working hard to get my library open as soon as possible amongst all the construction. I am finding it difficult between parental responsibilities and work responsibilities to attend an 8:30am meeting concerning a matter that I have interest in.

I know that the superintendent of our District has asked for a continuance for a meeting that could be held at a time that would work better for the people of our community that has a very high population of working parents. I am also writing to you asking for that same continuance in regards to item #06-0701.

Diana Susoy
Resident of Live Oak

EXHIBIT L

Please submit this letter as part of official public comment at:
9/7/07 Zoning Administrators' Public Hearing
(I wanted to attend this mtg in **person** but **have** lo **work and** cannot appear in **person)**

September 6,2007

Ms. Glenda Hill
Zoning Administrator
Santa Cruz County Planning Department

Dear Ms. Hill,

I **am** writing this letter to express my concern about the proposed cell tower off of 17th Avenue near Shoreline Middle School and Simpkins Community Center. I am the parent of a 6th grader who often uses the Simpkins Swim & Community Center, and I work full-time at the end of El Dorado Avenue. Where I work and where my child and I swim; are less than 500' from the proposed tower site.

The possibility of this Metro PCS tower being installed leaves me very concerned because I believe that **another cell tower in this neighborhood is incompatible with this increasingly residential and community-oriented neighborhood.** Even though there are some industrial facilities, this is mostly a community where people live and gather. I am also very concerned about the health of my child, myself, my co-workers, friends and neighbors.

In addition I am concerned about visual blight and increased noise for this very family-oriented neighborhood. Though I am a resident of Aptos, my child and I spend significant periods of time near this proposed site.

Also: since Live Oak is a very flat area; I cannot imagine that this proposed new tower could be truly necessary for cell coverage. I've never heard of any problems with coverage in this area for anyone and understand that people with Metro PCS are able to use their cell phones on El Dorado. It would seem prudent for the carrier to do an alternative analysis to locate a possible secondary site option.

Please consider this area and the people who live and work here and make the decision **not** to allow the cell tower to be installed. Thank you for you attention to this matter.

Sincerely,

Susan Wallace
(831) 685-0231

EXHIBIT L

Glenda Hill

From: Cathy Graves
Sent: Thursday, September 06,2007 4:07 PM
To: Glenda Hill
Subject: FW: new cell tower a! shoreline/simpkins

Forwarding comments for ZA agenda

Cathy
Cathy Graves
Development Review Planner
(831) 454-3141

-----Original Message-----
From: CARL GRAUE [mailto:bahiacruz@sbcglobal.net]
Sent: Thursday, September 06, 2007 4:05 PM
To: Cathy Graves
Subject: new cell tower at shoreline/simpkins

Hello,
I am very concerned about the proposed additional cell tower at the Ledyard property near shoreline middle school and simpkins swim center. since there is already a tower there and coverage already exists...why do we need more??? Have the neighbors and students been adequately informed about the addition of another one? I wonder how it will look in the **future** when it becomes clear that our communitys' safety has been sold off for 'better coverage.' Who will be accountable?
We are living in a new era regarding the technological age and we need to create a sane wireless policy. The science already exists and now it is up to us to catch the laws up....we feel strongly that schools are no place for cell towers. All city schools have close proximity to these towers which emit electromagnetic radiation which effects all of us and the animals and plants we live with. We need our leaders to **take** leadership and help **us** create sane policies for the future. In Europe, they have already done the research and have a 1500ft set back from all schools. How long will it take for us to do the same. Incidentally, they also have a law saying that children 10 and under cannot use cell phones. The science already exists and it **is** up to us to step **up** and stand united with all the other families in our country and say NO.

We need you to step up to the plate and help our community now
Thank you,
Michelle
aka Mother Bear

EXHIBIT L

September 7, 2007

Please submit this statement to be part of public comment for Zoning Administrators' Public Hearing, **9/7/07**

Ms. Glenda Hill
Zoning Administrator
Santa Cruz County Planning Department

Dear Ms. Hill,

I want to thank you for allowing there to be public commentary today so that the local citizens can be in dialogue with their local government. For the record I wish to begin by saying that I am strongly opposed to the possible installation of the Metro PCS cell tower on the Ledyard Properties, at the west end of 1005 17th Ave. I work full time on El Dorado Ave and do not wish to be exposed in any way to such a cell tower which would be approximately 400-500' from where I work. Here are the reasons for my concern:

1. Negative Visual Imoact: The proposed tower would be a "stealth tower," in the shape of a flagpole and per applicant, 50' high. Currently from El Dorado Ave one can see multiple parking lot lights in the Ledyard parking lot; while the height of these is unknown it is thought that they are in the vicinity of 50'; they are quite easy to see from the homes which are on the east & west side of El Dorado and which are far beyond the 300' and one can deduce therefore that a flagpole shaped structure would be also. There is currently a flagpole-shaped cell tower near the corner of Brommer & 17th Ave.; I find this tower ugly visually at as it looks like a smokestack and makes the area look like a factory area which it is not. The proposed tower further would further contribute to this area looking like an ugly factory area; it would cause visual blight. I am aware that many CA communities have long-term dialogue with residents about putting electric wires underground simply because of visual blight and aesthetic reasons and thus I sincerely request that this department consider this as an important issue to local constituents. If there is an actual flag placed on this pseudo-flagpole, I believe there is a Ledyard building nearby on the east side of the proposed site; this could cramp the flag on at least one side, depending upon the exact height of the pole and building and I believe create a visual impact which communicates disrespect for the American Flag because it is not

EXHIBIT L

in a central area in which it can be respected but it could be in an area where it would flap against or on a building. Additionally, the negative visual impact would be experienced by houses which are less than 300' from the proposed site, thus breaking the current **300'** setback ordinance which states these structures need to be at least 300' from residences. Also, this tower could present a safety risk to the community as there are schoolchildren and passersby who may become curious about this unusual structure and either attempt to access it by climbing the Ledyard fence on the west end of that property or who could simply walk onto the unenclosed Ledyard property at the east end of that property at the open driveway.

2. The possibility that this **requested variance** could be granted by this department per Planning Dept Code # **13.10.230** is **a discretionary authorization,"** by the zoning administration and does not need to occur. Additionally in section c, 2 of this code it states that "the granting of such variance will be in harmony with the general intent and purpose of zoning objectives and will not be materially detrimental to public health, safety or welfare or injurious to property or improvements in the vicinity." While I realize that the FCC ruling prohibits consideration of possible health impact, I will state that there is a growing groundswell of knowledge and opposition to cell towers across America. This is evidenced in places such as the 8/23/07 Good Times Article entitled **Attack of the Killer EM (Electromagnetic) Fields",** letters to the editor in the past **2** weeks in the Good Times & Santa Cruz Sentinel, coverage of a large community protest to this tower proposal last Friday by TV station **KION,** current legal battles in the District of Columbia about cell phones possibly causing brain tumors of 5 plaintiffs and on and on. I can only scratch the surface in this sharing to begin to describe the growing opposition to these towers and technology which already are causing devaluation of real estate and is therefore "injurious" to the value of nearby property, no matter how it is zoned. I sincerely ask the current Administrator to please be discretionary in this important decision.
3. Also, this **tower is incompatible with the neighborhood and adjacent development** for several reasons. First, this is a neighborhood which houses the Shoreline Middle School less than **1000'** away as well as at least 2 day care centers (one on Brommer and one near Shoreline School; clearly this is a center for educating/raising young people not an industrial/commercial project. Even Live Oak Supervisor, an important community leader and local politician, Jan Beautz has written a letter of

EXHIBIT L

concern about the schoolchildren on the second floor of the school and the possibility of them being significantly affected by the placement of this tower. Second, it is approximately less than 800' from Simpkins Swim Center which is a public center dedicated to health and leisure of thousands of local residents. Third, the "Live Oak Community Center" is housed within Simpkins Center and bills itself as "a centrally located attractive venue for receptions, celebrations, community events, and meetings." Fourth, according to the 2004 "Live Oak California" booklet published by Live Oak Neighbors & Live Oak Family Resource Center," "Live Oak is a primarily residential community located between the cities of Santa Cruz and Capitola..." I believe this booklet goes on to state that "According to the 2000 Census, the median income in Live Oak is $44,000, almost 20% lower than the Santa Cruz County media of $54,000. "..."Over the past decade, the County Redevelopment Agency has improved local streets, installed sidewalks and landscaping, build new parks and otherwise upgraded many of Live Oak's neighborhoods." This tower would act in opposition to the trends and efforts described in this booklet and it would also possibly be a form of classism in the placement of a tower in one of the less affluent Santa Cruz neighborhoods. 5th) The proposed tower is less than 1000' from both Schwan Lake State Park & Twin Lakes State Park; these are exercise, wellness and socializing areas for the community which draw hundreds of people to them every day. 6th) Residential development of the area continues rapidly as evidenced by the in progress building of condos ("in the 300's") on the corner lot of Brommer & 17th. 6th) This tower will ↑ industrial noise levels in residential & educational community area

4. **This tower is unnecessary for coverage.** Live Oak is a flat area where people easily have cell phone coverage. I have never met someone in Live Oak who could not find enough bars on their phone to use it. Also, I understand from speaking to a resident on El Dorado that there is a woman living there who uses Metro PCS and she reports at least adequate coverage. Is there anyone here in the audience today who has Metro PCS in this area of Live Oak and who has inadequate coverage?
5. While the applicants conducted "alternative site analysis" it is interesting to note that they of the 5 alternate sites considered, 3 of the possible hosts turned down the possibility of a lease with Metro PCS (2 flat out "were not interested in a lease" and 1 was not interested in a long-term lease. The fact that 60% of other possible hosts queried refused a contract with Metro PCS speaks to the aforementioned issues of neighborhood incompatibility and a general growing public awareness that "we

EXHIBIT L

don't want these towers in our backyards," for countless reasons.

6. Neaative Health Impact & Decrease in Real Estate Values: While I understand that the Zoning Administrator cannot base a decision on environmental or possible health effects, I would like to say for the record that I know that there will be many negative ones. In 2005 I bought a lovely home in Live Oak, .2 mile from a cell tower unbenounced to me; after 2 months I was not abie to sleep one night in that house past 4 am and suffered debilitating sleep deprivation as well as moderate-high blood pressure (where I had always had low blood pressure). I had put tens of thousands of dollars into that home thinking I would live there a long time and ride my bike to work. I sold it later that year and while the market was still rising I was not able to recoup all the investment I had put into that house. I personally know that these towers cause severe health, financial and personal devastation and know that it is only a short matter of time before "second hand radiation" is regulated just like second hand smoke.
7. Please see the following compilation of scientific studies detailing the impacts of electromagnetic radiation with recommendations for changes in public policy at: http://www.bioinitiative.org/report/index.htm. It seems that cellular companies who want to place towers need to work more cooperatively with their potential hosts and neighbors and make this information more available, before contracts are signed.

BioInitiative Report:

A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF)

Each of the links below opens a PDF file in a new browser window. When done with a particular file, dosing the window will bring you back to this page.

August 31,2007 UPDATE: This site was officially launched 8/31 at 1 a.m. EDT. If you downloaded, saved and/or printed any of the report files prior to this, please refer to all updated files after this launch date and time.

SECTION i. Preface

SECTION ii: Table of Contents

SECTION 1: Summary for the Public (Conclusions, Table 1-1)
Ms. Sage

SECTION 2: Statement of the Problem

EXHIBIT L

Ms. Sage

SECTION 3: The Existing Public Exposure Standards
Ms. Sage

SECTION 4: Evidence for Inadequacy of the Standards
Ms. Sage

SECTION 5: Evidence for Effects on Gene and Protein Expression (Transcriptomic and Proteomic Research)
Dr. Xu and Dr. Chen

SECTION 6: Evidence for Genotoxic Effects – RFR and ELF DNA Damage
Dr. Lai

SECTION 7: Evidence for Stress Response (Stress Proteins)
Dr. Blank

SECTION 8: Evidence for Effects on Immune Function
Dr. Johansson

SECTION 9: Evidence for Effects on Neurology and Behavior
Dr. Lai

SECTION 10: Evidence for Brain Tumors and Acoustic Neuromas
Dr. Hardell, Dr. Mild and Dr. Kundi

SECTION 11: Evidence for Childhood Cancers (Leukemia)
Dr. Kundi

SECTION 12: Evidence for Effects on Melatonin: Alzheimer's Disease and Breast Cancer
Dr. Sobel and Dr. Davanipour

SECTION 13: Evidence for Breast Cancer Promotion (Melatonin links in laboratory and cell studies)
Ms. Sage

SECTION 14: Evidence for Disruption by the Modulating Signal
Dr. Blackman

SECTION 15: Evidence Based on EMF Medical Therapeutics
Ms. Sage

SECTION 16: The Precautionary Principle
Mr. Gee

SECTION 17: Key Scientific Evidence and Public Health Policy Recommendations
Dr. Carpenter and Ms. Sage

SECTION 18: List of Participants and Affiliations

EXHIBIT I.

SECTION 19: Glossary of Terms and Abbreviations

SECTION 20: APPENDIX - Ambient ELF and RF levels
Average residential and occupational exposures

SECTION 21: Acknowledgements

Thank you very much for your consideration,

Rebecca Elder

Rebecca Elder, M.S

EXHIBIT I.

September 19,2007

To Whom This May Concern:

It has come to our attention here at Shoreline Middle School that there are tentative plans to put a cell phone tower near the school, We are asking that you do not put a tower near our school due to the harmful known (and unknown) health effects of the electromagnetic fields generated by towers. Studies show that wireless frequencies have been associated with higher rates of miscarriage, testicular cancer, higher rates of breast cancer, and low sperm counts. As the recent article in Santa Cruz' "Good Times" Magazine by Stan Cox stated, other countries have already taken the initiative of providing guidelines to the industry.

"At the 2006 meeting of the International Commission for Electromagnetic Safety in Benevento, Italy, 42 scientists from 16 countries signed a resolution arguing for much stricter regulation of EM (electromagnetic) fields from wireless communication. Previous to that in Germany, a group of physicians signed a paper asking for tighter regulations of wireless communication and a prohibition on the use of wireless devices by children. In the years since more than 3,000 doctors have the signed the so-called "Freiburger Appeal" and documents modeled on it." (Stan Cox)

Cox goes on in his article to compare the length of time that was needed in California to get a law in place regarding harmful secondhand smoke. Please do not ignore us now that we are asking that you do not put a tower near our middle school and expose so many young children and our staff to secondhand radiation. We do not want a tower in our community. Thank you.

Sincerely,

Susan Rivas

Jeffrey D. Eckert

Robin Divino

Roberta L McStack

Rebecca Clute

Ralph D'Alessio

EXHIBIT 1.

Live Oak School District

Excellence is achieved through a caring partnership

David S. Paine, Ed.D.
Superintendent

October 9,2007

Pia Levine
County of Santa Cruz
Planning Department
701 Ocean Street, Suite 410
Santa Cruz, CA 95060

Dear Pia,

Enclosed is a letter from staff members of Shoreline Middle School who are opposed to the proposed cell tower at the Ledyards property, adjacent to the school. Please include this letter in the packet for the November 2nd public hearing. Thank you.

Sincerely.

David S. Paine, Ed.D.
Superintendent

DISTRICT OFFICE 984-1 BOSTWICK LANE SANTA CRUZ, CA 95062-1798 (831) 475-6333 FAX (831) 475-2638
Del Mar School 1959 Merrill Street 477-1063
Live Oak School 1916 Capitola Road 475-2000
Ocean Alternative School 984-6 Bostwick Lane 475-0767
Green Acres School 966 Bostwick Lane 475-0111
Shoreline Middle School 855 17th Avenue 475-6565
Cypress Charter High School 2039 Merrill Street 477-0302
www.lodo

z.k12.ca.us

EXHIBIT L

COUNTY OF SANTA CRUZ | Planning Department

MEMORANDUM

Date: November 7,2007

To: Planning Commission

From: Mark Deming, Planning Commission Secretary

Re: Scheduling Public Hearing for Wireless Communication Facility Permit

On September 18th, the Board of Supervisors, as a pari of their review of the processing of cell tower applications, directed the Planning Department to refer the applications for all new cell towers proposed to be located near public schools to the Planning Commission for a public hearing. The purpose of *the* direction was to allow the public to have a wider forum to express their concerns regarding the impacts of new cell tower development. The Board also expressed an interest, but did include it as direction, that the Commission schedule these public hearings as nght meetings.

On November 2nd, the Zoning Administrator referred the first of these applications to the Planning Commission. This application is to construct a "flagpole" cell tower on the Ledyard Property (off 17th Avenue) near the Shoreline Middle School.

Your Commission must address two questions, as follows:

What meeting date? The next available meeting is December 12th (after that, meeting dates include January 9th and 23).

Will you schedule this as a night meeting?

EXHIBIT L

County **of** Santa Cruz
Planning Department

Planning Commission
Meeting Date: 1 1/14/07
Agenda Item: # **6.1**
Time: After 9:00 **a.m.**

Additions to the Staff Report for the Planning Commission

Item: 6.1

Correspondence

EXHIBIT L

From: PLN AgendaMail
Sent: Tuesday, November 06.2007 2:37 PM
To: PLN AgendaMail
Subject: Agenda Comments

Meeting Type : 1

Meeting Date : 11/14/2007

item Number : 6.10

Name : Theodora Kerry

Email : thekeny@comcast.net

Address : 150 canfield ave. #2
santa cruz. ca 95060

Phone : Not Supplied

Comments :
Re: Application 06-0701

I am a concerned resident of this county, with friends and business obligations in the area to be affected by this new cell tower. Out of respect for the many residents, parents, students, and business people in this affected area who would like to weigh in on this issue, I urge you *to* schedule a night hearing on this application. Thank you.

From: Douglas Johnson [djcruzer1@yahoo.com]
Sent: Monday, November 05, 2007 6:08 PM
To:
CC: Jan Beautz
Subject: Nov. 14, item 6.1 (cell lower)

Planning Commission members & staff.

As a resident who lives near the site of Ledyard's proposed cell phone tower, I'm requesting that the Planning Commission discuss and hear public comment regarding application #06-0701 during an evening meeting.

An evening meeting would allow Shoreline Middle School parents, teachers, staff and students working during the day to participate in the hearing. Neighbors and community members working during the day would also be able to attend and express themselves during an evening meeting.

I hope the Planning Commission decides on Nov. 14 to schedule an evening meeting to hear the issues regarding #06-0701.

Sincerely,

Doug Johnson

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Marc A. Jones Sign:	Best phone to reach you at: 425-2765	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby o Study nearby o Other:	Comments about this issue: Do not believe that that is necessary in neighborhood.
	Print: Scott Johnson Sign:	Address: 1000 El Dorado Ave Santa Cruz, CA Email: please print twice): Email Best phone to reach you at: 421-1870	o Parent of a child @ Shoreline Middle School o Teacher/Admin " " ✓ Local resident ✓ Work nearby o Study nearby o Other:	Comments about this issue: Dont believe it is necessary in neighborhood.
	Print: Eleanor Cumming Sign:	Address: 1000 El Dorado Ave Santa Cruz CA Email: please print twice): Email Best phone to reach you at 27-6223	o Parent of a child @ Shoreline Middle School o Teacher/Admin " " ✓ Local resident o Work nearby o Study nearby o Other:	Comments about this issue: Not necessary in neighborhood or for current cell phone service Already have adequate coverage
	Print: M.G. Johnson Sign:	Address: 6 Pashatiempo Dr. 426-2988 Santa Cruz, CA Email: please print twice): Email Best phone to reach you at:	o Parent of a child @ Shoreline Middle School o Teacher/Admin " " o Local resident o Work nearby o Study nearby ✓ Other: Property owner	Comments about this issue: LAND USE CONCERNS
	Print: Elizabeth Johnson Sign:	Address: 6 Pashatiempo Drive Santa Cruz CA 95060 Email: please print twice): Email 831-426-2988 Best phone to reach you at:	Shoreline Middle School o Teacher/Admin " " o Local resident o Work nearby o Study nearby ✓ Other: Property owner	LAND Concerns

EXHIBIT L

#10.1
9-7-07

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Lecyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Nadine Buchwald Sign: N. Buchwald	Address: 1147 30th Ave S.C. CA 95062 Email: please print twice): Email Best phone to reach you at:	(X) Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: no way!
	Print: Rachel Sept Sign: Rachel Sept	Address: 2651 Fresno St #2 Email: please print twice): Email rachstep@hotmail.com Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " " (○) Local resident ○ Work nearby ○ Study nearby ○ Other:	don't want it but won't be active about it
	Print: Nick Whitehead Sign: N Whitehead	Address: #1-2622 Mattison Lane Santa Cruz 95062 Email: please print twice): Email Best phone to reach you at: 234 2067	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " " (X) Local resident ○ Work nearby ○ Study nearby ○ Other:	Unknown health effects! Kids brains!
	Print: Susan Russell Sign: Susan Russell	Address: P.O. Box 556 Soquel Email: please print twice): Email Best phone to reach you at: 684-2403	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " " (○) Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Sign:	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L 8/31

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledvard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Elizabeth Daily **Sign:**	**Address:** 180 7th Ave Santa Cruz, CA 95060 **Email: please print twice):** Heidi2777 @aol.com **Email** **Best phone to reach you at:** (831) 325-4263	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ● **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:** Highly Oppose Cell towers in this Highly Sensitive Environmentally Pristine Area. And in such Close proximity to Emotionally Sensitive individuals/Famili
	Print: Dana Sellman **Sign:**	**Address:** 313 Spreckels Dr Aptos, CA 95003 **Email: please print twice):** **Email** dsellman@yahoo.com **Best phone to reach you at:** (831) 566-7655	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ● **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:** This would be disruptive to the local community, This area has several schools + individuals sensitive to disruption caused by cell tower
	Print: Dawn Imbrie **Sign:**	**Address:** 415 Palisades, Santa Cruz, CA 95062 **Email: please print twice):** **Email** **Best phone to reach you at:** (831) 462-3423	○ **Parent of a child @ Shoreline Middle School** ● **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	Concern about detrimental health affects from cell tower emissions.
	Print: Doug Johnson **Sign:**	**Address:** P.O. Box 5274, S.C., CA 95063 **Email: please print twice):** **Email** DJCRUZER1@YAHOO.com **Best phone to reach you at:** 479-9097	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ● **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:** CONCERNED ABOUT FAIRNESS OF PUBLIC POLICY OF CONSIDERING A "[illegible]" [illegible] METRO PCS "NEEDS", BUT NOT COMMUNITY'S "NEEDS."
	Print: Kim Tunilla **Sign:**	**Address:** P.O. Box 1722 Santa Cruz, CA 95061 **Email: please print twice):** **Email** kim@drbiles.com **Best phone to reach you at:** 421-7003	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ● **Other:** Certified Diet Counselor	**Comments about this issue:** ~~[illegible]~~ there is a large body of studies which show that cell towers are unhealthy.

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Lydia Blanchard **Sign:** Lydia Blanchard	**Address:** 142 Palo Verde Ter. Santa Cruz, CA 95060 **Email: please print twice):** **Email** mozart@cruzio.com mozart@cruzio.com **Best phone to reach you at:** 831-427-0346	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:** That there's no evidence of harm is exactly that, Many interpret complete information as having no evidence when it is (financially not) supported/researched by the Ledyard
	Print: RICH APPLE **Sign:**	**Address:** 1692 COLONY WAY SANTA CRUZ CA 95062 **Email: please print twice):** **Email** apple@richapple.com apple@richapple.com **Best phone to reach you at:** 831-462-132	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other: WALK NEARBY	**Comments about this issue:**
	Print: Doug Fotsch **Sign:** Doug Fotsch	**Address:** 968 Bostwick Lane Santa Cruz **Email: please print twice):** **Email** **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ✓ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: Robert Greenlee **Sign:** Robert Greenlee	**Address:** 30275 Chualar Cyn. Rd. Chualar, CA 93925 **Email: please print twice):** **Email** rgreenlee@santacruz.k12.ca.us **Best phone to reach you at:** 831-475-6565 ext. 303	○ Parent of a child @ Shoreline Middle School ✓ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: Marilyn Garrett **Sign:** Marilyn Garrett	**Address:** 351 Redwood Hts. Rd. Aptos, CA 95003 **Email: please print twice):** **Email** **Best phone to reach you at:** 688-4473	○ Parent of a child @ Shoreline Middle School ● Teacher/Admin " " ○ Local resident Co. resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Beverly Filip Sign: Beverly Filip	Address: 900 35th Ave Santa Cruz CA 95062 Email: please print twice): Email Best phone to reach you at: 475-3495	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: Local officials need to exercise prudent avoidance when it comes to the health + safety of citizens exposed to microwave radiation
	Print: Tammie Donnelly Sign: Tammie Donnelly	Address: 3684 Misty Lane Aptos, Ca 95003 Email: please print twice): Email EmpHelp@yahoo.com EmpHelpe yahoo.com Best phone to reach you at: 831 476 1526	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: The public needs to be educated about the dangers of Microwaves from Cell phone towers
	Print: L. Sue Raney Sign: L Sue Raney	Address: 9285 Monroe Ave Aptos, CA 95003 Email: please print twice): Email sueraney@cruzio.com Best phone to reach you at: 687-0926	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other: Concerned citizen	Comments about this issue:
	Allison Gilbert Sign:	140 Union St. Santa Cruz, CA. 95060 Email: please print twice): Email AWORKOFHEART@ATT.NET AWORKOFHEART@ATT.NET Best phone to reach you at: 831-457-9195	Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other: Parent of child at Westlake School next to 2 Towers at First Cong. Church	We need to protect Kids + residences
	Print: Gail Nekvasam Sign: Gail Nekvasam	Address: 890 38th Ave #40 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ✓ Other: neighbor	Comments about this issue: This is unproven dangerous (potentially) technology

EXHIBIT L

Petition to Oppose Proposed MetroPCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Robin Atwood Sign: RS Atwd	Address: 923 Paget Ave Email: please print twice): Email peaceinsight@yahoo.com Best phone to reach you at: 476-8246	○ Parent of a child @ Shoreline Middle School 2g graduates ○ Teacher/Admin " " ○ Local resident ✓ ○ Work nearby ○ Study nearby ○ Other: Represent 4 other opposed residents.	Comments about this issue: NIMBY IS NOT SUFFICIENT LEGISLATIVE APPROACH ∂ LIMITS OVERALL NEED TO BE IMPOSED.
	Print: Susan L. Wallace Sign: Susan L. Wallace	Address: El Dorado Ave. work Email: please print twice): mail: Rosea Dr. 124 Rosedor. Aptos, CA. Email Best phone to reach you at: 685-0231	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ● Work nearby ○ Study nearby ● Other: Walk + swim nearby ∂ child	Comments about this issue: Highly opposed I don't want to work near this cell-tower because I'm concerned about myself, my health, also that of my 11 year old son who often goes to Simpkins Center
	Print: Sign:	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Sig	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Sign:	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Sarah Lovell Sign:	Address: 930 32 Ave Santa Cruz 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ✓ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Linda Kirkland-Ley Sign:	Address: 1092 Live Oak Ave Santa Cruz Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ✓ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other:	Comments about this issue:
	Print: Amy Crotwell Sign:	Address: 1111 Bronson St Live Oak Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Talya Lutzker Sign:	Address: 2888 Sandy Lane, S.C. 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Micaela Eastman Sign:	Address: 1255 38th Ave Santa Cruz, CA 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ✓ Work nearby ✓ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Col. Terry Kol Sign:	Address: 122 Thunderbird Ct. Aptos, Calif. 95003 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: Stop the pollution by greedy Corporate Executives.
	Print: Sign:	Address: 200 Coatmeth Ct #11 Soquel 95073 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: no more!
	Print: Carol Jewett Sign:	Address: 350 13th Ave SC. 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " X Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: stop pollution!
	Print: Sign:	Address: Po. box 5735 S.C. CA. 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby X Other:	Comments about this issue:
	Print: Sign:	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT 1

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Judyth Bechtell Sign: Judyth Bechtell	Address: 300 13th Ave SC Ca 95062 Email: please print twice): Email Best phone to reach you at: hm 575-5542 cell 566-8470	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ● Local resident ● Work nearby ○ Study nearby ○ Other:	Comments about this issue: locate away from population
	Print: Marcella Myers Sign: Marcella Myers	Address: 2001 Via Pacifica Aptos, Ca 95003 Email: please print twice): Email Best phone to reach you at: 464-4113	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: locate away from School area
	Print: Lisa Marie Cazel Sign:	Address: 1584 Chanticleer Ave #7 Santa Cruz CA 95062 Email: please print twice): Email Best phone to reach you at: Cell (831) 227-0225	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ● Local resident ● Work nearby ○ Study nearby ○ Other:	Comments about this issue: Already towers everywhere Why put one near a school?
	Print: Diane Grassley Sign: Diane Grassley	Address: 834 LEWIS Rd Watsonville Ca 95076 Email: please print twice): Email Best phone to reach you at: 728-0174	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: WAY to MANY towers
	Print: Christine Mortensen Sign:	Address: 812-C Balboa Ave. Capitola, Ca. 95010 Email: please print twice): Email Best phone to reach you at: 420-1242	● Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ● Work nearby ○ Study nearby ○ Other:	Comments about this issue: too many towers

EXHIBIT 1

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Lorraine Coppolino Sign: Lorraine Coppolino	Address: 244 - 13th Avenue Email: please print twice): Email — Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ○ Work nearby ○ Study nearby ◉ Other: Concern health Safety	Comments about this issue: FAR TOO MANY TOWERS IN RESIDENTIAL AREAS. UNKNOWN POTENTIAL HAZARDS TO HUMANS
	Print: TARA MCKINNEY Sign:	Address: 809 ORCHID AVE Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ◉ Study nearby ◉ Other: used to live there & concerned.	Comments about this issue: I AM OPPOSED to making cellphone connections easier near the beach. I think the beach should be cellphone-free.
	Print: Mariaangela Bria Sign:	Address: 459 35th Ave Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ◉ Work nearby ○ Study nearby ◉ Other: Concerned about health	Comments about this issue: More than enough towers alreaady - worried about hazards to human health! (environmental)
	Print: Natascha Bruckner Sign:	Address: 769 7th Ave Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ◉ Work nearby ◉ Study nearby ○ Other:	Comments about this issue:
	Print: Wendy Hess Sign:	Address: 84 Robak Dr. Watsonville, CA Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ◉ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact Info:	Role in community	Comments:
	Print: Sabrina Sahlstrom Sign:	Address: 242 35th Ave Email: please print twice): sabrinasahlstrom@yahoo.com Email sabrinasahlstrom@yahoo.com Best phone to reach you at: 476-4974	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " (○) Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: work and study nearby)
	Print: Megan VanderRoest Sign:	Address: Email: please print twice): osheanikus@yahoo.com Email osheanikus@yahoo.com Best phone to reach you at: 477-7515	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " (○) Local resident (○) Work nearby (○) Study nearby ○ Other:	Comments about this issue: We don't need more cell phones OR health hazards!
	Print: shannon julian Sign:	Address: 470 38th Ave Santa Cruz, CA 95062 Email: please print twice): Email Best phone to reach you at: 345-7231	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " (○) Local resident (○) Work nearby ○ Study nearby ○ Other:	Comments about this issue: there is NO need for more cell-phone towers
	Print: SUSAN REYNOLDS Sign:	Address: 15098 CLIVE CANOE GOOLOCK CREEK CA 95006 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " (○) Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Susan Hampton Sign:	Address: 409 12th Ave Santa Cruz, Ca 95062 Email: please print twice): Email Best phone to reach you at: 479.9898	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " (○) Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: 11-no more 11 microwave 11 energy!!

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Julie Kellman Sign: Julie Kellman	Address: 1010 Cathedral Aptos, CA 95003 Email: please print twice): Email SeascapeFoods@SBCGlobal.net Best phone to reach you at: (408) 315-4145	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✗ Other:	Comments about this issue:
	Print: DAN HUNT Sign: DAN HUNT	Address: 1010 Cathedral Aptos, CA 95003 Email: please print twice): Email same as above Best phone to reach you at: 688-5748	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other:	Comments about this issue: I'm fine with gaps in cell coverage.
	Print: Peter Ward Sign: Peter Ward	Address: 205 Baltusrol Dr. Email: please print twice): surf_831@hotmail.com Email surf_831@hotmail.com Best phone to reach you at: 662-1829	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ✓ Other:	Comments about this issue:
	Print: Frank Arnett Sign: Frank Arnett	Address: 1919 Dolphin Dr. Email: please print twice): farcraw@rock.com Email farcraw@rock.com Best phone to reach you at: none	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ✓ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	AUDREY GARCIA Sign: Audrey Garcia	621 HALLRD Email: please print twice): Email MARTAPUP@AOL.COM MARTAPUP@AOL.COM Best phone to reach you at: 831-345-7574	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ✗ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: SOPHIA SMITH Sign: Sophia Smith	Address: 1555 MERRILL ST SP 24 SANTA CRUZ 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Kerry Hampton Sign: Kerry Hampton	Address: 3628 Stance Dr Soquel, CA 95073 Email: please print twice): Email blackpearlbaymoon@yaho Best phone to reach you at: (831)428-3303	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other: Family lives there	Comments about this issue:
	Print: Katy baby-Della Sign: Betty baby-della	Address: 1219 Andrew Ln, Sc. CA 95062 Email: please print twice): Email Best phone to reach you at: 831-464-4629	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: ANNA Sign: Anna Viring	Address: P.O. Box 2587, Aptos 95001 Email: please print twice): Email anna@mondialelinguistics.com Best phone to reach you at: 831.477.2020	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ◉ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Serena MacMillan Sign: Serena M.	Address: 350 Hacker Rd Soquel, CA 95073 Email: please print twice): Email Best phone to reach you at: 251-7764	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " X Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Dawn Finney Sign:	Address: 913 Mariana Ct Santa Cruz CA 95062 Email: please print twice): Email dfinneydf@yahoo.com dfinneydf@yahoo.com Best phone to reach you at: 831 588 7400	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ✓ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Rick Donnelly Sign:	Address: 3684 Misty Ln. Aptos, CA 95003 Email: please print twice): Email rdonnelly@mac.com rdonnelly@mac.com Best phone to reach you at: 831- 247-3388	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ✓ Other:	Comments about this issue: I go swimming frequently at Simpkins Pool and worry that the EMFs from new CELL phone tower will negate benefits of swimming.
	Print: Evan Gindt Sign:	Address: Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ✓ Study nearby ✓ Other:	Comments about this issue:
	Print: Carlos Martin Sign:	Address: 411 La Honda Dr Aptos, CA 95003 Email: please print twice): Email zurcoucarlos@hotmail.com zurcoucarlos@hotmail.com Best phone to reach you at: 715 315 3424	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Betsy Miller Sign:	Address: ~~Box~~ 8065 S.C. 95061 Email: please print twice): Email Spark@cruzio.com Spark@cruzio.com Best phone to reach you at:	✓ Parent of a child @ ~~Shoreline Middle School~~ in district ✓ Teacher/~~Admin~~ " " ✓ Local resident ✓ Work nearby ✓ Study nearby ○ Other:	Comments about this issue:

EXHIBIT E

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact Info:	Role in community	Comments:
	Print: Katie Shockley Sign: Katie Shockley	Address: 4465 Nova Dr Email: please print twice): Email Katie_Shockley@hotmail.com Best phone to reach you at: 678-793-3822	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " X Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: Don't do it
	Print: Aine Baum Sign: Aine Baum	Address: 2125 Chanticleer Ave Santa Cruz Email: please print twice): Email ainebaum@hotmail.com ainebaum@hotmail.com Best phone to reach you at: (831) 594-3687	○ Parent of a child @ Shoreline Middle School X Teacher/Admin " " X Local resident X Work nearby ○ Study nearby ○ Other:	Comments about this issue: Don't want it!
	Print: Heather Conway Sign:	Address: 438 Morris Dr. Soquel CA 95073 Email: please print twice): Email heatherconway@comcast.net Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " X Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: No need Don't want it.
	Print: N. Sonzel Sign:	Address: Aptos, CA. Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby X Study nearby ○ Other:	Comments about this issue:
	Print: M. Dodd Sign: M. Dodd	Address: 311 La Fonda Ave SC 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Mary Petersen **Sign:** Mary Petersen	**Address:** **Email: please print twice):** **Email** **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✓ Local resident ✓ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: Ken Shelton **Sign:**	**Address:** **Email: please print twice):** **Email** **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: Gloria Nazari **Sign:** Gloria Nazari	**Address:** 2822 Mattison Lane SC. 95065 **Email: please print twice):** **Email** URAN already has it! **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ✗ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: SARA SMITH **Sign:** SSmith	**Address:** 1385 7th Ave #19 Santa Cruz CA 95062 **Email: please print twice):** **Email** Vijita2@earthlink.net **Best phone to reach you at:** (831) 479-4446	✓ Parent of a child @ Shoreline Middle School ✓ Teacher/Admin " " ✓ Local resident ✓ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:** How to prevent killing birds from cell towers and prevent EMF's
	Print: JOHN LANTIS **Sign:**	**Address:** 4680 Tyrway Dr. Soquel CA 95073 **Email: please print twice):** **Email** N/A **Best phone to reach you at:** (831) 462-2783	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other: RETIRED	**Comments about this issue:**

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Laura Tucker **Sign:** Laura Tucker	**Address:** 930 Rosedale Ave #39 Capitola, CA 95010 **Email: please print twice):** **Email** gaiacelestie2000@yahoo.com **Best phone to reach you at:**	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:**
	Print: Carolyn Stallard **Sign:** Carolyn Stallard	**Address:** 222 Hidden Valley Rd Soquel CA 95073 **Email: please print twice):** **Email** **Best phone to reach you at:**	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:**
	Print: Barbara Wright **Sign:** Barbara A Wright	**Address:** 318 35TH Ave **Email: please print twice):** **Email** **Best phone to reach you at:**	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:**
	Print: Mary Lopez **Sign:** Mary Lopez	**Address:** 708 Summerfield Ave **Email: please print twice):** **Email** MLopez7916@aol.com MLopez7916@aol.com **Best phone to reach you at:** 831 950 9361	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ✓ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:**
	Print: PLevin **Sign:** PLevin	**Address:** 1760 48th Ave Capitola **Email: please print twice):** **Email** **Best phone to reach you at:**	○ **Parent of a child @ Shoreline Middle School** ○ **Teacher/Admin " "** ○ **Local resident** ○ **Work nearby** ○ **Study nearby** ○ **Other:**	**Comments about this issue:**

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Jana de la Torre Sign:	Address: 1311 Schell Ln. Email: please print twice): Email Best phone to reach you at: 425-3368	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue: Wildlife zone!
	Print: Katherine Thorn Sign:	Address: 14440 Jose Rd. #305 Santa Cruz, CA 95062 Email: please print twice): Email Maugiacavallo_thorn@yahoo.com Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: LINDA HUDSON Sign:	Address: 1065½ Lewis Dr Santa Cruz, CA 95062 Email: please print twice): Email Best phone to reach you at: 454-4909	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ X Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Valerie Lyttle Sign:	Address: 151 Canterbury Dr aptos Ca 95003 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Laura Verutti Sign:	Address: 3914 Melton St. Soquel 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: Lisa Patterson Sign: Lisa Patterson	Address: 930 Ponsetie Lane Email: please print twice): Email lisajoypatterson@yahoo.com Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby X Other:	Comments about this issue:
	Print: Stephen Sellinger Sign: Stephen Sellinger	Address: 3140 Trout Gulch Aptos CA Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Michele Faul Sign: Michele Faul	Address: 130 Camino Pacifico Aptos Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Enid Rusev Sign: Enid Rusev	Address: 403 Danube Dr. Aptos Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Karen Sign: Karen	Address: 600 Milky Way Wat, Ca 95076 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: ANGELA FLYNN **Sign:** Angela Flynn	**Address:** 204 GAULT ST. S.C., CA 95062 **Email: please print twice):** **Email** angelaflynn80@msn.com **Best phone to reach you at:** 469-4399	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other: CONCERNED CITIZEN	**Comments about this issue:** EMR IS A MAJOR HEALTH CONCERN. STOP HARMING PEOPLE
	Print: M. MOSES **Sign:** M Moses	**Address:** 622 Broadway **Email: please print twice):** bahiacruz@ **Email** bahiacruz@sbcglobal.net sbcglobal.net **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:** EMF is a serious health violation ~ Lets educate & motivate ourselves
	Print: **Sign:**	**Address:** **Email: please print twice):** **Email** **Best phone to reach you at:**	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	**Comments about this issue:**
	Print: **Sign:**	**Address:** **Email: please print twice):** **Email** **Best phone to reach you at:**	Shoreline Middle School Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	
	Sign:	**Email: please print twice):** **Email** **Best phone to reach you at:**	Shoreline Middle School ○ Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & In Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: PETER KEPLER Sign:	Address: 113 SEACLIFF BLVD Email: please print twice): Email PBZEN41@YAHOO.COM Best phone to reach you at: 831 332 2223	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other:	Comments about this issue:
	Print: Autumn Steven Sign:	Address: 222 Carey Ave Email: please print twice): Email: LeileisickLer@AOL.COM Best phone to reach you at: (831) 316-8093	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other:	Comments about this issue: Cell phone towers should not be near any schools because of child safety
	Print: Diane Eicle Sign:	Address: 600 Westbrook Dianeeicle@sbcglobal.net Email: please print twice): Email Best phone to reach you at: 831 662 3345	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other:	Comments about this issue:
	Print: LAUREEN MULLIN Sign: Laureen Mullin	Address: 1450 42nd ave. #3 Capitola, Ca. 95010 Email: please print twice): Email: TIMandLAUREEN@NETZERO.NET Best phone to reach you at:	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other:	Comments about this issue:
	Print: Anita Shaw Sign:	Address: Aptos, Ca 95003 Email: please print twice): Email: No email Best phone to reach you at:	Parent of a child @ Shoreline Middle School Teacher/Admin " " Local resident Work nearby Study nearby Other:	Comments about this issue:

EXHIBIT L

Petition to Oppose Proposed Metro PCS Live Oak Cell Tower @ western end of *Ledyard Properties* & in Support of Community Health

#	Name:	Address & contact info:	Role in community	Comments:
	Print: phyllis taub greenleaf Sign: P. greenleaf	Address: 1555 Merrill St. #75 Email: please print twice): Email phyllisgreenleaf@gmail.com Best phone to reach you at: 464-9062	○ Parent of a child @ Shoreline Middle School ○ Teacher/Admin " " • Local resident Work nearby Study nearby ○ Other: I work as sub-teacher in the Live Oak school Dist.	Comments about this issue: European studies have shown the detrimental impact of cell towers on childrens brain development ←
	Print: Tricia Pastor Sign:	Address: 984-4 Bostwick Lane Santa Cruz Ca. 95062 Email: please print twice): Email Best phone to reach you at: 462-1116 x 224	Parent of a child @ Shoreline Middle School X Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Jessica Middour Sign:	Address: 266 Cypress Park Santa Cruz, CA. 95060 Email: please print twice): Email Best phone to reach you at: 466-9967	○ Parent of a child @ Shoreline Middle School X Teacher/Admin " " ○ Local resident ○ Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Pamela Randall Sign: Pamela Randall	Address: 1491 Rodriguez St 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School X Teacher/Admin " " X Local resident X Work nearby ○ Study nearby ○ Other:	Comments about this issue:
	Print: Les Forster Sign:	Address: 2039 Merrill St. Santa Cruz 95062 Email: please print twice): Email Best phone to reach you at:	○ Parent of a child @ Shoreline Middle School • Teacher/Admin " " ○ Local resident • Work nearby ○ Study nearby ○ Other:	Comments about this issue:

EXHIBIT L

From the September 2007 Idaho Observer:

The radiation poisoning of America

*Prior to **1996,** the wireless age was not coming onlinefast enough, primarily because communities had the authority to block the siting of cell towers. But the Federal CommunicationsAct (1996) made it virtually impossiblefor communities to **stop** construction of cell towers —even if theypose threats topublic health and the environment. Since the decision **to** enter the age of wireless convenience was politically determinedfor **us,** we haveforgotten well-documented safety and environmental concerns and, with a devil-may-care zeal that is lethally short-sighted, we have incorporated into our lives every wireless toy that comes on the market as quickly as it becomes available. We behave as if we are addicted to radiation. Our addiction to cell phones has led to harder "drugs" like wireless Internet. And now we are bathing in the radiation that our wireless enthusiasm has financed. The addicted, uninformed, corporately biased and politically-influenced may dismiss our scientifically-sound concerns about the apocalyptic hazards of wireless radiation. But we must not. Instead, we must sound the alarm.*

By Amy Worthington

Illa Garcia wore jewelry the first day she went back to work as a fire lookout for the state of California in the summer of 2002. The intense radiation from dozens of RF/microwave antennas surrounding the lookout heated the metals on her body enough to bum her skin. "I still have those scars," she says. "I never wore jewelry to work after that."

Likely Mountain Lookout, on U.S. Forest Service land with **a** spectacular view of Mount Shasta, is one of thousands of RF/microwave "hot spots" across the nation. **A** newly-erected cellular communications tower was only **30** feet from the lookout. "One antenna on that tower was even with our heads," recalls Garcia. "We could hear high-pitched buzzing. There were also three state communications antennas mounted on the lookout, only ***6*** feet from where we walked. We climbed past them every day."

Motorola company manuals for management of communications sites confirm that high frequency radiation from these antennas is nasty stuff. Safety regulations mandate warning signs, EMF awareness training, protective gear, even transmitter deactivation for personnel working that close to antennas. Garcia and co-worker Mary Jasso were never warned about the hazards which, they say, demonstrates extreme malfeasance on the **part** of agencies and commercial companies responsible **for** their exposure.

By the end of fire season, Garcia and Jasso were so ill they were forced to retire and the lookout was closed to state personnel. Garcia, 52, is now severely disabled with fibromyalgia, auto-immune thyroiditis and acute nerve degeneration. Medical tests confiied broken DNA strands in her blood and abnormal tissue death in her brain.

Dr. Gunner Heuser, a medical specialist in neurotoxicity, states that Garcia's disorders are a result of chronic electromagnetic field exposure in the microwave range and that "she has become totally

EXHIBIT M

disabled as a result." Dr. Heuser said, "In my experience patients develop multisystem complaints after EMF exposure just as they do afier toxic chemical exposure."

Jasso, who worked the lookout for 11 seasons, is now disabled with brain and lung damage, partial left side paralysis, muscle tremors, bone pain and DNA damage. Jasso discovered that all lookouts who worked Likely Mountain since 1989 are disabled. At only 61 years of age, she has lost so much memory that she cannot remember back to when her first three children were born. She fears that communications radiation may be a major factor in the nation's phenomenal epidemics of dementia and autism.

Both women say they have been unjustly denied worker's comp and medical benefits. Their pleas for help to state and federal agencies have been fruitless. Between them they have racked up over $150,000 in medical bills, although there is no effective treatment for radiation sickness.

Twenty-two other members of Garcia and Jasso's two families received Likely Mountain radiation exposure. All suffer serious and expensive illnesses, including tumors, blood abnormalities, stomach problems, lung damage, bone pain, muscle spasms, extreme fatigue, tremors, numbness, impaired motor skills, cataracts, memory loss, spine degeneration, sleep problems, low immunity to infection, hearing and vision problems, hair loss and allergies.

Jasso's husband, who often stayed at the lookout, has a rare soft tissue sarcoma known to be radiation related. Garcia's husband, who spent little time at the lookout, has systemic cancer that started with sarcoma of the colon. Garcia's daughter Teresa was at the lookout for a total of two hours during her first pregnancy. Her daughter was born with slight brain damage and immunity problems. "That baby was always sick," says Garcia. Teresa spent only three days at the lookout during her second pregnancy. Her son was born with autism.

Garcia and Jasso also have a terminal condition known as "toxic encephalopathy," involving brain damage to frontal and temporal lobes. This was confirmed by SPECT brain scans. Twelve others in the two-family group who also had the scans were diagnosed with the affliction. "All of us with this condition have been told that we're dying," says Garcia. "Our mutated cells will reproduce new mutated cells until the body finally shuts down."

Nuclear bombs on a pole

Painful conditions endured by the families of Garcia and Jasso are identical to those suffered by Japanese victims of gamma wave radiation after nuclear explosions at Hiroshima and Nagasaki in 1945. Five decades of studies confirm that non-ionizing communications radiation in the RF/microwave spectrum has the same effect on human health as ionizing gamma wave radiation from nuclear reactions. Leading German radiation expert Dr. Heyo Eckel, an official of the German Medical Association, stated, "The injuries that result from radioactive radiation are identical with the effects of electromagnetic radiation. The damages are so similar that they are hard to differentiate."1

Understanding what happened at Likely Mountain is critical to understanding the public health threat posed by radiation in the United States. The families of Garcia and Jasso, plus previous lookout

EXHIBIT M

workers and multitudes of tourists who visited Likely Mountain for camping and sightseeing, were beamed by the same kind of high frequency radiation that blasts from tens of thousands of neighborhood cell towers and rooftop antennas erected across America for wireless communications. The city of San Francisco, with an area of only seven square miles, has over 2,500 licensed cell phone antennas positioned at 530 locations throughout the city. In practical terms, this city, like thousands of others, is being wave-nuked 24 hours a day.

The identical damage resulting from both radioactive gamma waves and high frequency microwaves **is** a pathological condition in which the nuclei of irradiated human cells splinter into fragments called micronuclei. Micronuclei are a definitive pre-cursor of cancer. During the **1986** nuclear reactor disaster at Chemobyl in Russia, the ionizing radiation released was equivalent to 400 atomic bombs, with an estimated ultimate human toll of 10,000 deaths. Exposed Russians quickly developed blood cell micronuclei, leaving them at high **risk** for cancer.

What they wouldn't tell us

RF/microwaves from cell phones and cell tower transmitters also cause micronuclei damage in blood cells. This was reported a decade ago by Drs. Henry Lai and Narendrah Singh, biomedical researchers at the University of Washington in Seattle. Dr. Singh is famous for refining comet assay techniques used **to** identify DNA damage. Lai and Singh demonstrated in numerous animal studies that mobile phone radiation quickly causes DNA single and double strand breaks at levels well below the current federal "safe" exposure standards.2

The telecommunications industry knows this thanks to its own six-year, wireless technology research (WTR) study program mandated by Congress and completed in 1999. Gathering a team of over 200 doctors, scientists and experts in the field, WTR research showed that human blood exposed to cell phone radiation had a 300-percent increase in genetic damage in the form **of** micronuclei.3 Dr. George Carlo, a public health expert who coordinated the WTR studies, confirms that exposure to communications radiation from wireless technology is "potentially the biggest health insult" this nation has ever seen. Dr. Carlo believes RF/microwave radiation is a greater threat than cigarette smoking and asbestos.

In 2000, European communications giant T-Mobile commissioned the German ECOLOG Institute to review all available scientific evidence in regard to health risks for wireless telecommunications. ECOLOG found over 220 peer-reviewed, published papers documenting the cancer-initiating and cancer-promoting effects of the high frequency radiation employed by wireless technology.4 Many corroborating studies have been published since.

By 2004, 12 research groups from seven European countries cooperating in the REFLEX study project confirmed that microwaves from wireless communications devices cause significant single and double strand DNA breaks in both human and animal cells under laboratory conditions.5 In 2005, a Chinese medical study confirmed statistically significant DNA damage from pulsed microwaves at cell phone levels.6 That same year, University of Chicago researchers described how pulsed communications microwaves alter gene expression in human cells at non-thermal exposure levels.7

Because gamma waves and RF/microwave radiation are identically carcinogenic and genotoxic to the cellular roots of life, the safe dose of either kind of radiation is zero. No study has proven that any level **of** exposure from cell-damaging radiation is safe for humans. Dr. Carlo confirms that cell damage is not dose dependant because any exposure level can trigger damage response by cell mechanisms.8

Officials at the U.S. Food and Drug Administration and the National Institutes **of** Health closely reviewed the damning results of WTR studies, which also revealed microwave damage to the blood brain barrier, but have chosen to downplay, obfuscate and even deny the irrepressible science of the day. Raking in $billions from selling spectrum licenses, the feds have allowed the telecom industry to unleash demonstrably dangerous technology which induces millions of people to become brain-intimate with improperly tested wireless devices9 and which saturates the nation with carcinogenic waves to service those devices. Dr. Carlo says that even the American Cancer Society is in bed with the communications industry, which infuses the Society with substantial contributions.10

Two ways to die

Medical science illustrates that there are two ways to die from radiation poisoning: Fast bum and slow bum. Nuclear flash-burned Japanese had parts of their flesh melt off before they died in agony within hours or days. People have also quickly died after walking through powerful radar beams, which can microwave-cook internal organs within seconds of exposure.

Slow-bum radiation mechanisms are cumulative, progressive, ongoing and continual. Thousands **of** Japanese nuke bomb victims died painfully years after exposure. The slow bum process of RF/microwave exposure is manifested by cancer clusters commonly found in communities irradiated by cell tower transmitters. Recent Swedish epidemiological studies confirm that, after 2,000 hours of cellular phone exposure, or a latency period of about 10 years, brain cancer risk rises by 240 percent.11

Communications antennas blast the human habitat with many different electromagnetic frequencies simultaneously. Human **DNA** hears this energetic cacophony loud and clear, reacting like the human ear would to high volume country music, R&B plus rock and roll screaming from the same speaker simultaneously. Irradiated cells struggle to protect themselves against this destructive dissonance by hardening their membranes. They cease to receive nourishment, stop releasing toxins, die prematurely and spill micronuclei fragments into a sort of "tumor bank account."

Nuking the crew

The constant roaming pain is intense for 32-year-old Kenneth Hurtado of Southern California. He's been to hell and back, starting with a seven-pound tumor on a kidney, diagnosed in 2002. The cancer spread to his brain. His first brain tumor was removed by craniotomy, the second by the cyber knife. In 2005, cancer nodes were found in his lungs. By 2006, the cancer had metastasized to his legs. This year he is battling three excruciating tumors on his spinal cord. Hurtado hates his seizures. His last

EXHIBIT M

one came on while he was driving. "It's like the devil taking over your body," he says.

Now unable to work, Hurtado says he was relatively healthy in 1998 when he began a career as an installer for a large international corporation manufacturing electronics equipment for wireless providers. At the base of cell towers there is an equipment "hut" where installers assemble the radios, amplifiers and filters which generate man-made microwave frequencies and route them up to transmitter antennas through huge cables. Mounted on sector supports aptly named alpha, beta and **gamma,** the antennas send and receive these carcinogenic radio waves and their pulsed data packets at the speed of light.

Posted on locked fences around the huts are "danger" warning signs. Hurtado says, "You look around these sites and you find many dead birds on the gravel. They can't take the radiation and they'll Just die. You don't have to ponder that too long to figure it's bad."

Hurtado doesn't know how much radiation he got on the job. He says there are at least four connection spots inside the hut where radiation can leak. He could not avoid the "heat" when he turned the radios on for testing and he wonders if his cancer is the result. "When I first got hired, we had safety meetings, but they pretty much minimized the hazards," he remembers. He was issued no electromagnetic safety clothing and it was not until 2002 that he got a radiation meter to wear. "The meter is supposed to warn you if you are getting too much radiation," he said, "but I put mine on a stick and placed it next *to* antennas and the alarm never went off."

A medical report in ***the International Journal of Occupational and Environmental Health*** confirms that workers exposed to high levels of RF/microwave radiation routinely have astronomical cancer rates.12 The report notes that, for these workers, the latency period between high radiation exposure and illness is short compared to less exposed populations.

Hurtado said there are many industry workers who are dangerously over-exposed. "I've talked to guys on power crews who have to climb around the antennas and they've told me that before a work day is half over, they start feeling really sick." He added, "In my mind they are getting cooked."

Hurtado suspects that, since the early days of the wireless buildout, there has been illegal activity related to public exposure from transmission sites. "I'm pretty sure," he says, "that some of the carriers are exceeding FCC exposure limits. They can turn the radios and amplifiers **up** to get a bigger footprint and they don't care if the alarms go on once the installers are gone." Regulatory inspectors could identify violators because channels can be spectrum analyzed. "But," he says, "there is just no one to check and I believe that the public is getting way too much radiation now."

Regulators asleep at the wheel

The Federal Communications Commission (FCC), the single agency with authority to regulate the communications industry, has neither money, manpower nor motive to properly monitor radiation output from hundreds of thousands of commercial wireless installations spewing carcinogenic waves across the nation. The FCC admits that physical testing to verify compliance with emissions guidelines is relatively rare.

Critics say that FCC appointees, with virtually no medical or public health expertise, represent an old-boy network and a cheering squad for the telecommunications and broadcast industries. The Center for Public Integrity found that FCC officials have been bribed by the industries with such perks as expensive trips to Las Vegas.13

Dr. Carlo confirms that there is no regulatory accountability. He says, "You have to go to those base stations and independently measure what is coming out of them because we have had many instances where you have an antenna that is allowed by law to transmit at 100 watts and we have seen up to 900 to 1000 watts. You can turn things up when nobody is looking."14

Neighborhood groups monitoring the broadcast/communications antenna farm on Lookout Mountain near Denver, Colorado, have consistently found that, despite protests to the FCC over nine years, radiation on the mountain has been measured at up to 125 percent of exposure levels permitted by federal law.15

Lethal exposure guidelines

Even if there were reliable compliance monitoring, experts say that FCC public exposure guidelines for RF/microwave radiation are deadly because they are based on the obsolete and unfounded theory that only power density hot enough to flash-cook tissues is harmful. This puts FCC at odds with current scientific evidence regarding the minimum exposure level at which harm to living cells begins.

Myriad symptoms of radiation poisoning can be induced at exposure levels hundreds, even thousands of times lower than current standards permit. Russia's public exposure standards are 100 times more stringent than ours because Russian scientists have consistently shown that, at U.S. exposure levels, humans develop pathological changes in heart, kidney, liver and brain tissues, plus cancers of all types.16

Norbert Hankin, chief of the EPA's Radiation Protection Division, states that the FCC's exposure guidelines are protective only against effects arising from a thermal (flash bum) mechanism. He concedes that, "the generalization by many, that these guidelines protect human beings from harm by any and all mechanisms, is not justified."17

Thus, public microwave exposure levels tolerated by the FCC and its industry-loaded advisory committees are a national health disaster. Yet, for pragmatic and lucrative reasons, federal exposure limits have been deliberately set so high that no matter how much additional wireless radiation is added to the national burden, it will always be "within standards."

The FCC regulatory mess comes into focus with the Likely Mountain case. Jasso says that when she and Garcia contacted the FCC regarding their radiation injuries, they were met with an appalling lack of expertise and concern. "FCC has no answers," Jasso says. "Their exposure guidelines are convoluted and nonsensical. They refuse to address problems of multiple antennas, field expansion, human body coupling and blood reversal because they want to avoid regulatory problems at telecommunication sites." She adds, "FCC will fine a licensee thousands of dollars for not having a light installed on top of a telecommunications tower, but they have not issued even a warning letter to

EXHIBIT M

their licensees for the injuries that occurred on Likely Mountain. They say injury cannot occur because their licensees are regulated."

Catch 22

When Garcia and Jasso filed suit against companies operating microwave transmitters on Likely Mountain, they could find no attorney who would take their case and they were forced to proceed ***pro se***. In August, 2007, a California district court denied their claim, mainly on the grounds that they had not proven that the defendants had exceeded FCC exposure guidelines. Under federal law the shattered health of 24 people, plus medical testimony, is not sufficient proof of negligence and liability.

Since FCC provides no enforcement monitoring at transmitter sites and since the radiation industry is not required to prove with consistent documentation that it is compliant, injured parties have little chance of proving non-compliance because the damage to their health often becomes obvious months or even years after their typically undocumented exposure.

The court worried that the Garcia-Jasso case highlights "the conflict between the FCC's delegated authority to establish RF radiation guidelines and limits and plaintiffs' attempt to establish that wireless facilities like the one at Likely Mountain are ultrahazardous."

So, while current science provides ample evidence that FCC's guidelines are ultrahazardous, the radiation industry hides behind FCC incompetence, simply because FCC retains exclusive authority to set the standards.

The FCC's disastrous authority is calcified by the Telecommunications Act (TCA) of 1996. The telecom industry is infamous for lavish "donations" which keep legislators on its leash. Anticipating a national radiation health crisis and the public backlash that would follow, the telecom lobby blatantly bought itself a provision in the law that prohibits state and local governments from considering environmental (health) effects when siting personal wireless service facilities so long as "...such facilities comply with the FCC's regulations concerning such emissions."

Many **say** the TCA insures that America's war on cancer will never be won, while protecting **gross** polluters from liability.

On our own

After passage of the TCA, a group of scientists and engineers, backed by the Communications Workers of America, filed suit in federal court. **They** hoped the **Supreme** Court would review both the FCC's outdated exposure guidelines and the legality of a federal law that severely impedes state **and** local authority in the siting of hazardous transmitters. In 2001, the Supreme Court refused to hear the case. The group's subsequent petition to the FCC asking the agency to bring **its** exposure guidelines

EXHIBIT M

current with the latest scientific data was denied.18

This is where we stand today. The public has no vote, no voice, no choice. Chronic exposure to scientifically indefensible levels of DNA-ravaging radiation is now compulsory for everyone in America. This is why Garcia and Jasso are ill today; this why the industry enjoys unchallenged power to place dangerous transmitters in residential and commercial areas with unsafe setbacks and; this is why untold thousands of Americans in buildings with transmitters on the roof are given no safety warnings, though they work and dwell in powerful, carcinogenic electromagnetic fields. In the meantime, the radiation industry rakes in $billions in quarterly profits, none of which is set aside for to pay for the national health catastrophe at hand.

Every citizen is now condemned to protect and defend himself against radiation assault as best he can. There have been a number of lawsuits against the radiation industry since cell towers began going up in backyards across the nation. In 2001, a group action lawsuit was filed in South Bend, Indiana, by families living in close proximity to towers. The complaint describes health effects suffered by the plaintiffs, including heart palpitations, interference with hearing, recurring headaches, short term memory loss, sleep disturbances, multiple tumors, glandular problems, chronic fatigue, allergies, weakened immune system, miscarriage and inability to learn.19

The South Bend suit was settled out of court on the basis of nuisance and decreased property values. Health claims don't hold water if emissions are within FCC exposure standards. This case is valuable for understanding the lunacy of FCC standards. The sick families enlisted the help of radiation consultant Bill Curry, who honed his expertise as an engineer for Argonne and Livermore labs. Dr. Curry found that one of the towers was irradiating homes at over *65* microwatts per square centimeter.20 This power density is well within federal exposure standards, which allow any neighborhood to be zapped with at least 580 microwatts per square centimeter, or higher, depending on the frequencies. If the families were sick at *65* microwatts/cm22 what would they be at *580?* Considering that the Soviets used furtive Cold War microwave bombardment to make US embassy personal radiation-sick at an average exposure level of only .01 microwatts/cm2, America's clear and present danger is obvious.21

How radiation sick is America?

Since the wireless revolution began wave-nuking the U.S. in the 1990s, there have been no federally funded health studies to assess the cumulative effects of ever-increasing communications radiation on public health. There is no national database enabling citizens to study the location of transmitters in their areas. Local and state governments can offer no information on how much commercial wireless radiation is contaminating their populations. When trying to find out who owns a tower or which companies have transmitters on that tower, citizens usually hit a brick wall.

Dr. Carlo heads the only independent, post-market health surveillance registry in the nation where people can report radiation illness.22 Dr. Carlo said the registry has heard from thousands of people who believe that their illnesses, including brain and eye cancers, are due to telecommunications radiation from both wireless phones and tower transmitters. In the last *two* years, the registry has seen an upsurge in reports as transmitters become ever more energetically dangerous in order to

EXHIBIT M

accommodate increased data flow for new, multi-media technologies.

We can only guess how many Americans are in their graves today from microwave assault. Arthur Firstenberg, who founded the Cellular Phone Task Force, wrote that, on November 14, 1996, New York City's first digital cellular provider activated thousands of PCS antennae newly erected on the rooftops of apartment buildings. Health authorities reported that a severe and lingering flu hit the city that same week. In response to its classified newspaper ad advising that radiation sickness is similar to flu, the Task Force heard back from hundreds of people who reported sudden onset symptoms synchronous to microwave startup – symptoms similar to stroke, heart attack and nervous breakdown.

Firstenberg gathered statistics from the U.S. Centers for Disease Control and analyzed weekly mortality statistics published for 122 U.S. cities. Each of dozens of cities recorded a 10-25 percent increase in mortality, lasting two to three months, beginning in the week during which that city's first digital cell phone network began commercial service. Sites with no cellular system start up in the same time period showed no abnormal increases in mortality.[23]

Studies abroad

Recent health surveys in other nations confirm that people living close to wireless transmitters are in big trouble:

• In 2002, French medical specialists found that people living close to cell towers suffered extreme sleep disruption, chronic fatigue, nausea, skin problems, irritability, brain disturbances and cardiovascular problems.[24]

• German researchers found that people living within 1,200 feet of a transmitter site in the German city of Naila had a high rate of cancer and developed their tumors on average eight years earlier than the national average. Breast cancer topped the list.[25]

• Spanish researchers found that people living within 1,000 feet of cellular antennas had statistically significant illness at an average power density of 0.11 to 0.19 microwatts /cm2, which is thousands of times less than allowed by international exposure standards.[26]

• An Egyptian medical study found that people living near mobile phone base stations were at high risk for developing nerve and psychiatric problems, plus debilitating changes in neurobehavioral function. Exposed persons had significantly lower performance on tests for attention, short term auditory memory and problem solving.[27]

• Researchers in Israel studied people in the town of Netanya who had lived near a cell tower for 3-7 years. They had a cancer rate four times higher than the control population. Breast cancer was most prevalent.[28]

Europe in an uproar

EXHIBIT M

A new European Union poll of more than 27,000 people across the continent reveals that 76 percent of respondents feel that they are being made ill by wireless transmitters.29 Seventy-one percent in the UK believe they suffer health effects from mast (cell **tower)** radiation. In April 2007, ***The*** *London* ***Times*** reported a startling number of cancer clusters in mast neighborhoods. One study in Warwickshire, found **31** cancers around a single street.30 Some sick Brits send their blood to a lab in Germany, which uses state of the **art** methodology to confirm wireless radiation damage.

Radiation sickness is now so prevalent in Germany that 175 doctors have signed the Bramberger Appeal, a document calling the situation a "medical disaster." It asks the German government to initiate a national public health investigation. This appeal closely follows *the* Freiburger Appeal, signed by thousands of German doctors who say they are dealing with an epidemic of severe and chronic diseases among both old and young patients exposed to wireless microwave radiation. **The** head ofthe cancer registry in Berlin found that one urban area with cellular antennas had a breast cancer rate seven times the national average.31

Sweden was one of the first nations to go wireless. Swedish neuroscientist, Dr. Olle Johansson; with hundreds of published papers to his credit, said that a national epidemic of illness and disability was unleashed by the wireless revolution. Long periods of sick leave, attempted suicides and industrial accidents all increased simultaneously with introduction of mobile phone radiation. Ninety-nine percent of the Swedish population is now under duress of powerful third generation masts. Johansson reports that people are plagued with sleep disorders, chronic fatigue that does not respond to rest, difficulties with cognitive function and serious blood problems. Recurrent headaches and migraines are a "substantial public health problem," he says.32

Rooftop transmitters, which readily pass microwave radiation into structures, can be a death sentence. Across the world there are reports of cancer clusters and extreme illness in office buildings and multi-tenant dwellings where antennas **are** placed on rooftops directly over workers and tenants. In *2006,* the top floors of a Melbourne University office building **were** closed after a brain tumor cluster drew media attention to the risks of communications transmitters on top of the building.33 Likewise, *ABC's* Brisbane television complex, topped with satellite dishes and radio antennas, was the site of a well-publicized breast cancer cluster among workers.34

Deadlier death rays

In the meantime, the radiation cowboys of America are having a good 'ol time because they know **there's no** sheriff in town. The commercial wireless industry is relentless in its drive to construct thousands of new transmitter sites in neighborhoods and schoolyards everywhere, while adding more **powerful** antennas at its older sites. Countless WiFi systems, both indoors and out, accommodate wireless laptop computers, personal digital assistants, WiFi-enabled phones, gaming devices, video cameras, even parking and utility meters. Hundreds of cities already have or are planning to fund WiFi networks, each consisting of thousands of small microwave transmitters bolted to buildings, street lamps, park benches and bus stops. Some networks are being buried under sidewalks. These access points or "nodes" blast carcinogenic energy at 2.4 to 5 gigahertz with virtually no warning signs about radiation **exposure.** WiFi radiation is unregulated by the FCC.

EXHIBIT M

Sprint-Nextel and Clearwire are now rolling out in U.S. cities tower-mounted WiMAX transmitters providing wireless internet access "to die for." WiMAX is WiFi on steroids. Upon startup of WiMAX transmitters near the Swedish village of Gotene, the emergency room at the local hospital was flooded by calls from people overcome with pulmonary and cardiovascular symptoms.35

WiMAX radiation could one day be cranked up to a bone-incinerating 66 gigahertz.36 A single WiMAX tower could provide internet coverage for an area of 3,000 square miles, although coverage for 6-25 square miles is the norm now. Promoters say WiMAX may some day replace all cable and DSI, broadband services and irradiate virtually all rural areas.

Not a single environmental or public health study has been required as the industry unleashes infrastructure for this savage new wireless technology from which no living flesh is able to escape.

The commercial ray-peddlers are not alone in their quest to make the U.S. a radiation wasteland. In August, 2007, Congress approved new Homeland Security legislation which funds a program to "promote communications compatibility between local, state and federal officials."

We catch a glimpse of what this portends as the state of New York gears up to erect hundreds of new wireless installations for a "Statewide Wireless Network (SWN)," allowing agencies at various government levels to communicate instantly.37 SWN will blanket 97 percent of the state, adding to the fog of commercial wireless pollution. The New York Office for Technology says that the radiation power densities of the system will be within FCC limits.

Angela's story

Angela Flynn, a 43-year-old caregiver, lives in Santa Cruz, California. Last spring she took classes at a local church where wireless antennas were concealed in a chimney on the building. She recalls, "Every muscle in my body felt sore. And my joints were feeling creaky. My instructor mentioned how people at the women's center on church property had similar symptoms. During my sixth day I had a severe reaction. My short term memory was gone and I was disoriented and confused. When the instructor asked a question, I could not recall anything from the lecture."

At night, Angela could not sleep and she would lie awake, feeling her body buzz. She became hypersensitive to other sources of electromagnetic radiation. The symptoms became so bothersome that she canceled the rest of her course. Using a chart for calculating cumulative, non-ionizing, electromagnetic radiation exposure levels, she found that the classes—located only 100 feet from antennas in the building—had suffered the highest possible exposure during peak operation.

"It took a month before I regained my health," she reports.

When Angela wrote letters to the church inquiring whether it was monitoring the health of the people exposed to antenna radiation, church officials were "unresponsive and dismissive." So Angela saw the light. She helped organize a community group to put pressure on county officials for answers. After hearing community testimony, officials directed the zoning department to create a comprehensive map of county transmitter sites and to put together a report on emissions testing.

EXHIBIT M

Angela says, "We recently had a delay of an installation of a tower near a middle school. The superintendent has even come out against the tower and was instrumental in delaying the hearing on the site. He also arranged a school board meeting on the issue." Angela's efforts to share critical information with her community made a difference.

Conclusion

America must soon face its radiation cataclysm. The EMR Network says that millions of workers occupy worksites on **a** daily basis where operating antenna arrays are camouflaged and where no RF safety program is canied out. Thanks to shameless predatory advertising techniques, American youth are now literally addicted to "texting," watching TV and accessing the Internet on tiny wireless screens. These are the toys that **keep** cell towers and WiFi hot spots buzzing. **A** nation that requires compulsory mass irradiation to fuel its trivial entertainment needs is surely destined to have a sickly and short-lived population.

Right now, 11.7 million Americans have been diagnosed with cancer. Because humans can harbor cancer conditions for years before detection, additional millions of cancer victims are yet undiagnosed. *The Journal of Oncology* ***Practice*** predicts that, by 2020, there will be *so* many cancer cases in the U.S. that doctors may not be able to cope with their caseloads. The report concludes the nation could soon face a shortage of up to 4,000 cancer specialists.[38]

A recent *CBS* news series on the raging American cancer epidemic left viewers with the mindset that trainloads of federal cash must flow if we are to find the cancer answer. But the cancer cause now inundates our cities, roadways, schools, offices and homes. Any environmental stressor that jackhammers human cells at millions to billions of cycles per second is a cancer factor. Any wave-pollution that breaks the DNA and causes pre-cancerous micronuclei in human blood is a cancer factor. Logic tells us that there will be no "answer to cancer" until we eliminate the cancer factors.

Wireless communications radiation is to America today what DDT, thalidomide, dioxin, benzene, Agent Orange and asbestos were yesterday. Historically, the truth about the public health menace of extreme toxins is never told until thousands sicken and die.

Dr. Robert Becker, noted for decades of research on the effects of electromagnetic radiation, has warned: "Even if we survive the chemical and atomic threats to our existence, there is the strong possibility that increasing electropollution could set in motion irreversible changes leading to our extinction before we are even aware of them. **All** life pulsates in time to the earth and our artificial fields cause abnormal reactions in all organisms ...These energies are too dangerous to entrust forever to politicians, military leaders and their lapdog researchers."[39]

Our mission to save *the* nation's health and restore sanity in the wireless age seems daunting. The wireless juggernaut is an aggressive, mean machine. Federal regulators are clearly compromised and incompetent to protect the public health. Uninformed consumers dearly love their magic digital toys and don't yet understand the connection between those toys and a national raging cancer epidemic that may consume us all.

EXHIBIT M

Powerful economic interests have lied to us long enough. Americans need and deserve the facts. We need dialogue. Wireless radiation is a form of electronic trespass. America must decide whose rights are more importan — idlers beaming death rays for gibberish or the elderly with pacemakers who are made ill by cell phone and tower radiation wherever they go. Must we all prematurely perish so that wireless enthusiasts can capture cell phone photos and instantly send them for processing via carcinogen express? Does a human being have the right to NOT be forcibly WiMAXED into a coffin, or do only wireless providers and their devotees have rights?

What can we do?

We can commit to join the growing radiation awareness movement and continue educating ourselves and others. We can employ digital and audio radiation detectors to help safeguard our personal health and to demonstrate the ceaseless brutality of ubiquitous wireless radiation which threatens the genetic integrity of future generations. We can promote emerging technologies that could make communications technologies safer.

We can demand that federal radiation exposure standards be updated and that wireless emissions from transmitters be drastically reduced. We can demand routine compliance testing at all transmitter sites. We can see to it that people living and working near transmitters be given opportunity to report their illnesses in national surveys. Proper epidemiological studies must be conducted and their results published and broadly disseminated. Federal communications law must be rewritten so that local jurisdictions can regain their right to consider health and environment when reviewing wireless siting applications.

Each of us can break the seductive, but oppressive wireless habit ourselves. We can play no game, use no wireless Internet system, make no trivial phone call that necessitates enlarging America's dense forest of wireless transmitters.

If no one buys WiMAX-enabled devices and related services, the system will fail. Whenever possible, we can go back to the old-fashioned, corded phones and message machines which made yesteryear a far more healthy time. We can encourage others to contact us by land line only.

Can we enjoy a leisurely conversation knowing that an irradiated caller risks disease and disability **for** mindless chatter? What good is wireless convenience if it means being ultimately tethered to a hospital bed? We can teach our children that health is more important than passing convenience and instant gratification.

According to OSHA, no environment should be deliberately made hazardous. Backed by current scientific knowledge, we can refuse to work or shop in an environment which endangers our health. We can demand that megahertz and gigahertz cordless phones, walkie talkie radios, WLAN and WiFi systems be removed from schools, offices, hospitals and any public place where people are grossly irradiated without their informed consent. Second hand smoke is bad; second hand radiation is worse.

We wish to *thank* the courageous radiation victims interviewed for this report who have generously revealed the details of their personal suffering in order to warn others. Following their example, we

EXHIBIT M

must continue undaunted in the moral quest to protect the national health and restore the world to sanity before it is too late.

Meters and resources

The ElectroSmog Detector allows you to HEAR the RF/microwave pollution in your environment. **(See** ad **on** page **14 of the** hardcopy **edition of *The IO*)**.

The Trifield Meter ($130), produced by Alpha Lab, is used mainly to measure the milligauss of electromagnetic fields coming from 60 hertz sources. Use this digital meter to make sure your living and working spaces are under 2 milligauss. Alpha Lab's Microwave Power Density Meter ($320) is a more sensitive digital microwave meter that will help you assess the kilohertz, megahertz and gigahertz radiation in our wireless environment. This easy-read meter measures microwave radiation in microwatts per cm2, allowing comparison of your readings to the 5 microwatts per cm2 used by the Russians to make our embassy staff sick. Remember, people inside the embassy reportedly received only about .01 microwatts per cm2. For more information, contact Alpha Lab Inc., **1280 South 300 West,** Salt Lake City, Utah **84101; (800) 658-7030;** www.trifield.com

For a list of more expensive professional meters available, go to: www.microwavenews.com. On the left side of the home page find a link called "Radiation Meters."

Alan Broadband produces radiation detection devices with models ranging in price from $159 to $2,800. The $159 model, while not giving detailed readings, is an extremely sensitive and sturdy instrument that gives an accurate dial read on whether or not radiation is present and its relative intensity. It lets you know when you are being irradiated and serves as an excellent tool to illustrate exposure levels to others. For more information, contact **Alan** Broadband **93** Arch **St., Redwood** City, California **94062; (888) 369-9627; www.zapchecker.com**

Books

Cell Phones: Invisible Hazards in the WirelessAge, Dr. George Carlo and Martin Schram, Carroll & Graf Publishers, 2001.

Cellular TelephoneRussian Roulette, Robert C. Kane, Vantage Press, 2001.

Cell Towers: Wireless Convenience or Environmental Hazard? The Berkshire-Litchfield Environmental Council, Edited by B. Blake Levitt, 2000. Order from Barnes and Noble.

Websites

These websites provide excellent information on all aspects of health and other issues relating to electromagnetic fields and radio frequency/microwave radiation.

www.buergerwelle.com This excellent German (but in English) site features RF/microwave radiation news from all over the world. The science keeps pouring in and this is where to find it, along with lots

EXHIBIT M

of human interest.

www.cprnewsbureau.org This is an excellent source of up-to-date news on wireless issues

www.emrnetwork.org This site has superb resources organized by professionals with expertise in all facets of our RF/microwave radiation problem.

www.safewireless.org This site features Dr. Carlo's Mobil Telephone Health Concerns Registry where people can report ill health effects from living near microwave transmitters or from the use of wireless devices. It also features great news reports.

www.microwavenews.com This is home to Microwave News, an excellent monthly publication. It offers cutting edge science reports, **plus** a great archive.

www.sageassociates.net This site provides valuable information on how to make homes and offices safer in the wireless age.

CAUTION: There are many devices on the market claiming to protect wireless users from radiation. These include: air tube headsets, ferrite bead clip-ons and an array of paste-ons advertised to cut down on thermal effects or deflect negative energy. Energy testing, kinesiology and meter readings indicate that these mitigation devices DO NOT adequately protect against the brutal force of near field microwave radiation. You can investigate the effectiveness of these devices by metering radiation levels while using them. If radiation pours from your "safe" headset, don't bank your life on it. If practiced in the art **of** kinesiology, you can also "muscle test" the effectiveness of the radiation mitigation device. The human body becomes very weak when irradiated with any man-made frequency, especially microwaves. If a protective device is really working, you will not detect muscle weakness when using a wireless phone or gadget.

Remember when there were no cellphones?

By Don Harkins

As her friend and editor for over a decade now, I have gown alongside Amy in her research on chemtrails, depleted **uranium** and radiation. There is zero doubt in our hearts and minds that Amy's references are sound, her interpretation of data flawless and her intentions purely honorable and compassionate.

That means use of cell phones, WiFi, WiMax and RFID is not only suicide, but complicity in a "slow burn" form of mass murder. If second-hand cigarette smoke bothers you, how does it compare to second hand radiation? Well, it doesn't. Using a cell phone in proximity to others only increases the intensity of the ambient levels of radiation that are omnipresent to **support** wireless personal communication networks. Where nonsmokers can remove themselves or the smoker from the room, noncellphoneusers (one word) cannot escape radiation by going to another room. In other words, everyone is bathing in dangerous levels of cellphone "smoke" whether you are "smoking" or not.

When the wireless age was growing in earnest in the late 90s, people kept telling Ingri and I, "You really need to get cell phones—they are so convenient."

EXHIBIT M

We opted not to for the same reason we have never acquired a laptop computer: If we are away from our desk that means we are (temporarily) FREE! —free of the phone and free of the computer.

The next stage, by the early 00s, people began saying to us, "Don, Ingri, you really need to get cell phones so it will be more convenient for *us* to get ahold of *you."*

Now, when the subject of ow having resisted carrying cell phones to this point comes up in conversation, people say, "You are so lucky."

It's not luck—we just didn't like the idea of being "on call" all the time and our lifestyles just didn't evolve to include cell phones. We have only known for a couple years how deadly they are.

But, for cellphoneusers (one word), the novelty of cell phones has been replaced with addiction and the convenience has been replaced with enslavement. In that sense, we are lucky.

The three following comments represent the most common justifications people recite for using cell phones:

"But with myjob, I have to have one."

"They are handy in an emergency."

"This way, the kids (the wife/husband/friends/business contacts) can always get ahold of me."

But consider these responses from noncellphoneusers:

"*Is your* ***job*** *worth irradiating yourself and the world around you?"*

"What did you do in an emergency BC (that's "before cellphones')?"

"Are you sure that you are so darned important that you can't just have people leave a message ***on*** *a land line recorder and check messages* ***now*** *and then?"*

And one bonus retort: *"If an industry is using your addiction to wireless* ***toys*** *as a means to finance the erection of a communications infrustructure that intends io control all life on earth en route to destroying it, should you choose to* ***buy*** *its services?"*

The **truth** is you can do your job without a cell phone—or find another one.

You can prepare in advance for emergencies like we used to.

And, it is true, we aren't so important that people can't wait a few minutes or ***a*** few hours to talk to us. **(DWH)**

Notes:

1. Interview with Dr. Eckel published by *Schwabischen Post* 12-07-06. Find interview at www.hese-project.org. See "The Cell Nucleus is Mutating."

EXHIBIT M

2. " Neurological Effects of Radiofrequency Electromagnetic Radiation," a paper presented by Dr. Lai to the Mobile Phones and Health Symposium, October 2528,1998, University of Vienna. Also "DNA Damage and Cell Phone Radiation," www.rfsafe.com, 11-02-05.

3. ***Cell Phones: Invisible Hazards in the Wireless Age,*** Dr. George Carlo and Martin Schram, Carroll & Graf Publishers, 2001, p.151.

4. " Mobile Telecommunications and Health — Summary of the ECOLOG study for T-Mobile, 2000," Find this summary at www.hese-project.org.

5. "Cell Phone Radiation Harms DNA, Study Claims," (Reuters) MSNBC, 12-04-04. Also "Mobile Phone Radiation Harms DNA," R Moss, CPR News Bureau, 10-16-06.

6. "RF-Induced DNA Breaks Reported in China," Microwave News, 09-29-05. This report comes from the Zhejiang University School of Medicine.

7. "2.45 GHz radiofrequency fields alter gene expression in cultured human cells," Lee S et al, Department of Medicine, University of Chicago, PubMed 16107253.

8 "Health Social Services and Housing Sub-Panel Telephone Mast Review," a public discussion by Dr. George Carlo, 2-26-07. Find this excellent dissertation at www. safewireless.org.

9. Few Americans know that cell phones have never been safety tested thanks to the FDA, which exempted cell phones from prcmarket testing based on a "low power exclusion" rule.

10. "The American Cancer Society is Misleading the Public," Dr. George Carlo, 8-5-07. Find this statement at www.buergerwelle.com.

11. "Long-Term Mobile Phone Use Raises Brain Tumor Risk Study," Reuters, 03-31-06. This research was conducted by the Swedish National Institute for Working Life whose scientists studied 905 people with malignant brain tumors to confirm a 240% increased risk of brain tumors after heavy mobile phone use.

12. "Cancer in Radar Technicians Exposed to RF/Microwave Radiation: Sentinel Episodes," Richter E. et al, Int. J. Occup Environ Health 6 (3):187-193, 2000.

13. "FCC Lives Large off Lobbyist Bribes," Capitol Hill Blue, 05-22-03, capitolhillblue.com.

14. "Health Social Services and Housing Sub-Panel Telephone Mast Review," public discussion by Dr. George Carlo, 2-26-07. Find this excellent dissertation at www. safewireless.org.

15. See www.c-a-r-e.org for information about groups affected by Lookout Mountain broadcast antennas.

16. For an excellent chart comparing biological effects at power density levels and a list of international exposure standards, go to: "Radio Wave Packet," Arthur Firstenberg, Cellular Phone Task Force, Sept 2001; also find this power density list at: "Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink WiFi Network, Magda Havas, Ph.D, Trent University, May 2007.

17. Quote from letter by Norbert Hankin, chief environmental scientist with EPA's Radiation Protection Division. This letter was received by EMR Network 7-16-02 and can be found at www.emrnetwork.org.

18. "Supreme Court Rebuffs Challenge to U.S. Tower Policy," ***Microwave News,*** Jan./Feb 2001.

EMR Network Petition For Inquiry To Consider Amendment of Parts 1 and 2 of the FCC's Rules Concerning the Environmental Effects of Radiofrequency Radiation, September 25, 2001. ***See*** also FCC order to deny

EXHIBIT M

application for review filed by the EMR Network, adopted July **28,2003.**

19. Hicks, Onnink, Barber, Pennington v. Horvath Communications, Cause No.71C01-0107-CP St. Joseph Circuit Court, St Joseph County, Indiana.

20. "Some Unexpected Health Hazards Associated with Cell Tower Siting," Bill P.Curry, PhD., ***Cell Towers: Wireless Convenience or Environmental Hazard?*** 'The Berkshire-Litchfield Environmental Council, edited by B. Blake Levitt, **2000.** See chapter **6.**

21. ***Practical Guidelines to Protect Human Health Against Electromagnetic Radiation Emitted in Mobile Telephony,*** Summary June **2001,** Miguel Muntane Condeminas, industrial engineer for Consulting Comunicacio i Disseny S.L, Barcelona, **m.co-di@eic.ictnet.es.** See Section **4.3.1** "**US** Embassy in Moscow Study."

22. See **www.health-concerns.org.** and www.safewireless.org. These sites provide **a** pathway to access Dr. Carlo's Mobil Telephone Health Concerns Registry where people can report ill health effects from living near microwave transmitters or from the use ***of*** wireless devices.

23. "Electromagnetic, Fields, (EMF) Killing Fields," Arthur Firsteuberg, ***The Ecologist,*** v. **34,** n. **5, 6-10-2004.**

24. "Study **of** the health of people living in the vicinity of mobile phone base stations: I. influences of distance and sex," R. Santini et al, Institut National des Sciences Appliquées—laboratoire de **biochimie-pharmacologie, *2002.***

- ***25.*** "Cancer Risks from Microwaves Confirmed," Dr. Mae-Wan Ho, Institute ***of*** Science **in** Society press release, **5-24-07.**

26. "The Microwave Syndrome – a preliminary study **in** Spain," Navarro E. et al, Biology and Medicine, **22 (2 &3) 161-169,2003; also "** The Microwave Syndrome – Further Aspects of a Spanish Study," Oberfeld G et **al 2004,** International Conference Proceedings, **Kos,** Greece **2004.**

27. "Neurobehavioral Effects Among Inhabitants Around Mobile Phone Base Stations," Abdel-Rassoul et al, Neurotoxicology, **8-01-2006.**

28. "Increase of Cancer Near Cell-Phone Transmitter Station," Wolf D. and Wolf, International Journal of Cancer Prevention **1-2,** April **2004.**

29. "Two in Three Believe Radiation from Pbones Damaged their Health," Geoffrey Lean, **7-8-07** ***Independen: on Sunday,*** **U.K.**

30. "Cancer Cluster at Phone Masts, " Times On Line, ***The Sunday Times,*** **UK 4-22-07.**

31. Report by Roland Stabenow, **9-21-06,** bead of cancer registry in Berlin.

32. "How Shall We Cope With the lncreasiug Amounts of Airborne Radiation?" Olle Johansson, Journal of the Australasian College ***of*** Environmental Medicine, Dec. **2006.**

33. "Building Top Floors Closed After Brain Tumor Alert," Lisa Macnamara, ***The Australian,*** **UK,** 05-13-07. Read this report at www.rense.com.

34. "Cancer Strikes **12** Female Staffers," Tony Koch, Omega-News, **4-06-07.**

35. Swedes Hit Hard By WiMax, **6-12-06,** Reported **by** Swedish media about Swedish town Gotene. Hospital emergency room flooded with calls regarding headaches, difficulty breathing, blurry vision and heart problems. At least ***5*** people had to leave their homes.

EXHIBIT M

36. "How WiMAX Works," E. Grabianowski and Marshal Brain, www. computer.howstuf€works.com

37. "250-foot Tower Raises New Bellevue Fears", John Hopkins, *Cheektowaga Times*, 8-09-2007; See also "Congress Approves Homeland Security Bill," Spencer Hsu, *Washington* Posl OS-07-07.

38. Jonrnal of Oncology Practice, Vol. 3, No. 2, March 2007: 79-86.

39. Robert Becker, *The Body Electric,* 1986.

EXHIBIT M

Radio Frequency Safety

Office of Engineering arid Technology

Information On Human Exposure ***To*** Radiofrequency Fields **From** Cellular and PCS Radio Transmitters

(1) Cellular and PCS base stations

Radiofrequencies constitute part of the overall electromagnetic spectrum. Cellular communications systems use frequencies in the 800-900 megahertz (MHz) portion of the radiofrequency (RF) spectrum (frequencies formerly used for UHF-TV broadcasting), and transmitters in the Personal Communications Service (PCS) use frequencies in the range of 1850-1990 MHz. Primary antennas for cellular and PCS transmissions are usually located on towers, water tanks and other elevated structures including rooftops and the sides of buildings. The combination of antennas and associated electronic equipment is referred to as a cellular or PCS base station" or "cell site." Typical heights for base station towers or structures are 50-200 feet. **A** typical cellular base station may utilize several "omni-directional" antennas that look like poles or whips, 10 to 15 feet in length. PCS (and also many cellular) base stations use a number of "sector" antennas that look like rectangular panels. The dimensions of a sector antenna are typically **1** foot by **4** feet. Antennas are usually arranged in three groups of three with one antenna in each group used to transmit signals to mobile units (car phones or hand-held phones). The other two antennas in each group are used to receive signals from mobile units.

The Federal Communications Commission (FCC) authorizes cellular and PCS carriers in various service areas around the country. At a cell site, the total RF power that could be transmitted from each transmitting antenna at a cell site depends on the number of radio channels (transmitters) that have been authorized and the power of each transmitter. Typically, for a cellular base station, **a** maximum of 21 channels per sector (depending on the system) could be used. Thus, for a typical cell site utilizing sector antennas, each of the three transmitting antennas could be connected to up to 21 transmitters for a total of 63 transmitters per site. When omni-directional antennas are used, up to 96 transmitters could be implemented at a cell site, but this would be very unusual. While a typical base station could have as many as ***63*** transmitters, not all of the transmitters would be expected *to* operate simultaneously thus reducing overall emission levels. For the case of PCS base stations, fewer transmitters are normally required due to the relatively greater number of base stations.

Although the FCC permits an effective radiated power (ERP) of up to 500 watts per channel (depending on the tower height), the majority of cellular base stations in urban and suburban areas operate at an ERP of 100 watts per channel or less. An ERP of 100 watts corresponds to an actual radiated power of 5-10 watts, depending on the type of antenna used (**ERP** is not equivalent to the power that is radiated but is a measure of the directional characteristics of the antenna). As the capacity of a

EXHIBIT M

system is expanded by dividing cells, i.e., adding additional base stations, lower ERPs are normally used. In urban areas, an ERP of 10 watts per channel (corresponding to a radiated power of 0.5 - 1 watt) or less is commonly used. For PCS base stations, even lower radiated power levels are normally used.

The signal from a cellular or PCS base station antenna is essentially directed toward the horizon in a relatively narrow beam in the vertical plane. For example, the radiation pattern for an omni-directional antenna might be compared to a thin doughnut or pancake centered around the antenna while the pattern for a sector antenna is fan-shaped, like a wedge cut from a pie. As with all forms of electromagnetic energy, the power density from a cellular or PCS transmitter decreases rapidly (according to an inverse square law) as one moves away from the antenna. Consequently, normal ground-level exposure is much less than exposures that might be encountered if one were very close to the antenna and in its main transmitted beam. Measurements made near typical cellular and PCS installations have shown that ground-level power densities are well below limits recommended by RF/microwave safety standards.

In 1996, the FCC adopted updated guidelines for evaluating human exposure to radiofrequency (RF) fields from fixed transmitting antennas such as those used for cellular radio and PCS base stations'. The new guidelines for cellular and PCS base stations are identical to those recommended by the National Council on Radiation Protection and Measurements (NCRP)'. These guidelines are also similar to the 1992 guidelines recommended by the American National Standards Institute and the Institute of Electrical and Electronics Engineers (ANSI/IEEE C95.1-1992)[3]. The FCC adopted guidelines for hand-held RF devices, such as cellular and PCS phones, that are the same as those recommended by the ANSI/IEEE and NCRP guidelines (see later discussion).

In the case of cellular base station transmitters, at a frequency of 869 MHz (the lowest frequency used), the FCC's RF exposure guidelines recommend a maximum permissible exposure level of the general public (or exposure in "uncontrolled" environments) of about 580 microwatts per square centimeter (μW/cm2), as averaged over any thirty-minute period. This limit is many times greater than RF levels typical found near the base of typical cellular towers or in the vicinity of other, lower-powered cellular base station transmitters. For example, measurement data obtained from various sources have consistently indicated that "worst-case" ground-level power densities near typical cellular towers are on the order of 1 μW/cm2 or less (usually significantly less). Calculations corresponding to a "worst-case" situation (all transmitters operating simultaneously and continuously at the maximum licensed power) show that in order to be exposed to levels near the FCC's limits for cellular frequencies, an individual would essentially have to remain in the main transmitting beam (at the height of the antenna) and within a few feet from the antenna. This makes it extremely unlikely that a member *of* the general public could be exposed to RF levels in excess of these guidelines from cellular base station transmitters.

For PCS base station transmitters, the same type of analysis holds, except that at the PCS transmitting frequencies (1850-1990 MHz) the FCC's exposure limits for the public are 1000 μW/cm2. Therefore, there would typically be an even greater margin of safety between actual public exposure levels and the recognized safety limit.

When cellular and PCS antennas are mounted at rooftop locations it is possible that RF levels greater than 1μW/cm2 could be present on the rooftop itself. This might become an issue if the rooftop were accessible to maintenance personnel or others. However, exposures approaching or exceeding the safety guidelines are only likely

EXHIBIT M

to be encountered very close to and directly in front of the antennas. Even if RF levels were to be higher than desirable on a rooftop, appropriate restrictions could be placed on access. Factoring in the time-averaging aspects of safety standards could also be used to reduce potential exposure. The fact that rooftop cellular and PCS antennas usually operate at lower power levels than antennas on free-standing towers makes excessive exposure conditions on rooftops even less likely. This reason and the significant signal attenuation of a building's roof also minimizes any chance for harmful exposure of persons living or working within the building itself.

(2) Mobile (vehicle-mounted) antennas 

Vehicle-mounted antennas used for cellular communications normally operate at a power level of 3 watts or less. These cellular antennas are typically mounted on the roof, on the trunk, or on the rear window of a car or truck. Studies have shown that in order to be exposed to RF levels that approach the safety guidelines it would be necessary to remain very close *to* a vehicle-mounted cellular antenna. For example, a study done for AT&T Bell Laboratories by the University of Washington documented typical and "worst-case" exposure levels and specific absorption rates (SAR) for vehicle occupants and persons standing close to vehicle-mounted cellular antennas. Worst-case exposure conditions were considered when an individual was at the closest possible distance from the antenna. Several configurations were tested using adult and child "phantom" models.

The results of this study showed that the highest exposure (1900 µW/cm2) occurred with a female model at a distance of 9.7 cm (3.8 inches) from one of the antennas operating at a power level of 3 watts. Although this level is nominally in excess of the FCC's exposure limits for power density at this frequency, analysis of the data indicated that the antenna would have to be driven to 7 W of power before the limit for specific absorption rate (SAR) allowed by the FCC guidelines would be exceeded. The intermittent nature of transmission and the improbability that a person would remain so close to the antenna for any length of time further reduces the potential for excessive exposure.

The University *of* Washington study also indicated that vehicle occupants are effectively shielded by the metal body. Motorola, Inc., in comments filed with the FCC, has expressed the opinion that proper installation of a vehicle-mounted antenna to maximize the shielding effect is an effective way of limiting exposure. Motorola and other companies have recommended antenna installation either in the center of the roof or the center of the trunk. In response to concerns expressed over the commonly-used rear-window mounted cellular antennas, Motorola has recommended a minimum separation distance of 30-60 cm (1-2 feet) to minimize exposure to vehicle occupants resulting from antenna mismatch for this type of antenna installation.

In summary, from data gathered to date, it appears that properly installed, vehicle-mounted, personal wireless transceivers using up to 3 watts of power would result in maximum exposure levels in or near the vehicle that are well below the FCC's safety limits. This assumes that the transmitting antenna is at least 15 cm (about 6 inches) or more from vehicle occupants. Time-averaging of exposure (either a 6 or 30 minute period is specified) will usually result in still lower values when compared with safety guidelines.

(3) Hand-held cellular telephones and **PCS** devices 

A question that often arises is whether there may be potential health risks due to

EXHIBIT M

the RF emissions from hand-held cellular telephones and PCS devices. The FCC'S exposure guidelines, and the ANSI/IEEE and NCRP guidelines upon which they are based, specify limits for human exposure to RF emissions from hand-held RF devices in terms of specific absorption rate (SAR). For exposure of the general public, e.g., exposure of the user of a cellular or PCS phone, the SAR limit is an absorption threshold of 1.6 watts/kg (W/kg), as measured over any one gram of tissue.

Measurements and computational analysis of SAR in models of the human head and other studies of SAR distribution using hand-held cellular and PCS phones have shown that, in general, the 1.6 W/kg limit is unlikely to be exceeded under normal conditions of use. Before FCC approval can be granted for marketing of a cellular or PCS phone, compliance with the 1.6 W/kg limit must be demonstrated. Also, testing of hand-held phones is normally done under conditions of maximum power usage. In reality, normal power usage is less and is dependent on distance of the user from the base station transmitter.

In recent years publicity, speculation and concern over claims of possible health effects due to RF fields from hand-held wireless telephones prompted industry-sponsored groups, such as Wireless Technology Research, L.L.C. (WTR) and Motorola, Inc., to initiate research programs aimed at investigating whether there is any risk to users of these devices. Past studies carried out at frequencies both higher and lower than those used for cellular and PCS phones have led expert organizations to conclude that typical RF exposures from these devices are safe. However, the Federal Government is monitoring the results of the ongoing industry-sponsored research through an inter-agency working group led by the EPA and the FDA's Center for Devices and Radiological Health.

In a 1993 "Talk Paper," the FDA stated that it did not have enough information at that time to rule out the possibility of risk, but if such a risk exists "it is probably small." The FDA concluded that there is no proof that cellular telephones can be harmful, but if individuals remain concerned several precautionary actions could be taken. These included limiting conversations on hand-held cellular telephones to those that are essential and making greater use of telephones with vehicle-mounted antennas where there is a greater separation distance between the user and the radiating structure.

* * *

NOTE: For more information on these and other RF-related topics, you may call the FCC's toll-free number: 1-888-CALL FCC (1-888-225-5322) or contact the FCC's RF Safety Program, in the Office of Engineering and Technology, at (202) 418-2464. Information is also available at the FCC's Office of Engineering and Technology World Wide Web Site under the "RF Safety" heading at the following address: http://www.fcc.gov/oet/rfsafety/.

Endnotes:

1. FCC Report and Order in ET Docket 93-62; 61 Federal Register 41006 (August 7, 1996); 11 FCC Record 15123 (1997). See also, FCC Second Memorandum Opinion and Order, ET Docket 93-62, 62 Federal Register 47960 (September 12, 1997), 12 FCC Record 13494 (1997). For more information on these documents contact the FCCs toll-free number: 1-888-CALL FCC (1-888-225-5322).They may also be viewed and downloaded at the FCC's Office of Engineering and Technoiogy World Wide **Web** Site under the "RF Safety" heading at the following address: www.fcc.gov/oet/rfsafety. The FCCs RF exposure guidelines are based on recommendations made to the FCC by U.S.federal safety and health agencies such as the Environmental Protection Agency (EPA), the

EXHIBIT M

Food and Drug Administration (FDA). the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA).

2. The NCRP is a non-profit corporation chartered by congress to develop information and recommendations concerning radiation protection.

3. The American National Standards Institute is a non-profit, privately-funded, membership organization that coordinates development of voluntary national standards in the United States. The IEEE is a non-profit technical and professional engineering society.

last reviewed/updated 1/9/06

If you have questions about this web page, or would like more information pertaining to **OET,** please send e-mail to oetinfo@fcc.gov

Federal Communications Commission
445 12th Street SW
Washington, DC 20554
More FCC Contact Information..

Phone: 1-888-CALL-FCC(1-888-225-5322)
TTY: 1-888-TELL-FCC (1-888-835-5322)
Fax: 1-866-418-0232
E-mail: fccinfo@fcc.gov

EXHIBIT M

SUBMITTED WITH
ORAL COMMENTS
ZONING ADMINISTRATOR
AUGUST 3,2007 AGENDA
ITEM **3**
APN 026-31 1-65
(NEW CELL TOWER ON LEDYARD PROPERTY, 1053 17TH AVENUE, SANTA CRUZ)

1. Telecom Towers Tsunami by B. Blake Levitt, March 3,2000
2. Freeburger Appeal, October, 2002
3. Blind Faith in Wireless Technology – Facts Everyone Should Know (EMR Policy Institute)
4. Antennas dismantled in Spain due to unprecedented childhood cancers in neighboring school
5. "Wi" Tech Genocide, 2005
6. Danger: Radiation fact sheet
7. Letter to Sen. Diane Feinstein from Board of Supervisors, 7/10/07, **re:** wireless facilities locations

EXHIBIT M

Telecom Towers Tsunami

By B. Blake Levitt

There are medical and political ramifications to cell* lower siting in our *county

Guest editorial published in The ***New** Milford (CT) Times, March 3,* 2000

B. Blake Levitt, a former *New* York Times science writer, is the author of *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves* (Harcourt Brace, 1995) for which she won an award from the American Medical Writers Association. She lives in Warren, CT

Litchfield County—along with the rest of the country—is suffering a telecommunications tower blitzkrieg. The local press has done an excellent job of covering the subject with one exception—the medical implications of tower siting.

At its core, this is a medical and an environmental issue. In emphasizing aesthetics, such as hiding antennas in church steeples, our premier planners are missing a critical opportunity to exercise prudent avoidance and precautionary principles—wise courses of action now recommended by doctors and public health officials all over the world.

Here is a partial list of MD's who are calling for prudent avoidance when siting antennas close to the population, particularly near schools: Dr. David Ozonoff, Dept. of Environmental Health, Boston University; Dr. Kathleen Thurmond, Harvard Medical School; Dr. Joseph Brain, Harvard School of Public Health, State University of New York at Albany; Dr. Kathleen M. Fagan, Division of Occupational and Environmental Medicine, Cleveland, Ohio; Dr. Cathey Falvo, International and General Public Health, New York Medical College; Dr. Philip J. Landrigan, Department of Community and Preventive Medicine, Children's Health and the Environment, Mt. Sinai-School of Medicine and many others.

And from the ever-blunt Helen Caldicott, MD, co-founder of Physicians for Social Responsibility, this e-mail statement: "Radiofrequencies emitted from mobile telephone towers will have deleterious medical effects to people within the near vicinity according to a large body of scientific literature. Babies and children will be particularly sensitive lo the mutagenic and carcinogenic effects of this radiofrequency radiation. It is therefore criminal to place one of there aerials on or near a school..."

P.3

So what's going on here? Could we *really* have another emerging public health problem? Like lead poisoning? DDT? Ashestor? Tobacco smoke? This time with ambient, low-level, non-ionizing radialion? Many now suspect so.

What we are talking about is the buildout of a new technology in close proximity to the human population for the first time in our evolutionary history, with no clear understanding of the bioefiects. Despite what industry says, no safe level of radiofrequency radiation has ever been determined. The standards in place at the Federal Communications Commission (FCC) are considered seriously flawed. Important questions raised over 50 years ago regarding radiofrequency (RF) radiation used in these and myriad other wireless technologies have never been resolved.

Outside of industry spokesmen, few experts who take an in-depth (vs. a cursory) look at the science feel comfortable with this today. The FCC standards are based on models for acute, thermal exposures only, with downward extrapolations built in for presumptions of safety. But adverse ***non-thermal*** effects, far below the standards, have been noted time and again in the research. In other words, the standards can guarantee we won't cook—like in a microwave oven which uses frequencies very close to digital PCS cell-phone technology—but they cannot guarantee anything else.

The studies used to reach these conclusions about safety are also suspect. Scientists, from the physics and engineering disciplines (the non-living sciences), have traditionally used test designs of high-power, short-term expomres then extrapolated to presumptions about long-term, low-level exposures such as those who live near RF installations experience. But are these comparable? Again, many think not.

Scientists from the biology disciplines (the living sciences) point out that living systems are far more complex than inanimate physics models. They say that inappropriate research has consistently been used to reach inappropriate conclusions and it's been generated by the wrong professions.

There is a federal RF Interagency Work Group comprised of division directors from the FCC, FDA, OSHA, EPA and NIOSH trying to address some of these problems.

EXHIBIT M

In lune 1999 the group issued an RF guidelines paper outlining the tasks at hand. In it they recognize that the current standards are based on acute exposures that are engineering dosimetry models, not an biological principles. They acknowledge that exnapolation of acute effects data to chronic exposure conditions is uncertain.

The zoning preemptions for RF contained in the Telecommunications Act of ***1996*** were not an accident. The telecom industry knew they could never develop a ground-based system (vs. a more expensive satellite system) without such preemptions because whenever the subject of RF health effects gets a **serious** airing at the local level, the industry loses. Individuals may want their cell phones, which are voluntary RF exposures, but no one wants a 24-hour involuntary exposure near an antenna array.

Behind the scenes, this industry plays hardball. In 1994, they asked the FCC to preempt all local zoning. In 1997, they asked the FCC to forbid the discussion of RF health effects at local zoning. (Don't they know we have a First Amendment here?) Also in 1997, they asked the FCC to declare it illegal for communities to make them prove they are in compliance with the standards. (The FCC hasn't granted any of these requests.)

The industry has repeatedly tried for interstate commerce status, which would override local zoning. John McCain heads the commerce committee. He is a pro-industry advocate. He has refused to allow citizens to testify at committee hearings; only industry reps are allowed. During the first six months of 1999 alone, telecommunications companies spent over $3,000,000 on lobbying legislators. Few vote against them.

But most ominously for our churches and towns, this industry has consistently tried lo shift all liability onto the site owners and away from themselves as providers of fhe service. Using third-party tower builders--verticalreal estate companies like SBA currently trolling Litchfield County– is another way of shifting liability. The service providers get an extra layer in between themselves and the community. And the tower companies understand the RF risks only too well. They are set up as holding companies with their assets tied up in subsidiary companies, meaning most of their assets are untouchable in lawsuits. High-risk companies always do this.

The Telecom Act only preempted for service providers, not for tower speculators. Tower companies hope local governments won't quite figure that one out.

P.4

This entire industry has carefully crafted insulation around itself, but the question remains, against what?

Here's a sampling of the non-thermal "contraband" science theydon't want us to talk about at public hearings:

- In the 80's and 90's, Dr. William Ross Adey, aneuroscientist, and Dr. Carl Blackman, a biophysicist at the U.S. EPA, found in several studies that the human anatomy has critical "windows" in which we respond to some frequencies, hut not to others. At set intervals in the non-ionizing bands they observed a dramatic cellular effect called calcium ion dumping. The cells use calcium for a host of important functions. This work could indicate any number of adverse cellular effects.

- In 1994, Drs. Henry Lai and N.P. Singh, at the University of Washington. Seattle, found both double and single-strand DNA breaks in test animals exposed to cellular and PCS-frequency pulsed microwaves. Double-strand DNA breaks are thought not to repair themselves and can lead to mutations. Dr. Lai recently published a smdy that found learning defects in test animals exposed to low-level pulsed microwaves.

- In 1996, Dr. Michael Repacholi found.? significant increase in B-cell lymphomas in test mice exposed to long-term, low-level pulsed microwave frequencies in the cellular and PCS range. Changes in B-cells in the immune system are implicated in roughly 85 percent *of* all cancers.

- The work of Dr. Stanislaw Szmigielski in Poland on microwave and radar personnel has found sharp increases in cancers—including lymphomas, melanomas, leukemias and brain tumors—as well as high blood pressure, headaches, memory loss, and brain damage. Also noted were immune system abnormalities. About 10 other studies have found immune-system suppression.

- In 1984, Dr. William Arthur Guy, at the University of Washington, Seattle, found an increase in malignant endocrine gland tumors and in benign adrenal gland tumors in test animals.

EXHIBIT M

- In 1975, researcher Alan Frey reported for the first time increases in the permeability of the blood-hrain barrier in test animals exposed to pulsed microwaves similar to what is used today in digital PCS systems. The blood-brain barrier protects the brain from access by viruses, bacteria and toxins.

- In 1975, Dr. William Bise, using 10 human test subjects, found severe alterations in human electroencephalograms at microwave and RF power levels that are now common in most urban areas due to ambient RF. The yearlong study documented a kind of entrainment phenomenon of the test subjects' brain waves with the external exposures. and radical changes in mood and behavior.

- In 1992, Dr. Joseph Kirchvink, a geobiologist, discovered magnetite in human brain tissue in the blood-brain barrier and in the meninges which covers the brain. Magnetite interacts a million times more strongly with external magnetic fields than with any other biological material. Many species-bees. buds, butterflies. fish—manufacture magnetite and use it as a navigational tool. Any standards for RF exposure presume humans *do* not manufacture magnetite.

- There are indications that some frequencies may *be* unsafe *at* any intensity. This is a crucial point when telecommunications reps talk about how low-power their installations are, likening them to 25- and 100-wan lightbulbs. (What they leave out is that it is 100 watts of effective radiated power per channel. There can be dozens of channels on one antenna, and dozens of antennas on one installation.)

- The pulsing factor of RF alone—such as that used in the newer digital PCS and High Definition Television (HDTV) technologies-has been found to be a significant variable in adverse effects. Dr. Jerry Phillips has found in several studies that RF pulsing of tumorogenic cell cultures accelerated their already abnormal growth rates by 3000 percent. *And* recent research from China found that important portals on the cell's surface are fantastically sensitive to low-intensity pulsed RF signals. The presence of such signals alone was found *to* completely alter the information reaching the interior of the cell. This is critical information with implications for everything from cancer. to genetic mutations, to immune system dysfunction, among many other things.

There is federal legislation *to* remedy this. Senator Patrick Leahy (D-VT) introduced Senate Bill 1538 that would restore all local siting control for RF. Representative Bernie Sanders (I-VT) has introduced similar legislation at the U.S. House of Representatives (HR 2834 and 2835). There are $10 million research appropriations anacbed to these bills, with funds directed to the National Institutes of Health. *[Render, please note as of 10/02 the above hills were updated as separate bills: S.3102, S.3103 and HR.5631. HR.5632. Sponsors were Senators Leahy(VT), Jeffords(VT), Murray(WA), and Dodd(CT), nnd Congressmen Sanders(VT), Tancredo(CO), Davis(IL), and Shays(CT). These bills will be reintroduced in the new session.]* There is currently no federal research effort into RF. Industry, with its inherent bias and with decades of well-leveled accusations of research tampering, controls the show. Four independent bioelectromagnetic research labs have folded within the last five years due to absence of funding. It's imperative, in the face of this buildout, that an unbiased research program without industry influence be initiated. It's a no-bramer, actually...

P.5

Is there contradictory science that would indicate we don't have reason for concern? Of course. Are there people of good faith on both sides of this issue? Of course.

But as laymen. it is still our obligation to err on the side of caution, especially where our children are concerned.

Hide antennas in church steeples? Near schools? Near homes? Our planners might want to rethink that recommendation, They can be held personally liable, too.

EXHIBIT M

This has been signed by 3,000 doctors worldwide

Interdisziplinäre Gesellschaft fur Umweltmedirin e. V.

IGUMED. Bergseestr. 57.79713 Bad Säckingen
Tel. 07761913490, FAX 913491, e-mail: igumed@gmx.de

9. Oktober 2002

FREIBURGER **APPEAL**

Out of great concern for the health of our fellow human beings do we - as established physicians of all fields, especially that of environmental medicine - turn to the medical establishment and those in public health and political domains, as well as to the public.

We have observed, in recent years, a dramatic rise in severe and chronic diseases among our patients, especially:

- Learning, concentration, and behavioural disorders (e.g. attention deficit disorder, ADD)
- Extreme fiuctuations in **blood** pressure, ever harder to iniiuence with medications
- Heart rhythm disorders
- Heart attacks and strokes among an increasingly younger population
- Brain-degenerative diseases (e.g. Alzheimer's) and epilepsy
- Cancerous afflictions: leukemia, brain tumors

Moreover, we have observed an ever-increasing occurrence of various'disorders, often misdiagnosed in patients **as** psychosomatic:

- Headaches, migraines
- Chronic exhaustion
- Inner agitation
- Sleeplessness. daytime sleepiness
- Tinnitus
- Susceptibility to infection
- Nervous and connective tissue pains, for which the usual causes **do** not explain even the most conspicuous symptoms

Since the living environment and lifestyles of our patients are familiar to us, we can see – especially after carefully-directed inquiry – a clear temporal and spatial correla-

EXHIBIT M

tion between the appearance of disease and exposure to pulsed high-frequency microwave radiation (HFMR), such as:

- Installation of a mobile telephone sending station in the near vicinity
- Intensive mobile telephone use
- Installation of a digital cordless (DECT) telephone at home or in the neighbourhood

We can no longer believe this to be purely coincidence. for:

- Too often do we observe a marked concentration of particular illnesses in correspondingly HFMR-polluted areas or apartments;
- Too often does a long-term disease or affliction improve or disappear in a relatively short time after reduction or elimination of HFMR pollution in the patient's environment;
- Too often are our observations confirmed by on-site measurements of HFMR of unusual intensity.

On the basis of our daily experiences, we hold the current mobile communications technology (introduced in 1992 and since then globally extensive) and cordless digital telephones (DECT standard) to be among the fundamental triggers for this fatal development. One can no longer evade these pulsed microwaves. They heighten the risk of already-present chemical/physical influences, stress the body's immune system, and can bring the body's still-functioning regulatory mechanisms to a halt. Pregnant women, children, adolescents, elderly and sick people are especially at risk.

P.7

Our therapeutic efforts to restore health are becoming increasingly less effective: the unimpeded and continuous penetration of radiation into living and working areas – particularly bedrooms, an essential place for relaxation, regeneration and healing – causes uninterrupted stress and prevents the patient's thorough recovery.

In the face of this disquieting development, we feel obliged to inform the public of our observations – especially since hearing that the German courts regard any danger from mobile telephone radiation as "purely hypothetical" (see the decisions of the constitutional court in Karlsruhe and the administrative court in Mannheim, Spring 2002).

What we experience in the daily reality of our medical practice is anything but hypothetical! We see the rising number of chronically sick patients also as the result of an irresponsible "safety limits" policy, which fails to take the protection of the public from the short- and long-term effects of mobile telephone radiation as its criterium for action. Instead, it submits *to* the dictates of a technology already long recognized as dangerous. For us, this is the beginning of a very serious development through which the health of many people is being threatened.

We will no longer be made to wait upon further unreal research results -which in our experience are often influenced by the communications industry – while evidential studies go on being ignored. We find it to be of urgent necessity that we act now!

EXHIBIT M

Above all, we are, as doctors, **the** advocates for our patients. In the interest of all **those** concerned. whose basic right to life and freedom from bodily harm ***is*** currently being put at stake, **we** appeal to !hose **in** !he spheres of politics and public health. Please support the following demands with your influence:

- New health-friendly communications techniques, given independent **risk** assessments before their introduction

and, ***as*** immediate measures and transitional steps:

- Stricter safety limits and major reduction of sender output and HFMR pollution on a justifiable scale, especially in areas of sleep and convalescence
- **A** say on **the** part of local citizens and communities regarding the placing of antennae (which in a democracy should be taken for granted)
- Education of the public, especially of mobile telephone users, regarding the health **risks** of electromagnetic fields
- Ban on mobile telephone **use** by small children, and restrictions on use by adolescents
- Ban **on** mobile telephone **use** and digital cordless (DECT) telephones in preschools, schools, hospitals, nursing homes, events halls, public buildings and vehicles (as with the ban on smoking)
- Mobile telephone and HFMR-free zones (as with auto-free areas)
- Revision of DEGT standards for cordless telephones with the goal of reducing radiation intensity and limiting actual use time, as **well** as avoiding the biologically critical HFMR pulsation
- Industry-independentresearch, finally with the inclusion of amply available critical research results and our medical observations

P.8

EXHIBIT M

④

Dr. med. Thomas Allgaier, General medicine, Environmental medicine, Heitersheim
Dr. med. Christine Aschermann, Neural physician, Psychotherapy, Leutkirch
Dr. med. Waltraud Bär, General medicine, Natural healing, Environmental medicine, Wiesloch
Dr. med. Wolf Bergmann, Genaeral medicine, Homeopathy, Freiburg
Dr. med. H. Bernhardt, Pediatry, Schauenburg
Dr. Karl Braun von Gladiß, General medicine, Holistic medicine, Teufen
Hans Brüggen, Internal medicine, Respiratory medicine, Environmental medicine, Allergenics, Deggendorf
Dr. med. Christa-Johanna Bub-Jachens, General medicine, Natural haling. Stiefenhofen
Dr. med. Arndt Dohmen, Internal medicine, Bad Säckingen
Barbara Dohmen, General medicine, Environmental medicine, Bad Säckingen
Verena Ehret, Doctor, Kötzting
Dr. med. Joachim Engels, Internal medicine, Homeopathy, Freiburg
Karl-Rainer Fabig, Practicali doctor
Dr. mal Gerhilde Gabriel, Doctor, München
Dr. mal Karl Geck, Psychotherapy, Murg
Dr. med. Jan Gerhard. Pediatrics, Child/adolescent psychiatry, Ahrensburg
Dr. med. Peter Germann, Doctor, Environmental medicine, Homeopathy, Worms
Dr. med. Gertrud Grünenthal, General medicine, Environmental medicine, Bann
Dr. med. Michael Gülich, Doctor, Schopfheim
Julia Günter, Psychotherapy, Korbach
Dr. med. Wolfgang Haas, Internal medicine, Dreieich
Dr. med. Karl Haberstig, General medicine, Psychotherapy, Psychosomatics, Inner-Urberg
Prof. Dr. med. Karl Hecht, Specialist in stress-, sleep, chrono- und space travel medicine, Berlin
Dr. med. Bettina Hövels, General medicine, Lörrach
Walter Hofmann, Psychotherapy, Singen
Dr. med. Rolf Janzen, Pediatrics, Waldshut-Tiengen
Dr. med. Peter Jaenecke, Dentist, Ulm
Michaela Kammerer, Doctor, Murg
Dr. med. Michael Lefknecht, General medicine, Environmental medicinc, Duisburg
Dr. med. Volker zur Linden, Internal medicine. Bajamar
Dr. med. Dagmar Marten, Doctor, Ochsenfurt
Dr. med. Rudolf Mraz, Psychotherapy, Natural haling, Stiefenhofen
Dr. med. Otto Pusch, Nuclear medicine, Bad Wildungen
Dr. med. Josef Rabenbauer, Psychotherapy, Freiburg
Elisabeth Radloff-Geck, Doctor, Psychotherapy, Homeopathy, Murg
Dr. med. Anton Radlspeck, Practical doctor, Natural healing Ahohning
Barbara Rautenberg, General medicine, Environmental medicine, Kötzting
Dr. med. Hans-Dieter Reimus, Dentist, Oldenburg
Dr. med. Ursula Reinhardt, General medicine, Bruchköbel
Dr. med. Dietrich Reinhardt, Internal medicine, Bruchköbel
Dr. med. Andreas Roche, General medicine, Kaiserslautern
Dr. med. Bernd Salfner, Pediatrics, Allergenics, Waldshut-Tiengen
Dr. med. Claus Scheingraber, Dentin, München
Dr. med. Bernd Maria Schlamann, Dentin, Non-medical practitioner. Ahaus-Wessum
Dr. med. Hildegard Schuster, Psychotherapy, Lörrach
Norbert Walter, General mcdicine, Natural healing, Bad Säckingen
Dr. med. Rosemarie Wedig, Doctor, Psychotherapy, Homeopathy. Düsseldorf
Dr. med. Günter Theiss, General medicine, Frankfurt
Prof. Dr. med. Otmar Wassermann, Toxicology, Schönkirchen

Prof. Dr. med. H.-J. Wilhelm, Ear, nose and t h a t doctor, Phoniater, Frankfurt
Dr. med. Barbara Würschnitzer-Hünig, Dermatology, Allergenics, Environmental medicine, Kempten
Dr. med. Ingo Frithjof Zürn, General medicine, Phlebology, Natural healing, Environmental medicine, Nordrach

List of supporters for the *FREIBURGER APPEAL:*

Dr. med. Wolfgang Baur, General medicine. Psychotherapy, Environmental medicine, Vienenburg
Prof. Dr. Klaus Buchner, Physicin, München
Volker Hartenstein, Member of Parliament (Bavaria), Ochsenfurt
Maria und Bruno Hennek, Self-help p u p for chemical- and wood preservative-damaged, Würzburg
Dr. Lebrecbt von Klitzing, Medicinal physicist, Stokelsdorf
Wolfgang Maw, Baubiology and Environmental analysis, Neuß
Helmut Merkel, 1st Chairman of Biobiology Organization, Bonn
Peter Neuhold, Non-medicinal practitioner, Berlin
Prof. Dr. Anton Schneider, Scientific leader of Institute for Baubiology and Ecology, Neubeuern
Dr. Birgit Stöcker, Chairwoman of Self-Help Organization for Electrosensitives, München
Prof. Dr. Alfred G. Swierk, Mainz
Dr. Ulrich Warnke, Biophysics, Biopsychology. Biomedicine, Saarbrücken

The EMR Policy Institute
A Non-Profit Corporation www.EMRPolicy.org

Adv ng Sound Public Policy
on the Use of Electromagnetic Radiation (EMR)
P.O. Box 117 Marshfield VT 05658
E-mail: info@emrpoliq.org
Tel: 802-426-3035 FAX: 802-426-3030

Blind Faith in Wireless Technology — Facts Everyone Should Know

Humans are electromagnetic beings. Our cells continuously communicate with each ther through electrical micro currents. Wireless technology (i.e. cell phones, wireless computers, radar, radio/television broadcast) transmits information through the use of electromagnetic radiation (EMR). This ever-increasing background radiation has the ability o disrupt the communication between our body's cells, resulting in abnormal functions in he developing cells of children, as well as adults and other living creatures.

Even though some radiation is natural, the emissions coming from these echnologies contain very different characteristics than anything that exists in nature, at evels much higher than the earth's natural background. The intensity level of 900 Megahertz radiation required to operate a cellular telephone is *2* billion times higher than he earth's natural radiation or the levels at which human beings evolved.

People who live in close proximity to a transmitting facility (such as roof-mounted antennas or freestanding towers) have already begun to exhibit symptoms of environmental EMR exposure. Symptoms include: short-term memory loss, sleep disturbances, nausea, chronic headaches, skin rashes, fatigue and disorientation. In August of 2004, the International Association of Firefighters — the largest labor union for firefighters in the **US** and Canada — voted not to allow new antenna facilities to be placed on or near fire stations. Firefighters are among the first workers to be exposed to low-level transmitting antennas for sustained periods of time over the past few years. Many are now beginning to show symptoms of environmental EMR exposure. This should automatically raise concerns for children in schools with wireless computer networks, and send up red lags to boards of education considering leasing school property for cell towers.

P.10

The United States government safety rules for maximum allowable exposure to citizens from an antenna or cell phone do not take scientific studies past 1985 into consideration. The current Federal Communications Commission (FCC) standards for ambient exposures were established in 1996, but the FCC has thus far refused to revisit them or incorporate 20 more years of pertinent research into their allowances. Adverse effects to living cells have been shown worldwide in numerous studies of EMR at levels far below those now allowed by the FCC. For example, studies have found that one two-minute cell phone call made by a child affects his/her brain activity for up to an hour afterward.

When we use wireless technology we are not only potentially harming ourselves but also those around us — the same way second hand smoke affects others. EMR is a form of air pollution, too. *A* cell phone emits radiation in a radius of approximately 2 yards. Children are particularly vulnerable because their cells are still developing.

Unfortunately because we can't see EMR, we tend to think it's not there. But just because you can't see radio and television waves, doesn't mean you don't hear the sounds or see the pictures. You can't see cell phone transmissions but the phones still ring.

Contrary to popular belief, wireless technology has *not* been proven safe by the FCC or the wireless industry itself. This technology has advanced at an unprecedented rate without regard to the impact on the health and well being of the people engaged in its use, or living in the vicinity of antenna sites. Who will be held responsible?

For more information and to view many of the international scientific studies on record visit our website **www.emrpolicy.org.** Please feel free to copy and distribute this pamphlet.

PLEASE HELP BY MAKING A DONATION THROUGH OUR **'WEBSITE!**

EXHIBIT M

Subject: An Interesting Letter to Blake Levitt "Our WiFi was making our s Sick!"

Dear **Ms.** Levitt

— Original Message —
From: Paul Dovon
To: doyon.paul@gmail.com
Sent: Tuesday, March 27,2007

My son has been having serious ailments over the last ***6*** months including: Severe and constant headaches, leg pains, poor sleep, and even heart palpitations. Various specialists were at a loss as to why he had these conditions! The only thing that showed Up in extensive bloodwork was a low IgA level. **I** did some research and figured out that it may be the WiFi Wireless Internet **I** installed in our home exactly ***6*** months prior.

So I quietly unhooked the system, and monitored my son so not to tell him **of** my changes. Sure enough, within hours his headache that he had without pause for ***6*** months went away. We're about 2 weeks from when **I** first disabled the WiFi system and my sons ENTIRE medical symptom list has complete cleared up! No longer does he complain of sore legs or headaches, which is a big relief to **us.**

Most importantly, his blood panel showed that his IgA levels returned to normal. Upon investigation **I** found that EMF/EMR from Wireless Networks can lower Melatonin, which indirectly lowers IgA -there are studies that confirm this. IgA itself is responsible for fighting a VARIETY of illness. So we can say indirectly that EMF/EMR may be responsible for an extremely wide range of human ailments.

I have found some schools and some countries are already removing WiFi systems because of extremely high levels of complaints from teachers and students about **ill** effects afler their installation.. **I** believe this issue is vastly more dangerous than Cellular towers **because** of the highly concentrated continuous signal nature of wireless internet.

I believe there needs to be some detailed and up to date works to reflect the rapid increase of high powered wireless internet networks being installed in schools, homes, and cities nationwide.

P.11

Any opinions on this? Kind Regards,

Robert McNaughton

Dear Robert,

Thanks tor this email. **I** will pass it along to appropriate people in federal regulatory agencies who need to hear this exact kind of information. Just so you know, this is about the 10th such communication within the last year that **I** have gotten describing pretty much the same symptoms. WiFi is certainly a problem. When **I** lecture on cell towers, **I** now say that it never ceases to amaze me that people will fight a cell tower in their neighborhood, then throw in a WiFi system at home which is just like invitlng a cell tower indoors. The problem with towers/infrastructure now is that they are using significantly higher frequencies due **to** the FCC licensing of broadband, i.e. telecom companies can now offer Internet access, TV, text messaging. music downloads, etc. etc. Yesterday's old analog cell tower that could cover a 10-15 mile radius morphed into digital PCS that could cover about a 3-mile radius, and now the "**next** generation" infrastructure requires antennas/towers every 1-2 miles. These are likely all unsafe technologies, it's just a question of degree and exposure parameters. But personal WiFi domestic systems are by far the worst right now due to **it's** very close proximity to people and the higher frequencies at which they operate. And of course whole cities are going WiFi. Unfortunately the learning curve on this is steep, there are literally NO research funds available in America, and the FCC, which controls for exposure standards, is a non-health agency. So everyone is learning about this one individual anatomy at a time, literally. Eventually the adage that the "plural of anecdote is data" will **come** to pass. But someone needs to collect the information and we don't even have that going on. No one wants to monitor this. Everyone just wants it to be fine. People who get into difficulties have no one to tell but a journalist like me. And most MDs are clueless.
I am glad that you figured *out* your son's problems so quickly. That's unfortunately rare. Please let me know how he progresses

Best Regards,
Blake Levitt
P.S. **I** wrote about melatonin in my first book on this subject and there is another book called The Melatonin Hypothesis, edited by Stevens, Wilson &Anderson. That latter is mostly about powerline frequencies but it is full of good information.

EXHIBIT I

this widely and saying that it had never happened to them before, They said it did not matter who was teaching, the children would still act disruptive.

On August 29, 2001, the *Japan Times* reported that employees' mental health was on the decline, with significant deterioration since 1996, and anxiety and obsessive behavior on the rise—this according to a survey by a private mental health research institute affiliated with the Japan Productivity Center for Socioeconomic Development which polls 100,000 company employees annually. The mental state of men was deteriorating in 19 categories, that of women, in 20. The article blamed it on the current gloomy corporate climate. (I guess the coincidental timing with the widespread introduction of cell phone systems has no significance?)

On December 30, 2001, TBS television did a program on how Japanese perceive themselves and their nation changing. Parents reported less communication with their children, who are always chatting with their friends on their cell phones. Many Japanese did not really feel themselves to be "Japanese." Maybe space aliens?

In your last *No Place To* ***Hide*** you described many cases of diseases among trees. I can add something from Japan. Japan's lovely pine trees *are* dying. Trees that just a year ago were healthy and well maintained, which have stood for centuries, are suddenly dead. Ostensibly, it is due to beetles carrying a disease, but one Japanese activist says scientists are still puzzled at the scope and timing. He told me some are saying global warming is to blame. In other cases, I've heard of ozone loss being blamed. I think all these theories have merits, but so does ours, and it deserves to be considered, especially in relationship to the timing.

Spain

Popular Revolt Against Antennas – More than 2,000 Installations dismantled

On the first day of winter in 2001, a Spanish judge ordered 49 cell phone antennas removed from a rooftop near a school in downtown Valladolid. It was the second time in 2001 that a Spanish court had ordered antennas removed for health reasons (see *No Place To* ***Hide,*** November 2001). This time the fight was led by parents of children at Garcia Quintana primary school, where three children had contracted acute lymphoblastic leukemia and one Hodgkins lymphoma, since the antennas were installed.

"This school was founded during the second republic," explained physician Luis Martin, spokesman for the parents, "and it has its original structure and materials. In 32 years there had not been a single cancer and, since the antennas were installed at the beginning of 2000, there have been 4 cases.''

Word spread like wildfire throughout Spain, with reports about the controversy appearing daily in the major media. Environmental groups and neighborhood associations got together to cooperate in the fight against what some began to call "mad waves disease": headache, memory loss, dizziness, insomnia, chronic fatigue, etc. This was a dramatic reversal, since only a few years ago, most apartment cooperatives had heen welcoming such installations as a source of good income.

Here is a small sample of headlines and quotations from the Spanish newspaper *El Mundo* earlier this year:

December 28: "The telecommunications industry asks for calm because the levels are safe."

January 4: "Antennas shut down near a public school in Teruel."

January 8: "The judge orders the re-opening of the Valladolid school...Meanwhile, other municipalities are echoing the controversy, some commissioning studies and

> "If the truth comes to light, we may have to talk about crimes against humanity, and logically those responsible will have to be sought."

others directly ordering the electric supply cut to installations of *this* type. To Ciudad Rodrigo, Salamanca, ia and Alcañiz was added yesterday Torrejón de la Calzada."

January 9: 'The mayor of Torrejón de la Calzada orders a telecommunications antenna removed from a school courtyard."

January **9:** "Eleven antennas in Valladolid will be removed near sensitive locations, such as schools, day care centers, hospitals, and nursing homes."

January 9: "In Sevilla, 300 antennas lack licenses, according to the Association of People Affected by Electromagnetic Fields."

January 11: "Alarm in Ronda about a number of cases of cancer in three schools near antennas."

January 13: "About 40 residents of the Madrid District of la Ciudad de Los Angeles yesterday blocked the installation of a telecommunications antenna on the roof of their building, located at #11, Calle Pan y Toros. The municipal police answered the call of a resident and asked for the papers of the crane operators. After determining that they lacked proof of a work permit, the two agents required the operators to stop the machine."

January 13: "Residents of Mataro prevent the installation of an illegal cell phone antenna."

January 13: "Four large municipalities in Madrid take measures against antennas."

January 15: "Minister of Science and Technology Birulés orders antenna emissions reduced near schools.

January 16: "The Socialist Party says the public has been deceived about antennas."

January 17: 'The IU group in the municipal government of Madrid asks for a moratorium on the installation of telecommunication antennas...and a distance of safety of at least 1,000 meters from educational centers, hospitals, nursing homes, and so forth, and 500 meters from homes, businesses or environmentally sensitive areas."

January 18: "A judge requires unanimous consent to install antennas on a building. A decision of the majority of the residents is without effect."

January 23 (letter to the editor): "If the truth comes to light, we may have to talk about crimes against humanity, and logically those responsible will have to be sought."

January 25: "Demonstration against cell phone antennas in Vilassar de Mar...The residents talk about the health risk, but also about the loss of value of their homes, which they calculate at about 30%."

January 26: "The European Union confirms that the antennas pose no risk if they comply with the law."

The Taskforce contacted Arturo Soria, author of one of the opinion pieces published in *El Mundo*. He wrote us a letter containing some insights into the genesis of the situation in his country:

The "Information Society" in Spain

by **Arturo** *Soria y Puig*

In the political program of President Aznar, telecommunications occupy an important place. After winning in 2000 by an absolute majority, he created a "Secretariat of State of Telecommunications and for the Information Society" and integrated it into a ministry, also newly created, called "Science and Technology." As the complete name of the new Secretariat of State indicates, the "infomation society" was identified with telecommunications; an identification that was reinforced by naming as minister Ana Birulés, a person without previous political experience and outside the governing party, whose only qualification consisted of being the CEO of a mobile telephone company. The political objective, proclaimed repeatedly, was for Spain to be integrated into, and occupy a prominent place in, said "Information Society".

On the other hand, the popular response to the rapid and chaotic installation of some 30,000 mobile phone antennas in Spain has been impressive. Because of judicial rulings (in a few cases) and because of pressure on municipal authorities (in the majority of cases) the mobile phone providers have had to disconnect or dismantle more than 2,000 already-installed antennas. In addition, plans for new installations have been notably slowed: in the year 2001 they were only able to deploy 42.5% of the planned antennas (information published April 10 in *El Mundo*). There are cities like Valladolid and provinces like Castellón and Murcia where for some time they have not succeeded in putting up a single additional antenna.

Given the political decision of the Popular Party in favor of deploying mobile telephony, how can one explain such opposition, when the party continues enjoying a good electoral outlook and the use of mobile phones in Spain is very intense? Why is something like this happening in Spain before or more than in other countries? The answer is not easy but I will throw out a hypothesis:

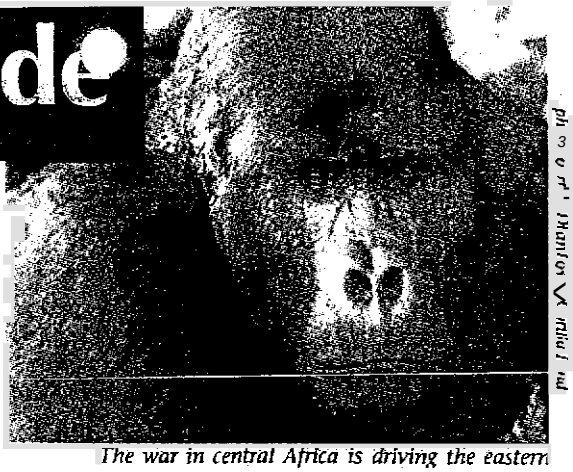
Knowing that they have a lot of political support, the providers have installed the antennas without worrying about complying with any administrative formalities—the majority don't have municipal licenses—and without attending to any consideration other than their own interests. That is to say, they didn't worry much about reducing emissions, respecting minimal distances, avoiding large concentrations of antennas, etc. Perhaps on this point their colleagues in other European countries have been more cautious? In their eagerness to secure particular rooftops, they

L'Hospitalet de Llobregat, Barcelona

have not hesitated to threaten the owners, telling them that if they sign a rental contract, they will have an interesting economic income—the owner of the building next to the famous Valladolid school that filled its roof with more than 40 antennas eamed some 150,000 euros ($132,000) per year—and will avoid the direct radiation, while if they refuse to rent the rooftop, the antenna will be installed on the building opposite, leaving them *without* ***this income*** *and* ***with the radiation. So*** the providers themselves have contributed to the womes of people who neither knew about nor feared electromagnetic fields.

As far as the popular reaction, one could speculate about particular theories that are difficult to prove, for instance that nations that are more ancient are often less credulous

High-Tech Genocide



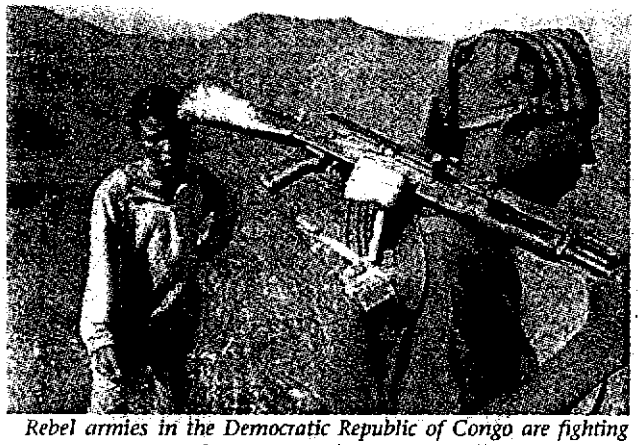
The war in central Africa is driving the eastern lowland gorilla to extinction.

BY SPROCKET

Cell p a) have ti the way we communicate, but in central Africa, their biggest legacy is war and the extermination of endangered species.

More than four million people have died in central Africa in a war over coltan, a heat-resistant mineral ore widely used in cell phones l p and other d s Coltan is found in l billion-year-old soils like those in the Rift Valley region of Africa. The tantalum extracted from the ore is used to make tantalum capacitors, tiny components that are essential in managing the flow of current in electronic devices. Eighty percent of the world's coltan reserves are found in the Democratic Republic of Congo (DRC).

This mountainous jungle area is the battleground of what has been grimly dubbed "Africa's First World War," pitting Congolese forces against those of *six* neighboring countries and numerous armed factions. The victims are mostly civilians; starvation and disease have killed hundreds of thousands, and the fighting has displaced two million people from their homes. Often dismissed as "just an ethnic war," the conflict is actually a battle over the natural resources that are sought by foreign corporations—diamonds, tin, copper, gold and—most **of** all—coltan. At stake for the heavily armed militias and governments is a cut of the high-tech boom of the **1990s.** in which the price of coltan skyrocketed to nearly **$300** per pound.



Rebel armies in the Democratic Republic of Congo are fighting over **coltan,** *a mineral essential to cell-phone circuits.*

The war started in **1998** when Congolese rebel forces, backed by Rwanda and Uganda, seized the eastem DRC and moved into strategic mining areas, attacking villages along the way. The Rwandan army was soon making an estimated $20 million a month from coltan mining.

Today, the fighting rages on despite peace treaties signed in Summer 2002. The peace process was initiated after the assassination **of** DRC President Laurent Kabila in January 2001, and following mounting pressure from South Africa. But while foreign troops have officially withdrawn from the DRC, internal factions remain at war.

Digging for "Black Gold"

Coltan has also transformed the DRC in more subtle ways. Farmers displaced from their lands have little option but to join coltan-mining brigades. Mined much like gold, coltan is found by digging large pits in riverbeds, with miners scraping away at the dirt to get to the coltan below.

Reports of rampant human-rights abuses pour out of the rebel-controlled mining region, where there is also a huge market for prostitution. ***An*** estimated two million people in the DRC are HIV-infected. Local men, women and children are forced into mining, fighting and sex work, or they are threatened with torture, rape and murder.

The coltan makes its way out of the mines to "trading posts," which are taxed or controlled by the rebels. Foreign traders then buy the mineral and ship it abroad, mostly through Rwanda.

All of it ends up being bought by just **three** companies Cabot, Inc. of the **US,** Germany's HC Starc and China's Ningxia—which are the only firms with the capability to turn coltan into the coveted tantalum powder. The "magic powder" is then sold to Nokia, Motorola, Compaq, Sony and other manufacturers for **use** in cell phones and other products.

On a side note, *Sam* Bodman, former CEO of Cabot, was appointed in December to serve as President Bush's Secretary of Energy. Under Bodman's leadership from **1987** until 2000, Cabot was one of the largest polluters in the US, accounting for 60,000 tons of airborne toxic emissions annually.

Ecological Effects of the War

The main coltan mining area within the DRC contains the Kahuzi Biega National Park *(KBNP),* home of the critically endangered eastem lowland gorilla. Deforestation from mining has destroyed much **of** the gorilla's habitat, and the poverty caused by the displacement of the local human populations has led to gorillas being killed and sold as "bush meat" to the miners and rebel armies that control the area.

The KBNP population of eastem lowland gorillas, along with the population in the adjacent Kasese forests, represented 86 percent of the subspecies' total population prior to the civil **war.** According to a report released by the Dian Fossey Gorilla Fund and the Bom Free Foundation in May **2001,** the population of eastern lowland gorillas in KBNP has plummeted from an estimated 8,000 in **1991** to less than **1,000** individuals in the year 2000, an 85 percent crash in only nine years. The report continues: "The indications are that the biodiversity of the Kahuzi Biega region has been seriously, if not irreparably,

EXHIBIT M

damaged.... If further procrastination and bureaucratic delays prevent effective 3nd timely action, the world will have stood by and watched as the magnificent eastern lowland gorilla becomes the first great ape to be driven to extinction—a victim of war, human greed and high technology."

Making the Connection

Somehow, it's not surprising that this information isn't included in the instruction manual that comes with your cell phone. Perhaps mobile phones should be outfitted with stickers that read: "Warning! This device was created with raw materials from central Africa. These materials are rare, non-renewable, were sold to fund a bloody civil war and have caused the virtual elimination of endangered species. Have a nice day." People need to realize that there is a direct link between the gadgets that make their lives more "convenient" and the frightening reality of the violence, turmoil and destruction that plague our world.

CELL-PHONE DEVASTATION

BY SPROCKET

The production and disposal of cell phones exacts a severe environmental cost. As wireless technology becomes more widespread, the Earth pays the price.

A cell phone is basically a handheld computer with an antenna, microphone, speaker and battery. These various components are soldered onto a main circuit board, which contains several tiny computer chips, including the digital signal processor, the microprocessor, the ROM and flash memory chips, and the radio frequency amplifiers.

These components require complex, environmentally costly manufacturing. According to the Silicon Valley Toxics Coalition, the production of just a single silicon computer chip requires:

- 3,200 cubic feet of bulk gases,
- 22 cubic feet of toxic, corrosive and volatile gases,
- 2,275 gallons of de-ionized water (a suspected liver, gastrointestinal and neurological toxin),
- 20 pounds of assorted chemicals,
- 285 kilowatt hours of electricity (enough to power a modest US home for one month).

It also produces 25 pounds of highly corrosive sodium hydroxide, 2,840 gallons of wastewater and seven pounds of miscellaneous hazardous wastes. In addition, computer chip production leaves behind a laundry list of air- and waste-stream pollutants, such as arsenic, lead, chromium, acid fumes and volatile organic compounds. It's no secret that the pollutants in wastewater eventually end up in wells, reservoirs, watersheds and marine ecosystems, where they are detrimental to human and nonhuman life alike. Many of these toxic compounds are found on the EPA's list of "persistent, bio-accumulative and toxic chemicals," and they can cause a range of adverse human health effects, including reproductive and developmental problems, cancer and damage to the nervous system.

To add to the problem of high-tech industrial manufacturing, there is the issue of used cell phone disposal. An Environmental Protection Agency (EPA)-funded report from February 2004 concluded that cellular phones alone are expected to make up 65,000 *tons* of landfill waste in 2005.

Why so much waste? Calling plans are often packaged with a free or low-cost cell phone, which makes keeping your current phone economically disadvantageous. Therefore, many cell phones are thrown out even before becoming technologically obsolete. According to a 2002 article in *BusinessWeek Online*, this trend, coupled with an ever-increasing number of features—such as email and Internet access, 3D games, video cameras, and music and movie downloads—leads consumers to get new phones approximately every 18 months.

Not only does this use landfill space, it also means that the lead, arsenic, bromated flame-retardants and other hazardous substances contained in mobile phones have another chance to enter the environment. As the cell phones sit in landfills, rainwater leaches these chemicals and heavy metals into the water table and soil.

Other silent killers are the cellular towers, transmitting the signals that make wireless communication possible. According to an August 2002 press release by the American Bird Conservancy and Forest Conservation Council, the number of birds killed annually by accidental collisions with such towers may be as high as 40 million. More than 40,000 communications towers standing taller than 200 feet are found in the US, and this number will likely double in the next 10 years.

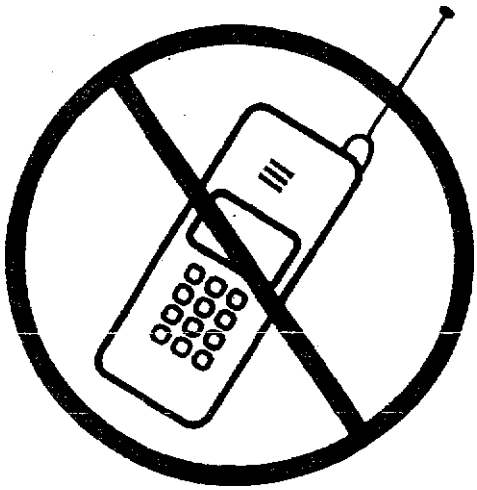
We are killing ourselves and poisoning life on the planet—all for the sake of convenience. We are giving our children a world of poison so that we can know where they are at all times. We are contaminating the soil that grows our food so that we won't have to make another trip to the grocery store. Let's put an end to this madness. Let's bury this high-tech industry instead of its hazardous waste.

artwork by Steve Norris

P.15

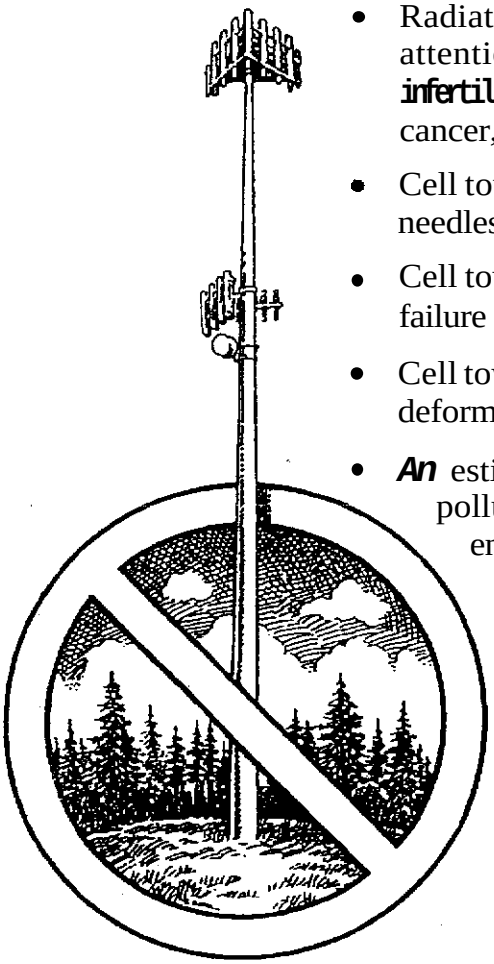
EXHIBIT M

DANGER: RADIATION



Warning: the brain has no indicators

- A 2-minute exposure to a cell phone disrupts the blood-brain barrier in laboratory animals, while a 2-hour exposure damages up to 2% of their brain cells. Many cell phone users experience symptoms such as dizziness, nausea, insomnia, memory loss, inability to concentrate, fatigue, depression, anxiety and agitation. These are neurological symptoms warning of possible brain damage.
- If you use a cell phone you are irradiating everyone around you, causing other people headaches, chest pain, heart palpitations, muscle spasms, etc. Not everyone notices the effects immediately, but at least 3% of the population does, according to surveys.
- The cell towers that make your cell phone work are irradiating the entire countryside. If cell phones work where you live, you are being irradiated 24 hours a day.



- Radiation from towers and phones is causing asthma, diabetes, attention deficit disorder, autism, high blood pressure, heart arrhythmias,; infertility, epilepsy, hearing loss, thyroid disease, cataracts, leukemia, brain cancer, and heart attacks and strokes in young people.
- Cell towers affect our forests: trees grow more slowly, lose their leaves or needles prematurely, and become vulnerable to insects and fungal diseases.
- Cell towers disorient and kill migrating birds, and cause reproductive failure in nesting birds.
- Cell towers lower milk production in dairy cows, and cause birth deformities in wild and domestic animals.
- An estimated one million Americans are so disabled by electromagnetic pollution that they cannot work Increasingly many are also homeless environmental refugees with no place to bide.

See other side for a summary of current science

STQP THIS FAILED EXPERIMENT!

EXHIBIT M

The Cellular Phone Task Force, PO Box 1237, Mendocino, CA 95460, (707) 937-3990

For Santa Cruz County information, call (831) 688-4603. www protectschools org www emrnetwork org, www emfbioeffects org, Swedish Association for the Electrosensitive

Here is what scientists are finding:

Every cell phone call damages brain cells

Scientists at Lund University in Sweden exposed rats to a cell phone just once for two hours, and then sacrificed them two months later. The rats which had been exposed had scattered areas of shrunken, degenerated neurons throughout their brains.'

This is alarming, because up to 70% of cell phone users experience one or more of the following: warmth around the ear, burning sensations in the face, fatigue, headache, dizziness, difficulty concentrating, memory loss and insomnia.[2,3] These are warning signs of nervous system damage.

Like cigarettes, cell phones and towers harm both users and non-users

Secondhand radiation comes from nearby cell phones, and from nearby and even distant cell towers.

Researchers in 8 countries have found that the closer people live to cell towers, the more likely they are to suffer from fatigue, irritability, headaches, dizziness, nausea, shortness of breath, weakness, sleep disturbances, difficulty concentrating, memory loss, depression, skin problems, visual and hearing disturbances, tremors and cardiovascular problems.[4-6]

Men who wear cell phones on their waist have lower sperm count

Cell phones emit radiation continually, even in stand-by mode when they are not in use.

Fertility specialists at the University of Szeged in Hungary found that men who cany a cell phone on their belt or in 2 trouser pocket have up to a 30% reduction in both sperm count and sperm motility.' At an infertility clinic in Cleveland, heavy cell phone users had a 40% reduction in sperm count, a 34% reduction in sperm motility and viability, and more than double the number of abnormal sperm compared to non-cell phone users.[8]

Cell phones and cell towers cause diabetes

It has been known since the 1950s, from both occupational health studies and animal research, that low-level microwave radiation interferes with carbohydrate metabolism, increases blood sugar and inhibits insulin production.' Now, doctors are finding that cell towers as well as wireless technology in homes is causing an increase in both type 1 and type 2 diabetes. And cleaning up the electromagnetic environment of many diabetics has reduced their symptoms and their blood sugar levels."

---

[1] LG Salford *et* ol., "Nerve Cell Damage in Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones," *Environmental Health Perspectives* 111:888-883, 2003.

[2] *R* Santini *et al.*, "Symptoms Experienced by Users of Digital Cellular Phones,' *Electromagnetic* Biology *and Medicine* 21:81-88,2002;

[3] OE Salama *et al.*, "Cellular phones: Are they detrimental?" *Journal of the Egyptian Public Health Association* 79(3-4): 197-223, 2004.

[4] EA Navarro *et al.*, "The Microwave Syndrome: A Preliminary Study in Spain," *Electromagnetic Biology ond Medicine* 22:161-169,2003;

[5] H-P Hutter *et al.*, "Subjective symptoms, sleeping prob.ms, and cognitive performance in subjects living near mobile phone base stations," *Occupational ond Environmental Medicine* 63:307–13, 2006;

[6] G Abdel-Rassoul *et al.*, "Neurobehavioral effects among inhabitants around mobile phone base stations," *NeuroToxicology* 28:434-440, 2007.

[7] I Fejes *et al.*, 'Relationship Between Regular Cell Phone Use and Human Semen Quality:' paper presented at the 20" Annual Meeting of the European Society of Human Reproduction and Embryology, Berlin, June 29, 2004.

[8] A Agarwal *et al.*, "Effect of Cell Phone Usage on Semen Analysis in Men Attending Infertility Clinic," paper presented at the American Society for Reproductive Medicine 62" Annual Meeting, New Orleans, October 21-25, 2006.

[9] J Bielski, M Sikorski, "Disturbances of glucose tolerance in workers exposed to electromagnetic radiation," *Medycyna Pracy* 47(3):227-231, 1996.

[10] M Havas, "Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis.," *Electromagnetic Biology and Medicine* 25:259-286, 2006.

"I have no doubt in my mind that at the present time, the greatest polluting element in the earth's environment is the proliferation of electromagnetic fields. I consider that to be far greater, on a global scale, than warming, and the increase in chemical elements in the environment."

Robert O. Becker, M.D.

EXHIBIT M

P. 17

County of Santa Cruz

BOARD OF SUPERVISORS

701 OCEAN STREET, SUITE 500, SANTA CRUZ. CA 95060-4069

(831) 454-2200 FAX (831) 454-3262 TDD. (831) 454-2123

JANET K. BEAUTZ	ELLEN PIRIE	NEAL COONERTY	TONY CAMPOS	MARK W. STONE
FIRST DISTRICT	SECOND DISTRICT	THIRD DISTRICT	FOURTH DISTRICT	FIFTH DISTRICT

July 10, 2007

Senator Dianne Feinstein
331 Hart Office Building
Washington, D.C. 20510

Dear Senator Feinstein:

I am writing at the unanimous direction of the Santa Cruz County Board of Supervisors to convey our grave concern about the current regulatory context for permitting cell towers ("wireless communications facilities" or "WCFs"). As you are aware, as a result of existing federal law, local government has no ability to regulate the siting of WCFs based on the possible health and environmental effects of radio-frequency radiation ("RF emissions") to the extent that a WCF complies with Federal Communications Commission standards.

P.18

Within the constraints of our ability to regulate in this area, Santa Cruz County adopted a wireless communication facilities ordinance in 2004 (see attached) regulating potential visual impact issues related to cell tower placement. Our ordinance generally prohibits WCFs on parcels zoned single-family residential, multi-family residential or on school grounds on the basis that WCFs are incompatible commercial uses on such parcels. The ordinance also includes restrictions in other zone districts but again, pursuant to federal law, does not address any health effects associated with RF emissions.

There is mounting concern that a conclusive study has not been undertaken at the federal level to evaluate the health considerations associated with this technology. We believe that such a study must be ordered and financed by the federal government to answer the public's very real questions about the health impacts associated with WCFs and RF emissions. Clearly, if any health effects are identified by these studies, necessary controls on this technology must be put in place to protect the public health and welfare at the level of government possessing regulatory authority.

EXHIBIT M

I might add that as more and more people are concerned with this technology, they are also quite outraged that Congress has completely precluded any meaningful review by local government where they can actually participate. This is seen as another "sell out" to large corporations that only care about money and not people.

Accordingly, we are writing to ask that you make every effort to see that the federal government authorizes and funds a thorough study of this issue so that the public has answers to what are very legitimate questions and concerns about the health effects of this technology. Please feel free to contact me if I can provide any further information.

Sincerely,

JANET BEAUTZ, Chairperson
Board of Supervisors

JKB:ted

cc: Clerk of the Board

4087A6

P.19

EXHIBIT M

IMPORTANT STUDIES & ARTICLES

Analysis of Control Studies on Use of Cellular and
Cordless Phones and the Risk of Malignant Brain Tumors
(Dept of Oncology, University Hospital, Orebro, Sweden}

Neurobehavioral Effects of Inhabitants
Around Mobile Phone Base Stations
(NeuroToxicology - 2006 - ***Science Direct)***

Nerve Cell Damage io Mammalian Brain after
Exposure to Microwaves from GSM Mobile Phones
(Environmental Health Perspective - June, 2003)

Effect of GSM Mobile Phone Radiation
on Blood Brain Barrier
(Bio-NlR Research Group - Helsinki. Finland)

Genetic Effects of Nonionizing Electromagnetic Fields
(Henry Lai - University of Washington)

Cellular Phone Radiation and
Potential Risks to the Human Brain
(Ani-Aging Medical News - Winter, 2002)

SPECIAL ARTICLE
The Sensitivity of Children to Electromagnetic Fields
(Journal of American Academy of Pediatrics)

EXHIBIT M

Analysis of Control Studies on Use of Cellular and Cordless Phones and the Risk of Malignant Brain Tumors

(Dept of Oncology, University Hospital, Orebro, Sweden)

EXHIBIT M

Int Arch Occup Environ Health (2006)
DOI 10.1007/s00420-006-0088-5

ORIGINAL ARTICLE

Lennart Hardell. Michael Carlberg
Kjell Hansson Mild

Pooled analysis of two case-control studies on use of cellular and cordless telephones and the risk for malignant brain tumours diagnosed in 1997–2003

Received: 30 August 2005 / Accepted: 5 January 2006

Abstract *Objectives:* To study the use of cellular and cordless telephones and the risk for malignant brain tumours. *Methods:* Two case–control studies on malignant brain tumours diagnosed during 1997–2003 included answers from 905 (90%) cases and 2,162 (89%) controls aged 20–80 years. We present pooled analysis of the results in the two studies. *Results:* Cumulative lifetime use for > 2,000 h yielded for analogue cellular phones odds ratio (OR) = 5.9, 95% confidence interval (CI) = 2.5–14, digital cellular phones OR = 3.7, 95% CI = 1.7–7.7, and for cordless phones OR = 2.3, 95% CI = 1.5–3.6. Ipsilateral exposure increased the risk for malignant brain tumours; analogue OR = 2.1, 95% CI = 1.5–2.9, digital OR = 1.8, 95% CI = 1.4–2.4, and cordless OR = 1.7, 95% CI = 1.3–2.2. For high-grade astrocytoma using > 10 year latency period analogue phones yielded OR = 2.7, 95% CI = 1.8–4.2, digital phones OR = 3.8, 95% CI = 1.8–8.1, and cordless phones OR = 2.2, 95% CI = 1.3–3.9. In the multivariate analysis all phone types increased the risk. Regarding digital phones OR = 3.7, 95% CI = 1.5–9.1 and cordless phones OR = 2.1, 95% CI = 0.97–4.6 were calculated for malignant brain tumours for subjects with first use < 20 years of age, higher than in older persons. *Conclusion:* Increased risk was obtained for both cellular and cordless phones, highest in the group with > 10 years latency period.

L. Hardell (✉) · M. Carlberg
Department of Oncology, University Hospital,
701 85, Örebro, Sweden
E-mail: lennart.hardell@orebroll.se
Tel.: +46-19-6021546
Fax: +46-19-101768

K. Hansson Mild · L. Hardell
Department of Natural Sciences, Örebro University,
701 82, Örebro, Sweden

K. Hansson Mild
National Institute for Working Life, 907 13, Umeå, Sweden

Keywords Astrocytoma . Glioblastoma . Mobile phones . DECT · Microwaves

Introduction

The issue of a potential association between cellular and cordless telephones. and health effects is of concern and has been discussed in several articles during recent years (Kundi 2004; Kundi et al. 2004). Since the use of these phone types is widespread and increasing in the society, also a small risk increase would result in several affected persons. Of special concern is the risk of brain tumours since this part of the body is highly exposed during phone calls compared with other parts.

The Nordic countries were among the first,in the world to introduce cellular phones and this allows a fairly long follow-up of usen to evaluate possible health consequences. The analogue (NMT, Nordic Mobile Telephone System) phones operating at 450 MegaHertz (MHz) were introduced in Sweden in 1981. First they were used in a car with a fixed external antenna, but from 1984 portable NMT 450 phones are available on the market. The next generation of analogue phones using 900 MHz (NMT 900) was used in Sweden between 1986 and 2000. The digital system (GSM, Global System for Mobile Communication) started in 1991 and has, during recent years, dramatically increased to be Ihe most common phone type. This system uses dual band. 900 and 1,800 MHz, for communication. From 2003 the third generation of mobile phones, 3G or UMTS (Universal Mobile Telecommunication System) has started operating at 1 900 MHz in Sweden.

Cellular telephones emit radio frequency signals during calls. Exposure is characterized through the specific absorption rate (SAR) expressed as watt per kilogram. However, SAR differs in absolute values as well as in anatomical distribution between various types of cellular telephones, and information about SAR values was not available until most recent years.

EXHIBIT M

Of interest in this context are also desktop cordless phones. First the analogue system in the 800-900 MHz RF range was used, but since 1991 digital cordless telephones **(DECT)** which operate at 1,900 MHz are on the market.

Since the brain is one of the most highly exposed organs for RF-held exposure during cellular and cordless phone calls, tumours with that localization are suitable to study. Acoustic neuroma might be a "signal" tumor for an association, since it is located in an area with the highest exposure. Furthermore, the risk would be higher for tumours on the same side of the head as the exposure to the RF-field (ipsilateral exposure).

In 1999 we published **our** first study on this topic with cases and controls from the time span 1994–1996 (Hardell et al. 1999). The analyses were based on answer$ from 209 (90%) of the cases and 425 (91%) of the controls. Overall we did not find an increased risk. However, for ipsilateral exposure we saw a somewhat higher risk, although based on a few exposed subjects (Hardell et al. 1999, 2001). Due to low numbers of exposed subjects and short latency periods no conclusions could be drawn from that study.

Our next case–control study was larger. The responding numbers were for cases 1,429 (88%) of those fulfilling the inclusion criteria and for controls 1,470 (91%). Both cases and controls were recruited during January 1, 1997 until June 30, 2000. We modified somewhat the questionnaire used in the first study to assess exposure as carefully as possible. Also more questions on other exposures of interest were added. For all brain tumours we found an increased risk for analogue phones that was most pronounced in the group with > 10 year latency period, odds ratio (OR) 1.6, 95% confidence interval (CI) 1.1–2.5 (Hardell et al. 2003a). Moreover, the risk was highest for analogue and digital cellular telephones with ipsilateral exposure. This effect was most pronounced for high-grade astrocytoma. We found no association for meningioma. Regarding acoustic neuroma high risk was calculated for **use** of analogue phones, OR = 4.4, 95% CI = 2.1–9.2 (Hardell et al. 2003a, b).

Our third study was similar to the second study. In fact, the same questionnaire, methods and protocol were used in order to be able to pool these two studies to get a larger study material with longer time for **use** of both cellular and cordless phones. This study continued from July 1, 2000 until December 31, 2003. The study area consisted of Uppsala/Örebro and Linköping medical regions in Sweden. Stockholm and Gothenburg medical regions were not included this time since the WHO Interphone study on the same issue was performed during part of this time in these regions. Thus, there was no overlap of cases between any of our studies on this topic or the Interphone study (Hardell et al. 2003a, b, 2005a, b).

The aim of this presentation is to give the results of a pooled analysis of **our** second and third study on use of cellular and cordless telephones, and the risk for brain tumor. Here we present results for malignant brain tumours. All controls from the second and third studies are used as reference entity.

Malerials and **methods**

We have, in **our** studies, presented details on the study methods (Hardell et al. 2003a, b, 2005a, b), **so** only a short presentation is given here. The ethical committees approved the studies. Both men and women aged 20–80 years at the time of diagnosis, as defined according to the date of the histopathology report, were included. Cases were reported in a consecutive way from the regional Cancer registries, in total 3,729 patients. Subjects that did not meet the study prerequisites were excluded. i.e., brain metastases or wrong reporting to the registry (n = 288), wrong year for diagnosis (n = 73), missing histopathology (n = 5), not resident in study area (n = 14), deceased (n = 745), physician refusal (n = 81), not capable to participate (n = 84) and unknown address (n = 2). in total 1,292 cases. The final pooled study included 2,437 cases or 65% of those initially reported. Of these finally included cases 1,008 had a malignant brain tumor.

We draw one control subject matched on age and **sex** to each case from the Swedish population registry. They lived in the same geographical area (region) as the cases. The population registry covers the whole population with unique id-numbers and current address for all inhabitants. Any change of residence can be traced in the registry. Thus, 2 437 controls were recruited.

Assessment of exposure

The study was approved by the ethics Committees and was performed in accordance with the ethical standards laid down by the Helsinki Declaration. All included persons had the possibility to refuse participation. We assessed different environmental and occupational exposures by using a 20-page questionnaire sent to the study subjects. It contained questions on the whole working history, exposure to different agents, smoking habits, etc. Regarding use of cellular telephones we asked about first year **of use,** type of phone (analogue with prefix 010, digital with prefix 07), mean minutes of daily **use over** the years, use in a car with external antenna or a hands-free (both calculated as unexposed), and ear most frequently used. Similar questions also dealt with *use* of cordless telephones.

If the questionnaire was not answered two reminders were sent. In order to verify exposures supplementary phone interviews were made in both studies by trained interviewen using the same structured protocol. We were careful to assess which ear was used most frequently over the years since a change might have occurred, e.g., in a case with acoustic neuroma. The interviewer checked this information but we also sent a letter and asked in both

studies all study subjects using cellular or cordless telephones to clarify this issue in detail.

We gave all questionnaires an id-code that did not show if it was a case or a control. Thus, interviews and coding of data for the statistical analysis were performed blinded as to case or control status. All cases had a diagnosis based on histopathological examination. We obtained such data from cancer registries and histopathological departments in the study area. Both clinical and pathology report were sent to the cancer registry in Sweden. Tumor localization was obtained by data in the cancer registries or if missing or unclear from neuroradiology investigations. We obtained copies of records after informed consent from the cases. Exposure ≤ 1 year before diagnosis was disregarded. Thereby the same year was used for the matched control as for the corresponding case.

Statistical methods

Unconditional logistic regression analysis was used to calculate odds ratios (OR) and 95% confidence intervals (CI), (Stata/SE 8.2 for Windows; StataCorp, College Station, TX, USA). Thereby the whole study population could be used in the statistical analyses adjusted for the matching variables. Subjects that had not used cellular or cordless phones were regarded as unexposed in the statistical calculations. The exposed cases and controls were divided according to phone type, analogue, digital, and cordless. We also calculated OR and 95% CI for use of any of these phone types and for different combinations. Adjustment was made for sex, age, socioeconomic index (SEI)-code and year for diagnosis. Thereby the same year as for the case was used lor the corresponding control. Adjustment for year of diagnosis was made in order to avoid bias in exposure since all controls, both malignant and benign brain tumor cases, were used in the analysis. We used age as a continuous variable in the analysis. Latency or tumor induction period was analysed using three time periods, > 1–5, > 5–10. and > 10 years since first use of a cellular or cordless telephone until diagnosis. In the dose–response calculations median number of cumulative lifetime use in hours among controls was used as cut-off. Note that overall results for all lalency groups were calculated in one analysis, whereas dose–response was analysed separately for each latency category.

Results

In total 905 (90%) cases and 2,162 (89%) controls participated. We display the results for cumulative use in hours for the different phone types (Fig. 1) and in total for any phone type in Table I. Overall OR was highest in the group with longest duration of use, > 2,000 h. Thus, analogue cellular phones yielded in that group OR = 5.9, 95% CI = 2.5–14, digital cellular phones OR = 3.7, 95% CI = 1.7–7.7, cordless phones OR = 2.3, 95% CI = 1.5–3.6, and total for any combination OR = 2.4, 95% CI = 1.7–3.4.

In Table 2 we give the results for the different phone types according to latency period and cumulative number of hours divided into two groups based on median number of hours among the controls. The risk increased with latency (Fig. 2) and duration of use. Thus, lor all malignant brain turnours with > IO-year latency period and in the highest exposure group we calculated for analogue cellular telephones (> 85 h cumulative use) OR = 3.0, 95% CI = 2.0–4.5, digital cellular telephones

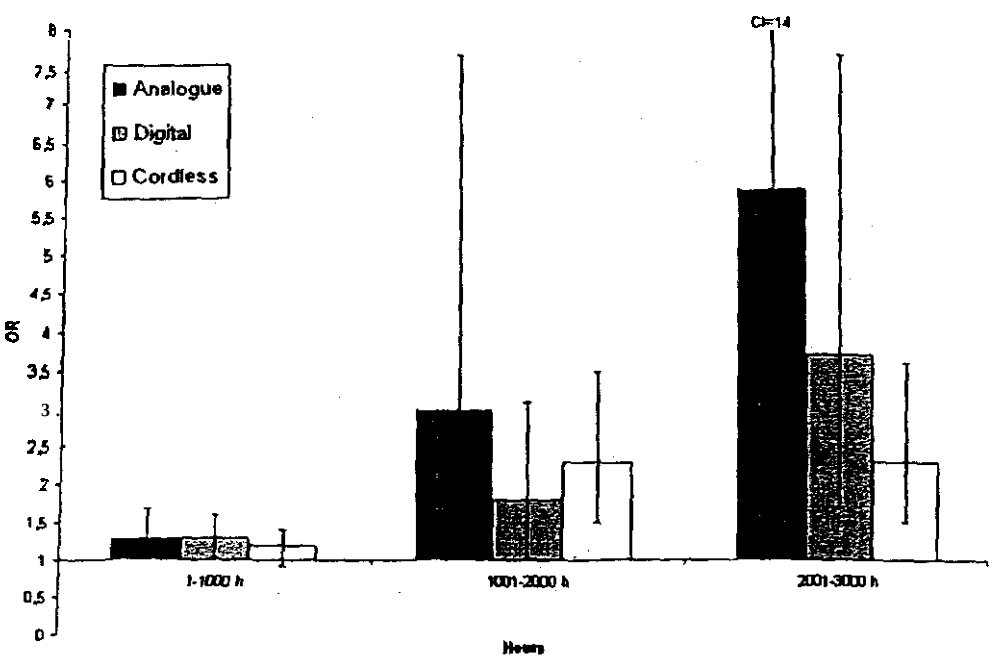


Fig. 1 Odds ratio (OR) and 95% confidence interval (CI) bars lor three categories of cumulative use in hours (h) of analogue, digital, and cordless telephones, respectively. All malignant brain tumours

EXHIBIT M

Table 1 Odds ratio *(OR)* and 95% confidence interval (CI) for cumulative lifetime use in hours of analogue and digital cellular telephones, cordless telephones and any combination of the three types. Number of exposed cases (Ca) and controls (Co) are given. Unconditional logistic regression analysis adjusted for age, sex, socio-economic index, and year of diagnosis was used. Test for trend yielded for analogue phones $P < 0.001$, digital $P = 0.01$, cordless $P < 0.001$, any combination $P < 0.0001$

	1–1,000 h			1,001–2,000 h			> 2,000 h		
	Ca/Co	OR	95% CI	Ca/Co	OR	95% CI	Ca/Co	OR	95% CI
Analogue	147/281	1.3	1.0002–1.7	10/8	3.0	1.1–7.7	21/8	5.9	2.5–14
Digital	355/731	1.3	1.03–1.6	26/33	1.8	1.02–3.1	21/12	3.7	1.7–7.7
Cordlas	265/599	1.2	0.9–1.4	42/52	2.3	1.5–3.5	43/50	2.3	1.5–3.6
Total, any combination	433/983	1.2	0.98–1.4	65/104	1.6	1.1–2.2	85/85	2.4	1.7–3.4

Table 2 Number of exposed Ca with malignant brain tumour and Co, OR, and 95% CI for use of cellular or cordless telephones. Unconditional logistic regression analysis adjusted for age, sex, SEI, and year of diagnosis was used. In the dose–response calculations median number of cumulative use in hours among controls in the total material was used as cut-off

	> 1–5 year latency		> 5–10 year latency		> 10 year latency		Total, > 1 year latency	
	Ca/Co	OR, CI	Ca/Co	OR, CI	Ca/Co	OR, CI	Ca/Co	OR, CI
Malignant (n = 905, 322 unexposed)								
Analogue	39/86	1.2 0.8–1.8	57/127	1.1 0.8–1.6	82/84	2.4 1.6–3.4	178/297	1.5 1.1–1.9
≤ 85 h	29/67	1.1 0.7–1.8	32/63	1.3 0.8–2.1	12/26	1.2 0.6–2.4	73/156	1.2 0.9–1.7
> 85 h	10/19	1.1 o.Ir2.5	25/64	0.9 0.5–1.5	70/58	3.0 2.0–4.5	105/141	1.7 1.3–2.4
Digital	265/581	1.2 0.96–1.5	118/177	1.7 1.2–2.2	19/18	2.8 1.4–5.7	402/776	1.3 1.1–1.6
≤ 64 h	155/349	1.2 0.97–1.6	33/70	1.4 0.9–2.1	0/0		188/419	1.2 0.98–1.6
> 64 h	110/232	1.1 0.9–1.5	85/107	1.9 1.3–2.8	19/18	2.8 1.4–5.7	214/357	1.4 1.1–1.8
Cordless	193/437	1.2 0.9–1.5	124/219	1.5 1.1–2.0	33/45	1.8 1.1–3.0	350/701	1.3 1.1–1.6
≤ 195 h	105/260	1.1 0.8–1.4	30/74	1.1 0.7–1.a	3/17	0.4 0.1–1.5	138/351	1.0 0.8–1.3
> 195 h	88/177	1.4 0.99–1.8	94/145	1.8 1.3–2.5	30/28	3.3 1.8–5.9	212/350	1.6 1.3–2.1
Astrocytoma, high grade (n = 539, 198 uncaposcd)								
Analoguc	21/86	1.3 0.8–2.2	35/127	1.3 0.8–2.0	59/84	2.7 1.8–4.2	115/297	1.7 1.3–2.3
≤ 85 h	13/67	1.0 0.5–1.9	22/63	1.6 0.96–2.8	8/26	1.4 0.6–3.3	43/156	1.3 0.9–2.0
> 85 h	8/19	1.9 0.8–4.7	13/64	1.0 0.5–1.9	51/58	3.7 2.3–5.9	72/141	2.2 IS–3.2
Digital	143/583	1.3 0.97–1.7	86/177	22 1.6–3.1	15/18	3.8 1.8–8.1	244/776	1.5 1.2–1.9
≤ 64 h	90/349	1.4 1.01–1.9	22/70	1.6 0.9–2.8	0/0		112/419	1.4 1.04–1.8
> 64 h	53/232	1.2 0.8–1.7	64/107	29 1.9–4.4	15/18	3.8 1.8–8.1	132/357	1.7 1.3–2.3
Cordless	103/437	1.2 0.9–1.7	79/2 I9	1.8 1.3–2.5	23/45	2.2 1.3–3.9	205/701	1.5 1.1–1.9
≤ 195 h	58/260	1.1 0.8–1.6	19/74	1.3 0.8–2.3	3/17	0.9 0.2–3.2	80/351	1.1 0.8–1.5
> 195 h	45/177	1.4 0.96–2.1	60/145	24 1.7–3.5	20/28	3.9 2.0–7.8	125/350	1.9 1.4–2.6
Astrocytoma, low grade (n = 124. 36 unexposed)								
Analogue	6/86	1.1 0.4–2.8	7/127	1.1 0.4–2.6	6/84	1.6 0.6–4.1	19/29?	1.2 0.622
≤ 85 h	5/67	1.2 0.4–3.4	4/63	1.4 0.4–4.2	0/26		9/156	1.1 0.5–2.5
> 85 h	1/19	0.7 0.1–6.0	3/64	0.8 0.2–2.8	6/58	2.2 0.8–5.9	10/141	1.3 0.6–2.9
Digital	41/581	1.4 0.8–2.3	14/177	1.6 0.8–3.4	1/18	1.3 0.2–1 I	56/776	1.A 0.9–2.3

EXHIBIT M

Tnbk 2 (Contd.)

	> 1–5 year latency		> 5–10 year latency		> 10 year latency		Total, > 1 year latency	
	Ca/Co	OR. Cl	Ca/Co	OR. Cl	Ca/Co	OR, Cl	Ca/Co	OR, Cl
≤ 64 h	24/349	I.5 0.9-2.7	3/70	1.2 0.3–4.3	0/0		271419	1.5 0.8–2.6
> 64 h	17/232	1.2 0.6–2.3	11/107	I.7 0.7–4.1	1/18	1.3 0.2-11	291351	I.3 0.7-2.4
Cordless	31/437	1.3 0.7–2.2	20/219	1.6 0.9–3.0	5/45	1.6 0.5–4.6	56/701	1.4 0.9-3.4
≤ 195 h	17/260	1.2 0.6–2.3	4/74	1.4 0.5–4.4	0/17		21/351	12 0.6-2.1
> 195 h	14/177	12 0.6-2.6	16/145	21 1.1–4.2	5/28	3.3 0.9–12	35/350	1.7 0.96–2.9
Other malignant (n = 242, 88 unexposed)								
Analogue	12/86	11 0.6–2.1	15/127	1.0 0.5–1.8	17/84	2.4 1.3–4.6	441297	1.3 0.9-2.0
≤ 85 h	11/67	1.3 0.6–2.6	6/63	I.0 0.4-2.4	4/26	1.6 0.5–5.0	21/156	I.2 0.7–2.1
> 85 h	1/19	0.4 0.05-3.1	9/64	1.0 0.5–2.3	13/58	2.6 I .3-5.4	23/141	I.4 0.8-2.5
Digital	81/581	I.2 0.8–1.7	18/177	1.0 0.5–1.7	3/18	2.7 0.7-11	102/776	1.1 0.8–1.6
≤ 64 h	41/349	1.1 0.7–1.7	8/70	I.4 0.63.2	0/0		49/419	11 0.8–1.7
> 64 h	40/232	I.3 0.8-2.0	10/107	0.8 0.3–1.7	3/18	2.7 0.7- I I	53/357	1.1 0.7–1.7
Cordless	59/437	I.2 0.8–1.8	25/219	1.1 0.6–1.7	5/45	1.1 0.4–2.9	89/701	1.2 0.8–1.7
I 195 h	30/260	1.1 0.7–1.7	7/74	1.0 0.4–2.3	0/17		37/35)	1.0 0.6–1.5
> 195 h	29/177	I.5 0.9-2.4	18/145	I.0 0.6–1.8	5/28	2.4 0.8-7.4	52/350	1.4 0.9–2 0

(> 64 h cumulative use) OR = 2 8, 95% CI = I 4–5.7, and cordless telephones (> 195 h cumulative use) OR = 3.3, 95% CI = 1.8–5.9. OR increased further for high-grade astrocytoma. We found high OR also for low-grade astrocytoma in the > IO-year latency group, but these results were based on *low* numbers of exposed cases. A similar tendency was found for other types of malignant brain tumours.

The group of other malignant brain tumours consisted of oligodendroglioma (n = 93), other/mixed gli-

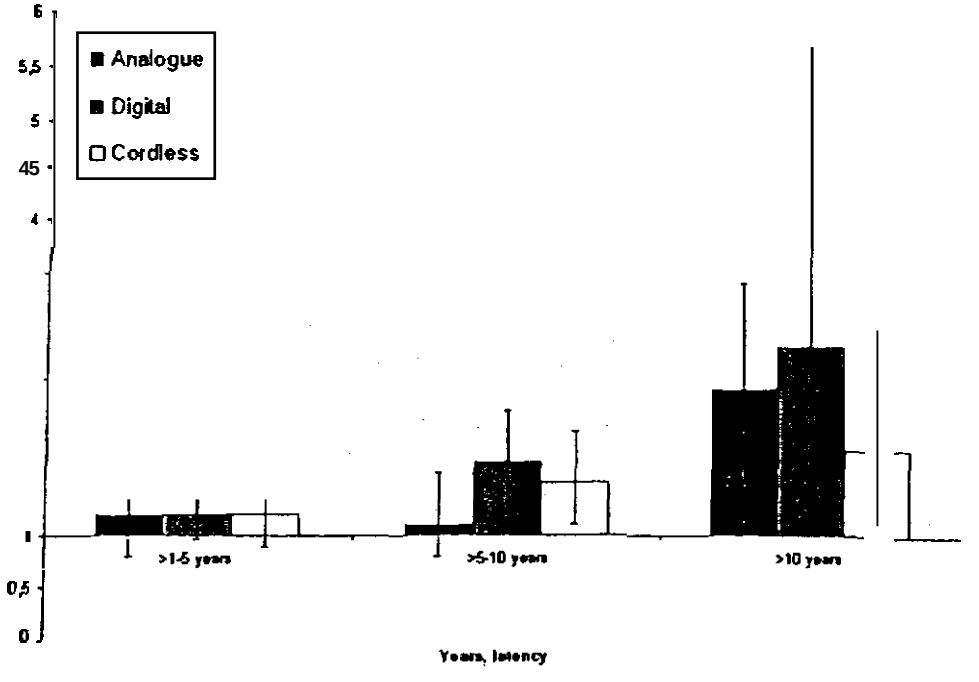


Fig. 2 Odds ratio and 95% CI ban for *three categories* of latency period for use of analogue, digital, and cordless tclcphoncs. respectively All malignant brain tumours

EXHIBIT M

oma ($n = 78$), and other malignant brain tumours ($n = 71$). Using > IO-year latency period increased OR was found for these three groups hut based on low numbers (data only shown for all).

As it can be seen in Table 3 we found consistently highest OR for ipsilateral exposure. This was most pronounced for high-grade astrocytoma yielding for analogue phones OR = 2.4, 95% CI = 1.6–3.6, digital phones OR = 2.3, 95% CI = 1.7–3.1, and cordless telephones OR = 2.0, 95% CI = 1.5–2.8.

In the multivariate analysis as displayed in Table 4 all of the studied phone types were associated with an increased risk for malignant brain tumours. For high-grade astrocytoma we found increased OR both in > 5–10 and > 10-year latency groups for digital cellular telephones and cordless phones. whereas for analogue phones OR increased only in the > IO-year latency group.

Table 5 shows our analysis of OR for use of only one type of the different phone types and for different combinations. OR increased further for use of more than one type of the phones and was highesl for the use of analogue, digital, and cordless phones, OR = 1.8, 95% CI = 1.2–2.6. These calculations yielded higher OR for high-grade astrocytoma. Only use of digital cellular phone gave for high-grade astrocytoma OR = 1.5, 95% CI = 1.1–2.0.

We analysed the association between use of cellular and cordless telephones for different age groups based on first use of the respective phone (Table 6. OR was highesl for subjects in the < 20 years age group for use of both digital and cordless telephones. Regarding analogue phones few subjects had started use < 20 years of age.

Discussion

As it has been discussed elsewhere (Kundi 2004; Kundi et al. 2004) the main shortcoming of most of the so-far

Table 3 Number of exposed Ca with malignant brain tumour and Co. OR, and 95% CI for use of cellular or cordless telephones for tumour localisations in relation to ear used during phonc calls. Ipsilateral = same ride *for* tumour and phone, contralateral = opposite side, and ipsi/contralateral = both ears used much equally. Unconditional logistic regression analysis adjusted for age, sex, SEI and year of diagnosis, was used. Nolc that tumour site was missing for some cases and the matched control was excluded as well as controls with missing corresponding case

Localisation/type of telephone	All Ca/Co OR. CI	Ipsilateral Ca/Co OR, CI	Contralateral Ca/Co OR, CI	Ipsi/contralateral Ca/Co OR, CI
Malignant				
Analoguc phone	178/297	95/98	54/100	20135
	I.5	2. I	1.1	1.2
	1.1–1.9	1.5–2.9	0.8–1.6	0.7–2.2
Digital phone	402/776	195/240	119/266	54/84
	1.3	I.8	1.0	1.5
	1.1–1.6	1.4–2.4	0.7–1.3	1.004–2.2
Cordless phone	350/701	172/232	116/235	35/77
	1.3	1.7	1.1	1.1
	1.1–1.6	1.3–2.2	0.8–1.5	0.7–1.7
Astrocytoma, high gradc				
Analogue phone	115/297	62/98	37/100	14/35
	1.7	2.4	I.6	1.5
	L.3–2.3	1.6–3.6	0.98–2.5	0.8–3.0
Digital phone	244/776	127/240	69/266	37/84
	1.5	2.3	1.1	2.1
	I.2–1.9	1.7–3.1	0.8–1.5	I.3–3.4
Cordless phone	205/701	113/232	63/235	20/77
	1.5	2.0	1.3	1.3
	1.1–1.9	1.5–2.8	0.9–1.8	0.7–2.3
Astrocytoma. low gradc				
Analogue phone	19/297	10/98	4/100	4/35
	1.7	1.8	0.5	1.9
	0.6–2.2	0.8–4.1	0.2–1.6	0.6–6.2
Digital phonc	56/776	27/240	16/266	6/84
	1.4	1.9	1.1	0.9
	0.9–2.3	I.02–3.5	0.s-2.1	0.3–2.5
Cordless phone	56/701	261232	18/235	8/77
	1.4	1.9	1.1	I.4
	0.9–2.3	I.05–3.5	0.5–2.1	0.5–3.5
Other malignant				
Analoguc phone	44/297	23/98	13/100	2/35
	1.3	L9	0.9	0.5
	0.9–2.0	1.1–3 3	0.5–1.8	0.1–2.0
Digital phone	102/776	41/240	34/266	11/84
	1.1	1.2	1.0	1.0
	0.8–1.6	0.8–2.0	0.6–1 6	0.5–2.2
Cordless phone	89/70]	33/232	35/235	7/77
	1.2	1.1	1.2	0.8
	0.8–1.7	07–1.7	0.7–1.8	0.3–1.8

Table 4 Number of exposed Ca and Co. OR. and 95% CI lor use of cellular or cordless telephones. Unconditional logistic regression multivariate analysis adjusted for age, sex, SEI, and year of diagnosis was used

	>1–5 year latency		> 5–10 year latency		> 10 year latency		Total. > 1 year latency	
	Ca/Co	OR. CI	Ca/Co	OR. CI	Ca/Co	OR, CI	Ca/Co	OR, CI
Malignanl								
Analogue	39/86	1.0	57/127	0.9	82/84	1.9	178/297	1.2
		0.7–1.5		0.6–1.2		**1.4–2.6**		0.97–1.5
Digital	265/581	1.0	118/177	1.3	**19/18**	1.9	402/776	**1.1**
		0.8-1.2		1.03–1.7		0.98–3.8		0.9–1.4
Cordless	193/437	1.0	124/219	1.3	33/45	1.3	350/701	1.1
		0.8–1.2		0.98–1.6		0.8–2.0		0.9–1.3
Astrocytoma, high gradc								
Analogue	**21/86**	1.0	35/127	0.9	59/84	2.0	115/297	1.3
		0.6–1.6		0.6–1.4		**1.4–2.9**		1.001–1.7
Digital	143/581	1.0	86/177	1.7	15/18	2.4	244/776	1.3
		0.8–1.2		1.2–2.3		1.1–4.9		1.03–1.6
Cordless	103/437	0.9	79/219	1.4	23/45	1.3	205/701	1.2
		0.7–1.2		1.05–1.9		0.8–2.3		0.9–1.4

published studies on the association between cellular telephones and brain tumours is too shon a lalency period. Thus, both longer latency period and higher cumulative number of hours for **use** are necessary lo pet a more precise estimate of the risk. In **our** pooled study 96 cases with malignant brain tumor had used a cellular telephone (analogue and/or digital) for > 10 years, and it should be noted that 33 cases had used a cordless phone for > 10 years in our study.

Two case–control studies on brain turnours from USA (Muscat et al. ***2000;*** Inskip et al. 2001), one from Denmark (Johansen et al. 2001) and one from Finland (Auvinen et al. 2002) did not report any cases with > 10 years latency period for use of cellular telephones. In a Danish study on acoustic neuroma (Christensen et al. 2004) only two cases had used a cellular telephone with a latency period > **10** years. A Swedish study on acoustic neuroma (Lonn et al. *2004)* reported an increased risk in the group with. > 10 years latency period based on 14 cases. From the same study group results are now available on glioma and meningioma (Lonn et a]. 2005) with ***25*** and 12 cases, respectively, with > 10 years latency period.

In the latter Swedish study (Lonn et al. 2005) an increased risk was reported for glioma with OR = 1.6, 95% CI = 0.8–3.4 (*n* = 15 cases) and meningioma OR = 1.3, 95% CI = 0.5–3.9 (*n* = 5 cases) for ipsilateral exposure using > 10 years latency period. On the other hand a somewhat decreased OR was reported for contralateral exposure but based on only 11 glioma cases and 3 meningioma cases. As we have discussed elsewhere (Hardell et al. 2005c) there are several methodological problems in the Lönn et al. (2005) study, such as numbers of cases not in agreement with the data in the Swedish Cancer registry, histopathological grading of more tumours than with available histopathology, and inclusion of cases and controls with exposure of the other side of the brain among unexposed in laterality analyses.

The Lönn et al. (2005) study is pan of the WHO Interphone study. Regular use of cellular telephones gave a slightly decreased risk for glioma with OR = 0.8, 95% CI = 0.4–1.7. Interestingly the Danish part of the Interphone study produced OR = 0.6, ***95% CI = 0.4–0.9*** for high-grade glioma, in fact all 17 calculated ORs for high-grade glioma regarding latency, number of calls, hours of use, and intensity gave OR < 1.0 (Christensen et al. 2005). In Finland the Interphone study group reported OR = 0.6, 95% CI = 0.4–0.8 for brain tumours (Lahkola et al. 2005) and in Norway OR = 0.6, 95% CI = 0.4–0.9 for glioma (Klæbo 2005).

These results are contradictory to our findings and imply either protection against brain tumours from microwaves or methodological problems in the Interphone study. The study methods in the Interphone study were quite different from our study, e.g., computer-based face to face and even bedside interviews shortly after tumour diagnosis, multiple interviewers, uncertain diagnosis not all based on histopathology, disclosure of case or control status during interviews, inconsistent numbers in published tables, use of cordless phones not assessed, recruitment of some controls by phone calls (Klæbo 2005, Hardell et al. 2005c).

Certainly patients with brain tumour are a special group to be interviewed who differ from other cancer patients. Depression has been associated with brain turnours (Oksbjerg Dalton et al. ***2002).*** Cognitive dysfunction including dementia has been reported in cancer patients (Heflin et al. ***2005).*** However, the authors excluded brain cancer from the study "due to its direct effect on cognition". In fact, in the Danish Interphone study cases with glioma scored significantly lower than controls due to problems in recalling words (aphasia) and symptoms due lo paralysis. In our studies use of cellular and cordless phones was assessed by questionnaires that were answered about 2 months after diagnosis when the patient was at home. This is a more relaxed situation than a stressful bedside interview.

Table 5 Number or Ca wilh malignant brain tumor and Co, OR. and 95% CI for use of cellular or cordless telephones lor different combinations of phonc use. Unconditional logistic regression analysis adjusted lor age, sex, SEI, and year of diagnosis was used

	> 1 year latency		
	Ca/Co	OR	CI
Malignant			
Analoguc only	42/79	1.4	0.9–2.1
Digital only	149/312	1.3	0.99–1.6
Cordless only	115/272	1.3	0.99–1.7
Analoguc + digital	112/173	1.5	1.1–2.1
Analogue + cordless	94/138	1.6	1.2–2.2
Digital + cordless	211/34	1.4	1.1–1.8
Analogue + digital + cordless	70/93	1.8	1.2–2.6
Total, m y combination	583/1112	1.3	1.1–1.5
Astrocytoma, high *grade*			
Analoguc only	20/79	1.1	0.6–1.9
Digilal only	90/312	1.5	1.1–2.0
Cordlas only	60/272	1.3	0.9–1.8
Analogue t digital	78/173	2.1	1.5–3.1
Analogue + cordless	69/138	2.3	1.6–3.4
Digilal + cordless	128/384	1.7	1.2–2.3
Analogue t digital + *cordless*	52/93	2.7	1.7–4.1
Total, any combination	341/1172	1.4	1.1–1.7

Table 6 Odds ratio and 95% CI in different age groups first use of cellular or cordless telephones. Numbers of exposed Ca and Co are given. Unconditional logistic regression analysis adjusted for age, sex, SEI, and year of diagnosis was used

	> 1 year latency		
	Ca/Co	OR	95% CI
Analogue phone			
All ages	178/297	1.5	1.1–1.9
<20	4/6	1.3	0.3–4.9
20 to 49	131/214	1.4	1.1–1.9
50 to 80	43/77	1.6	1.02–2.4
Digital phonc			
All ages	402/776	1.3	1.1–1.6
<20	16/9	3.7	1.5–9.1
20 to 49	229/445	1.3	0.99–1.6
50 to 80	157/322	1.3	1.02–1.7
Cordlas phonc			
All ages	350/701	1.3	1.1–1.6
<20	17/16	2.1	0.97–4.6
20 to 49	200/416	1.2	0.9–1.5
50 to 80	133/269	1.5	1.1–1.9

From a biological view it is unlikely that microwave radiation protects against malignant brain tumours, so the results in the Interphone study indicate methodological problems. Furthermore, the Interphone study showed a statistically significantly increased risk for acoustic neuroma after 10 years ipsilateral use of a cellular phone, OR = 1.8, 95% CI = 1.1–3.1. Cases with acoustic neuroma are in a rather healthy group wm-pared with malignant brain turnours (Schoemaker el al. 2005). Thus, so far the Interphone study shows both statistically significantly increased and decreased risks for brain tumours.

According to Table 1 in our pooled study, it is obvious that a fairly high number of lifetime cumulative use of cellular or cordless telephones is necessary to get a stable risk estimate. Thus, with > 2,000 h of cumulative use we found a high risk and ORs in that range are usually hard to explain by undetected bias or confounding in a case–control study. There are no other studies with data on cumulative use for > 2,000 h. The numbers of hours for grouping of use of cellular and cordless telephones were arbitrary chosen since there is no biological cut-off for exposure. However, of interest is the statistically significant trend test. It might also be argued that 2,000 h roughly corresponds to 10 years use in the work place for 1 h per day.

The reporting of new cancer cases to the Swedish cancer registry is compulsory. Furthermore certain benign diseases, such as benign brain tumours, are reported. As soon as the histopathological diagnosis is obtained the respective pathological departments send a report to the local cancer registry in the five medical regions in Sweden. In addition, the treating physician makes a clinical report. Thus, a high reporting frequency is obtained with good coverage of all new cases and no selection bias as to reporting exists.

Cases were reported in a consecutive way to us from the cancer registries in the included medical regions, and we have no indication of selection bias in this respect. For inclusion it was necessary to have histopathological verification of the diagnosis. If information was unclear or missing in the cancer registry we obtained copies of records from the pathology and radiology departments.

All exposure was assessed and coded in a blinded manner as to case or control status so as to avoid observational bias, as we have discussed in more detail elsewhere (Hardell et al. *2002).* Misclassification of exposure may occur if cases recall exposure different to controls. Cordless telephones have not been discussed as a risk factor for brain tumours in the populalion, so also the results for that phone type indicate that recall bias may not explain the results. OR increased both with latency period and cumulative number of hours for use. The concepts of tumor induction period and dose–response are generally not understood in the population so these results strengthen our results and argue against recall bias as an explanation of the findings.

In the analyses we adjusted for sex since all controls were used and they were frequency matched to the cases. It should be noted that meningioma is more commonly occurring among females (Whittle et al. 2004) so sex might be a confounder, since the use of both cellular and cordless phones differs among men and women. Certainly the use is also age dependant, generally use of a phone is more common among younger persons, so adjustment was made for age in the calculations of OR and 95% CI. Another factor to take into account is year for diagnosis of the cases and corresponding year for the controls since this pooled analysis encompassed cases and controls recruited during 1997–2003 and the use of both cellular and cordless telephones increases over the

years. Finally, we also adjusted for current or last reported SEI-code since social class has been reported to be a determinant for brain tumours (Preston Martin and Mack 1996).

It has been argued that use of cordless phones should not be assessed since they have lower power output than GSM phones. However, as discussed elsewhere (Hansson Mild et al. 2003). the GSM phone regulates the output power depending on the quality of transmission. Measurements show that, for instance, in Stockholm city the GSM 900 phones only use 4% of the maximum output power as a median value (Persson et al. 2002). Furthermore, the DTX function which makes the phone transmit with 217 pulses per second when one is talking, but only with 2 pulses per second when listening, in principle causes a further reduction with a factor of up to two. Most GSM phones have less than 1 watt peak output power instead of the allowed 2 watt in the standard. Thus, the GSM phones have a median power of 10–20 mwatt, i.e., the same order of magnitude as the cordless phones. With the longer calling time with cordless telephones (c.f. Table 2) the "dose" for cordless users is then even higher than for that of the GSM users.

The mechanism for a carcinogenic effect from RF fields has been discussed for several years. Some studies have shown biological effects in experimental studies, whereas these findings have not been replicated in others (Kundi 2004; Kundi et al. 2004). Of interest is findings of genotoxic effects in cell systems exposed to radio frequency electromagnetic fields (RF-EMF) in the recently presented REFLEX-study (REFLEX final report 2005; Diem et al. 2005). In the REFLEX-study SAR levels which varied between 0.3 and 2 watt/kg were used. Increase in single and double strand DNA breaks and micronuclei frequency was found. Findings of chromosomal aberrations were observed in fibroblasts and intracellular increase of free radicals in HL-60 cells. It was concluded that RF-EMF might activate several groups of genes that play a role in cell division, cell proliferation, and cell differentiation. These results indicate pathophysiological mechanisms that could be the basis for the development of chronic diseases, such as cancer, in humans. Based on these results and our findings it must be concluded that the current allowed SAR level of 2 watt/kg based on thermal effects from RF-EMF is not appropriate.

In summary, this pooled analysis showed consistently increased risk for malignant brain tumours using > 10 years latency period. Especially high OR was found for high-grade astrocytoma. OR increased with cumulative lifetime number of hours of use of analogue and digital cellular telephones and cordless phones. In multivariate analyses increased risk was found for all three phone types. OR was highest for ipsilateral use which is also of biological relevance. Of special concern is the higher risk for use of digital cell& telephones and cordless phones in the age group < 20 years at start. However, these results are based on low numbers and need to be confirmed in further studies. Since the use of cellular and cordless telephones has increased during most recent years it is too early to detect a change of brain tumour incidence in cancer registries. Risk estimates and exposure frequencies in our studies enable calculation of the attributable fraction (AF); that is the proportion of cases that can be attributed to the particular exposure. This was calculated as the exposed case fraction multiplied by [(OR-1)/OR]. For use of cellular or cordless telephones in any combination AF was calculated to 15% based on the results in Table 5.

Acknowledgements The study was supported by grants- from Cancer-och Allergifonden, Cancerhjälpen, Nyckelfonden, Örebro Cancer Fund

References

Auvinen A, Hietanen M, Luukonen R, Koskela RS (2002) Brain tumors and salivary gland cancers among cellular telephone users. Epidemiology 13:356–359

Christensen HC, Schüz J, Kosteljanetz M, Poulsen HS, Thomsen J, Johansen C (2004) Cellular telephone use and risk of acoustic neuroma. Am J Epidemiol 159:277–283

Christensen HC, Schüz J, Kosteljanetz M, Poulsen HS, Boice JD, McLaughlin JK, Johansen C (2005) Cellular telephones and risk for brain tumors. A population-based, incident case–control study. Neurology 64:1189–1195

Diem E, Schwarz C, Adlkofer F, Jahn O, Rüdiger H (2005).Non-thermal DNA breakage by mobile-phone radiation (1800 MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro. Mutat Res 583:178–183

Hansson Mild K, Hardell L, Kundi M, Mattsson M-O (2003) Mobile telephones and cancer: Is there really no evidence of an association? (Review). Int J Mol Med 12:67–72

Hardell L, Näsman Å, Påhlson A, Hallquist A, Hansson Mild K (1999) Use of cellular telephones and the risk for brain tumours: A case-control study. Int J Oncol 15:113–116

Hardell L, Hansson Mild K, Påhlson A, Hallquist A (2001) Ionising radiation, cellular telephones and the risk for brain tumours. Eur J Cancer Prev 10:523–529

Hardell L, Hallquist A, Hansson Mild K, Carlberg M, Påhlson A, Lilja A (2002) Cellular and cordless telephones and the risk for brain tumours. Eur J Cancer Prev 11:377–386

Hardell L, Hansson Mild K, Carlberg M (2003a) Further aspects on cellular and cordless telephones and brain tumours. Int J Oncol 22:399–407

Hardell L, Hansson Mild K, Sandström M, Carlberg M, Hallquist A, Påhlson A (2003b) Vestibular schwannoma, tinnitus and cellular telephones. Neuroepidemiology 22:124–129

Hardell L, Carlberg M, Hansson Mild K (2005a) Case–control study on cellular and cordless telephones and the risk for acoustic neuroma or meningioma in patients diagnosed 2000–2003. Neuroepidemiology 25:120–128

Hardell L, Carlberg M, Hansson Mild K (2005b) Case–control study of the association between the use of cellular and cordless telephones and malignant brain tumors diagnosed during 2000–2003 (2005b) Env Res doi:10.1016/j.envres.2005.04.006

Hardell L, Hansson Mild K, Kundi M (2005c) Re: Long-term mobile phone use and brain tumor risk, Am J Epidemiol 162:600–601

Heflin LH, Meyerowitz BE, Hall P, Lichtenstein P, Johansson B, Pedersen NL, Gatz M (2005) Cancer as a risk factor for long-term cognitive deficits and dementia. JNCI 97:854–856

Inskip PD, Tarone RE, Hatch EE, Wilcosky TC, Shapiro WR, Selker RC, Fine HA, Black PM, Loeffler JS, Linet MS (2001) Cellular-telephone use and brain tumors. New Engl J Med 344:79–86

EXHIBIT M 1

Johansen C, Boice J D Jr, McLaughlin JK. Olsen JH (2001) Cellular telephones and cancer—a nationwide cohort study in Denmark. J Natl Cancer Inst 93:203–207

Klæbo L (2005) Mobilc phones and brain tumours. Cell Phones & Cancer. Annual ECP Symposium & Michael J Hill Memorial Lecture. Blakenberge, Belgium, November 4–5, 2005

Kundi M (2004) Mobilc phone use and cancer. Occup Environ Mcd 61:560–570

Kundi M, Hansson Mild K, Hardell L. Mattsson M-O (2004) Mobile telephones and caner—a review of epidemiological evidence. I Toxicol Environ Health B 7(5):351–384

Lahkola A. Salminen T, Auvinen A (2005) Selection bias due to differential participation in a case–control study of mobile phone use and brain tumors. Ann Epidcmiol 15:321–325

Lönn S, Ahlbom A, Hall P, Feychting M (2004) Mobilc phonc use and the risk of acoustic neuroma. Epidcmiology 15:653–659

Lönn S, Ahlbom A. Hall P, Feychting M, Swedish Interphone Study Group (2005) Long-lcrm mobile phone use and brain tumor risk. Am J Epidemiol 161:526–535

Muscat JE, Malkin MG, Thompson S, Shore RE, Stellman SD, McRee D, Neugut AI, Wynder EL (2000) Handheld cellular telephone use and risk of brain caner. JAMA 284:3001–3007

Oksbjerg Dalton S, Mellemkjær L. Olsen JH. Mortensen PB. Johansen C (2002) Depression and cancer risk: A registry-based study of patients hospitalized with affective disorders, Denmark, 1969–1993. Am J Epidemiol 155:1088–1095

Persson T. Törnevik C, Larsson L-E. Lovén J (2002) GSM mobile phone output power distribution by network analysis of all calls in some urban, rural and in-ofice networks, complemented by test phanc measurements. Twenty-fourth Annual Meeting of the Bioelectromagnetics Society, pp 181–183

Preston-Martin S, Mack WJ (1996) Neoplasms of the nervous system. In: Schottenfeld D, Fraumeni JF Jr (cds) Cancer epidemiology and prevention. Oxford University Press, New York. pp 1231–1281

REFLEX final report (2005) Risk evaluation of potential environmental hazards lrom low frequency electromagnetic field exposure using sensitive in vitro methods http://ww.itis.ethz.ch/downloads/REFLEX_Final%20Report_171104.pdf (assessed August 25, 2005)

Schoemaker MJ, Swerdlow AJ, Ahlbom A, Auvinen A, Blaasaas KG, Cardis E. Collatz Christensen H, Feychting M, Hepworths SJ. Johansen C. Klæboe L, Lönn S, McKinney PA, Muir K, Raitanen J, Salmincn T, Thomsen J, Tynes T (2005) Mobik phanc use and risk of acoustic neuroma: results of the Interphone case–control study in five North European countries. Br J Cancer 93:842–848

Whittle IR, Smith C, Navw P, Collie D (2004) Meningiomas. Lancet 363:1535–1543

EXHIBIT M

Neurobehavioral Effects Among Inhabitants Around Mobile Phone Base Stations

(NeuroToxicology - **2006** - ***Science Direct)***

EXHIBIT M

Models
NEUTOX-636; No of Pages 7

Available online at www.sciencedirect.com
ScienceDirect
NeuroToxicology xxx (2006) xxx–xxx
Neuro Toxicology

Neurobehavioral effects among inhabitants around mobile phone base stations

G. Abdel-Rassoul *, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem

Community, Environmental and Occupational Medicine Department, Faculty of Medicine, Menoufiya University, Shebin El-Kom, Egypt

Received 20 October 2005; accepted 18 July 2006

Abstract

Background: There is a general concern on the possible hazardous health effects of exposure to radiofrequency electromagnetic radiations (RFR) emitted from mobile phone base station antennas on the human nervous system.

Aim: To identify the possible neurobehavioral deficits among inhabitants living nearby mobile phone base stations.

Methods: A cross-sectional study was conducted on (85) inhabitants living nearby the first mobile phone station antenna in Menoufiya governorate, Egypt. 31 are living in a building undo the station antenna while 48 opposite the station. A control group (80) participants were matched with the exposed for age, sex, occupation and educational level. All participants completed a structured questionnaire containing: personal, educational and medical histories; general and neurological examinations; neurobehavioral test battery (NBTB) [involving tests for visuomotor speed, problem solving, attention and memory]; in addition to Eysenck personality questionnaire (EPQ).

Results: The prevalence of neuropsychiatric complaints as headache (23.5%), memory changes (28.2%), dizziness (18.8%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%) were significantly higher among exposed inhabitants than controls: (10%).(5%), (5%), (0%), (8.8%) and (10%). respectively ($P < 0.05$). The NBTB indicated that the exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory [Paced Auditory Serial Addition Test (PASAT)]. Also, the inhabitants opposite the station exhibited a lower performance in the problem solving test (block design) than those under the station. All inhabitants exhibited a better performance in the two less of visuomotor speed (Digit symbol and Trailmaking B) and one test of attention (Trailmaking A) than controls. The last available measures of RFR emitted from the first mobile phone base station antennas in Menoufiya governorate were less than the allowable standard level.

Conclusions and recommendations: Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition. So, revision of standard guidelines for public exposure to RFR from mobile phone base station antennas and urine of NBTB for regular assessment and early detection of biological effects among inhabitants around the nations are recommended.

Keywords: Neurobehavioral effects; Mobile phone base stations; Radiofrequency radiations (RFR)

1. Introduction

There is a general concern about the possible hazardous health effects of exposure to radiofrequency radiations (RFR) emitted from mobile phone base station antennas. Disturbance of the nervous system leads to behavioral changes and may serve as an early indicator of disturbances in regulatory functions of many systems (Lai and Singh, 1994). Exposure of the neural tissue to RFR can cause electrophysiological changes in the nervous system (Navakatikian and Tomashevskaya, 1994; *Velizarov et al., 1999)*. Some studies have suggested that RFR induce tissue heating leads to tissue damage (Gajsek et al., 2002; Preece et al., 1999). Some effects are observed among mobile phone users at low intensity and after repealed exposure (Hyland, 2000). The efflux of calcium ions from brain tissue is an important neurochemical effect of RFR as calcium ion plays an important role in the functions of the nervous system such as the release of neurotransmitters (Dutta et al., 1989). Experimental studies on

* Corresponding author. Tel.: +20482951291; fax: +20482950240
E-mail address: gulnrl7@yahw.com(G. Abdel-Rassoul).

0161-813X/$ – see front matter © 2006 Elsevier Inc. All rights reserved.
doi:10.1016/j.neuro.2006.07.012

EXHIBIT M

Please cite this article as: G. Abdel-Rassoul et al., Neurobehavioral effects among inhabitants around mobile phone base stations, ... doi:10.1016/j.neuro.2006.07.012

Table 1
Personal characteristics of exposed and control participants

Personal characteristics	Exposed (n = 85) mean ± S.D.		Controls (n = 80) mean ± S.D.		Test of significance	P-value
Age (years)	38.23 ± 14.56		39.88 ± 15.29		t-Test = 0.98	>0.05
	No	%	No	%		
Sex						
Male	48	56 50	47	58.75	χ^2 = 0.09	>0 05
Female	31	43.50	33	4 1.25		
Education level						
Basic	3	3 50	0	000	χ^2 = 2 96	>0 05
Secondary	34	40.00	35	43 75		
University	48	56 50	45	56 25		
Smoking						
Smokers	4	4 70	7	8.75	χ^2 = 1.08	>0.05
Nonsmokers	81	95.30	13	91.25		
Mobile phone use						
Users	10	11.76	8	10.00	χ^2 = 0.01	>0.05
Non-users	13	88.24	72	90.00		

Exposed and controls were of the same age, sex, educational levels, smoking habits and mobilr phonc use ($P > 0.05$).

stared the confidentiality of the response with no identification of names or contact information.

(B) Clinical examination: including general and local neurological examination.

(C) Neurobehavioral test battery (NBTB) (Lezak. 1995; Wechsler, 198 l): a series of eight neurobehavioral tests translated into Arabic by Meleka (1991) was used. They included tests of:(1) Visuomotor Speed (Digit Symbol and Trailmaking B), (2) problcm solving (block design). (3) attention and short-term auditory memory (PASAT. Letter Cancellation and Trailmaking A), (4) memory [(Digit Span forward and backward and Benton Visual Retention Test (BVRT)]. In addition to this NBTB, Eysenck Personality Questionnaire (EPQ) (Eysenck, 1990) was used to measure personality domains. Better performance is evaluated by higher scores obtained on tests of Digit Symbol. Block Design, PASAT, Digit Span and BVRT, while lower latency or time to complete Trailmaking parts A and B tests indicated better performance.

(D) Environmental measures: the mosl recent measures at the start of the study for the power density (mW/cm^2) of mobile phone base station antennas under the study done by the National Telecommunication Institute at the year 2000 were considered.

2.1. Statistical analysis

Data were collected. tabulated and statistically analyzed using chi-square (χ^2) and student I-tests and analysis of covariance (ANCOVA) for comparison between groups at 5% level of significance.

3. Results

Eighty-five exposed participants (56.5% males and 43.5% females) with a mean age (38.2 ± 14.5 years) were matched with 80 controls (58.7% males and 43.3% females) with a mean age (39.8± 15.2 years) ($P > 0.05$). They were also matched regarding sex distribution, education level. smoking and mobile phone use ($P > 0.05$, Table 1). Although both exposed and control groups did not differ significantly on studying these variables, the analysis of covariance (ANCOVA) was used to adjust for their influence as they are confounders for neurobehavioral performance. ANCOVA confirmed the same deficits as the t-test comparisons.

Table 2
Measurements of power density for mobilr phonr base station antennas upon the building under the study by National Telecommunication Institute INTI, 2000)

Site of measurement	Power density (mW/cm^2)	The maximum permissible level for continuous exposure (mW/cm^2)
Antenna 1		
1	0.0020	0.0080
1	0.0024	0.0080
3	0.0063	0.0080
Antenna 2		
1	0.0033	0.0080
2	0.0032	0.0080
3	0.0026	0.0080
4	0.0067	0.0080
5	0.0024	0.0080
Antenna 3		
1	0.0055	0 0080
2	0.0039	0 0080
3	0.0027	0 0080
Inside the shelter	0.0001	0 0080
At different sites	0.0001	0 0080
Within the apartment below antenna 1	0.0001	0 0080

NB: The maximum permissible level for intermittent exposure is 0.4 mW/cm^2 that decreased to 0.0080 mW/cm^2 for continuous exposure (Egyptian Protocol of Criteria for Construction of Mobile Phone Stations, 2000).

EXHIBIT M

Please cite this article as: G. Abdel-Rassoul et al., Neurobehavioral effects among inhabitants around mobile phone base stations, NeuroToxicology (2006), doi:10.1016/j.neuro.2006.07.012

Tablr 3
Neurological complaints among exposed and controls

Neurological complaints	Exposed (*N* = 85), *N* (%)	Controls (*N* = 80), *N* (%)	χ^2	*P*-value	OR 195% CI)
Headache	20 (23.5)	8 (10.5)	4.44	<0.05	2.77 [1.06–7.4]
Memory changes	24 (28.2)	4 (5.0)	14.19	<0.001	7 48 [2.29–26.98]
Tremors	8 (9.4)	0 10.01	Fisher exact	<0.01	
Dizziness	16 (18.8)	4 (5.0)	6.15	<0.01	4.41 [1.29–16.46]
Depressive symptoms	18 (21.7)	7 (8.8)	4.03	<0.05	2 8 [1.02–7.94]
Blurred vision	19 (22.3)	12 (15.0)	1.02	>0.05	1.63 [0.69–3.91]
Sleep disturbance	20 (23.5)	8 (10.0)	4.44	<0.05	2.77 [1.06–7.4]
Irritability	23 (27.1)	16 (20.0)	0.78	>0.05	1.48 [0.68–3.27]
Lack of concentration	14 (16.5)	8 (10.0)	0.99	>0.05	1.77 [0 65–4.97]

Fischer exact test was used as the calculated expected number in this cell was lower than five.

The last available measures of RFR from the mobile phone base stations antennas from the building in the sludy were less than the allowable standard level (0.4 mW/cm^2) (Table 2) in the year 2000. The numbers 1–5 indicate the sites at which the measures on a specific antenna were taken. The shelter was an enclosed room containing an electric power slation and the cables for the base slation antenna. The tower is a building of 12 stories. No measures were available for the buildings across the street or from the control building.

The prevalence of headache (23.5%). memory changes (28.2%), tremors (9.4%), dizziness (18.8%), depressive symptoms (21.7%) and sleep disturbances (23.5%) among exposed subjects were significantly higher than controls (10%. 5%, 0%, 5%. 8.8% and 10%; respectively) ($P < 0.05$, Table 3). The only difference between the exposed panicipants under the station as opposed to those working opposite it was in the prevalence of sleep disturbance (10.8% and 31.3%, respectively) ($P < 0.05$, Table 4).

The exposed panicipants exhibited a significantly poorer performance than controls in one rest of attention and shon-term audirory memory (PASAT), but they exhibited significantly better performance than controls in tests of visuomotor speed (Digit Symbol and Trailmaking B) ($P < 0.01$) and one test of attention (Trailmaking A) ($P < 0.001$). The difference in scores in Trailmaking A was so high and these scores were verified again and no numerical errors were found. There was no significant difference between exposed and controls in the score of EPQ scale ($P > 0.05$, Table 5). The exposed panicipants opposite to the station exhibited a significantly lower performance in the problem solving (Block Design) than those living under the station ($P < 0.05$, Table 6).

4. Discussion

The extensive use of mobile phones has been accompanied by public debate about possible adverse effects on human health. However, little is known about the effects of long-term exposure that is experienced by people living near mobile phone base stations (Bortkiewicz et al., 2004).

The last available measurements of RFR emitted from mobile phonc base station antennas under the study in the year 2000 were less than the Egyptian allowable standard level (0.4 mW/cm^2). However. the level of exposure to RFR increases or decreases according to the number of phone calls lrom different parts of country or other countries. The number of subscribers in mobile phonc service increased approaimately four times within 2 years from about 1,575,000 (2.5% of the Egyptian population) in the year 2000 at the time of the previously measured levels to about 7,000,000 (9.5% of the Egyptian population) in the year ZW2 (El-Mesairy, 2002) just before the beginning of this study in the year 2003. Consequently, it is expected that the previously mentioned levels of exposure to RFR in the year 2000 were higher at the time of the study.

Table 4
Neurological complaints among inhabitants living under and opposite the station

Neurological complaints	Inhabitants		χ^2	*P*-value	OR [95% CI]
	Opposite the station (*N* = 48), *N* (%)	Under the station (*N* = 37). *N* (%)			
Headache	15 (31.3)	5 (13.5)	2.13	>0.05	2.91 [0.85–10.47]
Memory changes	12 (25.0)	12 (32.4)	0.26	>0.05	0.69 [0.24–1.99]
Tremors	4 (8.3)	4 (10.8)	0.00	>0.05	0.75 [0.14–3.92]
Dizziness	9 (18.8)	7 (18.9)	0.07	>0.05	0.99 [0.29–3.38]
Depressive symptoms	9 (18.8)	8 (21.6)	0.10	>0.05	0.84 [0.25–2.75]
Blurred vision	12 (25.0)	7 (18.9)	0.16	>0.05	1.43 [0.45–4.65]
Sleep disturbance	15 (31.3)	4 110.81	3.92	<0.05	3.75 [1.01–15.09]
Irritability	16 (33.3)	7 (18.9)	1.53	>0 us	2.14 [0.7–6.74]
Lack of concentration	9 (18.8)	5 (13.5)	0.12	>0.05	1.48 [0.4–5.71]

EXHIBIT M

Please cite this article as: G. Abdel-Rassoul et al., Neurobe ffects among inhabitants around mobile phone base stations: NeuroToxicology (2006), doi:10.1016/j.neuro.2006.07.012

Table 5
Mean ± S.D. of neurobehavioral performance and personality scores of exposed and controls

Neurobehavioral tests	Exposed (n = 85)		Controls (n = 80)		t-Test	P
	$\bar{X}$	±S.D.	$\bar{X}$	±S.D.		
Performance tests						
Visuomotor speed						
Digit symbol	41.43	11.91	31.30	11.98	3.19	<0.01
Trailmaking B	84.79	21.88	108.40	39.49	3.16	<0.01
Problem solving						
Block design	24.32	7.23	24.15	5.25	0.10	>0.05
Attention						
PASAT	12.20	4.20	15.47	5.49	4.31	<0.001
Letter cancel	30.28	5.20	31.56	5.00	1.35	>0.05
Trailmaking A (s)	26.10	21.43	88.25	25.46	3.84	<0.001
Memory						
Digit span forward	6.40	1.69	7.05	2.50	1.21	>0.05
Digit span backwards	2.60	0.82	2.37	0.89	1.73	>0 05
Digit span total	9.w	2.82	9.42	3.78	0 38	>0 05
BVRT	4.48	1.62	3.95	0.97	1.36	>0 05
Eysenck personality questionnaire (EPQ)						
P (psychoticism)	7.04	1.73	7.40	2 10	1.20	>0.05
C (criminality)	12.69	3.60	13.58	4.39	0 86	>0 05
N (neuroticism)	10.84	3.93	12.20	4.14	I2 9	>0 05
E (extroversion)	10.82	3.62	10.85	3.95	0 38	>0 05
L (lie)	15.45	4.18	10.10	3.45	0 61	>0 05

On studying the prevalence of neurological complaints among exposed subjects and controls, headache. memory changes, tremors, dizziness. depressive symptoms and sleep disturbance were significantly higher among exposed (23.5%, 28.2%. 9.4%. 18.8%, 21.7% and 23.5%, respectively) than controls (10%, 5%, 0%, 5%, 8.8% and 10%, respectively) ($P < 0.05$). These results agree with Sanlini et al. (2002) who found that the frequency of headache, loss of memory, irritability, dizziness. depression and sleep disturbance was significantly higher among people living near cellular phone base stations (25.4%. 27.6%, 4.5%, 4%, 9.2% and 4.1%, respectively) than controls ($P < 0.05$). Also, Frey (1998) and Leif (2003) observed various complaints mostly of sleep disturbance. irritability, depression. headache. vertigo and Concentration difficulties among people living near mobile base stations.

On comparing exposed inhabitants living in the building under the slalion with those opposite the slalion regarding

Table 6
Mean ± S.D. of neurobehavioral performance score of inhabitants living under and opposite the station

Performance tests	Inhabitants (n = 85)				Student's t-test	P
	Under the station (n = 37)		Opposite the station (n = 48)			
	$\bar{X}$	±S.D.	$\bar{X}$	±S.D.		
Visuomotor speed						
Digit symbol	42.24	12.67	40 19	11.72	0.41	>0.05
Trailmaking B	89.52	24.95	81 .35	19.16	0.11	>0.05
Problem solving						
Block design	17.57	4.61	21.31	7.97	3.23	<0.01
Attention						
PASAT	11.69	1.73	12.25	2.10	1.80	>0.05
Letter cancel	32.31	5.43	33.15	5.65	0.52	>0.05
Trailmaking A (s)	65.24	24.16	56.96	19.24	0.11	>0.05
Memory						
Digit span forward	6.63	0.51	6.30	1.77	0.63	>0.05
Digit span backward	3.21	1.02	2.90	0.75	1.43	>0.05
Digit span total	9.84	2.29	9.20	2.61	1.68	>0.05
BVRT	4.57	1.33	4.40	1.88	0.35	>0.05

EXHIBIT M

Please cite this article as: G. Abdel-Rassoul et al., Neurob effects among inhabitants around mobile phone base stations, NeuroToxicology (2006), doi:10.1016/j.neuro.2006.07.012

neurological complaints. there was a significant increase in :he prevalence of sleep disturbance among the inhabitants opposite to the station (31.3% versus 10.8%) ($P < 0.05$). This could be explained by the fact thal the concrete roof can soak up to 5–30% of the radiation from the antennas. so the levels of radiation in the building under the station may be lower than opposite and pose fewer hazards (El-Mesairy, 2002; Knave, 2001).

On studying the neurobehavioral performance using NBTB and personality domains using (EPQ) scale, the exposed participants exhibited a significantly better performance than controls in tests of visuomotor speed (Digit Symbol and Trail making B) and one test of attention (Trail making A) than controls, but they exhibited a poorer performance in PASAT test (which measures attention and short-term auditory memory) than controls. Better performance is evaluated by higherscores obtained on tests of Digit Symbol, Block Design. PASAT. Digit Span and BVRT. by contrast: lower latency or time to complete Trailmaking pans A and B tests indicated better performance.

The better performance in some neurobehavioral tests in this study agreed wilh Koivisto el al. (2000) and Lee el al. (2001) who suggested that the electromagnetic held emitted by cellular telephones may have a facilitatory effect on brain functioning. On the other hand. responses of central nervous system to RFR could be a Stress response (Duan et al., 1998; Lai and Singh, 1997). Stress effects are well known to accumulate over time and involve first adaptation and then an eventual breakdown of homeostatic processes. Moreover. Lai et al. (1990. 1994) experimental studies on rats indicated that RFR can activate endogenous opioids in the brain. which in turn cause a decrease in cholinergic activity leading to shon-term memory deficit. The Stress hormone "corticotropin releasing factor" is also involved. This may explain the lower performance of exposed subjects in PASAT lest in this study. On the other hand, on studying the personalily domains using (EPQ) scores. there was no difference between exposed inhabitants and controls in the present study regarding these scores. This may be explained by the fact of the presence of relatively low levels and shon duration of exposure (about 5 years) to RFR since the establishment of the base station under the study, a matter which needs a further wide scale research to be verified.

5. Conclusion and recommendations

The inhabitants around mobile base station antennas significantly complain or develop headache, memory changes. tremors, dizziness. depressive symptoms and sleep disturbance than controls. Also. there are some effects of RFR emitted from these antennas on neurobehavioral performance. Therefore, the study recommends:

(1) Annual monitoring of RFR emitted from the mobile phone base station antennas should be carried out as their values may become higher due to the expected extensive future use of mobile phones and hence more activity and more arising emissions leading to increase in incidence and severity of neurobehavioral disorders among inhabitants around these stations. At the same time, this will clarify conlroversies met with in this study regarding scores of some NB tests for exposed inhabitants.
(2) For inhabitants near mobile phone base station, NBTB can be used as a useful non-invasive tool for assessment and early detection of subtle effects of exposure to RFR.
(3) Further follow up wide scale studies for those inhabitants exposed for longer durations to RFR arising from mobile phone base stations should be done to clarify if there is an actual positive association and/or causation between exposure and either of :he development of neurobehavioral complaints or NBTB and personality changes so as to cut off the challenge of presence of controversies in the results done in this field all over the world.

References

Abdel Gawad S 11972). The Arabic ropy of middle six questionnaire for assessment of psychological status and diagnosis of psychiatric disorders. Psychiatric department, El-Kasr El-Aini Hospital, personal communication.

American National Standards Institute and the Institute of Electrical and Electronics. Engineers [ANSI/IEEE] (1992). Standard for safety levels wilh respect to human exposure to radiofrequency electromagnetic fields. ANSI/IEEE C 95-1-1991. New York. http://www.electric-words com/adey/adeyoverviewl.html.

Bortkiewicz A. Zmyslony M. Szyjkowska A. Gadzicka E. Subjective symptoms reported by people living in the vicinity of cellular phonc base stations Rev Mrd Pr 2004;55:345–51.

Duan L. Shan X. Xu X. Observation of changes in neurobehavioral functions in workers exposed to high frequency radialion. Chung Hua Xu Fang Hsueh Tsa Chilh 1998;32(2):109–11 (Abstract in English).

Dutta S, Gharh B, Blackman C. Radiofrequency radiation induced calcium efflux enhancement lrom human and other neuroblastoma cell in culture. Bioelectromagnetics 1989;10:197–202.

Eysenck H. Biological dimensions of personality. In: Previn L, editor. Handbook of personality. Theory and research. New York: Guilford; 1990. p. 244–76.

Frry A. Commentary: headache fromcellular phones: are they real and what are the implications? Environ Health Perspect 1998;106:101–3.

Gajsek P, Pakhomov A. Klauenberg B. Electromagnetic field standards in Central and Eastern European countries: current state and stipulations for international harmonization. Health Phyr 2002;82:473–83.

Hyland G. Physics and biology of mobile telephony. Lancet 2000;356:1833–6.

Knave B. Electromagnetic fields and health outcomes. Ann Acad Med Singapore 2001;30:489–93.

Koivisto M, Revonsuo A. Krause C. Haarala C. Sillanmaki L. Effects of 902 MH3 electromagnetic held emitted by cellular phones on response times in human. Neuro-Report 2000;11:413–5.

Lsi H (2000). Biological effects of radiofrequency radiation from wireless transmission towers. Berkeshire-Litchfield Environmental Council. http://electric-words.com/adey/adeyoverview/html.

Lai H. Singh N. Research on the neurological effects of non-ionizing radialion at the university of Washington. Bioelectromagnetics 1994;13:513–26.

Lsi H. Singh N. Neurological effects of radiofrequency electromagnetic radiation related to wireless communication technology. Int J Rad Biol 1997;71:413–21.

Lai H, Carino M A. Horita A, Guy AW. Corticotropin-releasing factor antagonist blocks microwave-induced changes in central cholinergic activity in the rat. Brain Res Bull 1990;25:609–12.

Lai H. Horita A, Guy AW. Microwave irradiation affects radial-arm maze performance in the rat. Bioelectromagnetics 1994;15:95–104.

EXHIBIT M

Please cite this article as: G. Abdel-Rassoul et al., Neurobehavioral effects among inhabitants around mobile phone base stations, NeuroToxicology (2006), doi:10.1016/j.neuro.2006.07.012

Lee T, Ho S, Tsang L, Xang S, Li L, Chan C. Effect on human attention of exposure to the electromagnetic field emitted by mobile phones. Neuro Report 2001;12:729–31.

Leif S. Mobile phones confirmed as a cause of earlier Alzheimer's onset and damage to memory and learning ability in mammals. Sweden: Lund University Hospital; 2003.

Lezak MD. Neuropsychological assessment. 3rd ed. Oxford University Press; 1995 pp. 335–344.

Navakatikian M, Tomashevskaya L. Phasic behavioral and endocrinal effects of microwaves of non-thermal intensity. In: Carpenter D, editor. Biological effects of electric and magnetic fields, vol. 1. San Diego: Academic Press; 1994. p. . p. 2369.

Preece A, Iwi G, Davies-Smith A, Wesnes K, Buler S, Lim E, Varey A. Effects of 915 MHZ stimulated mobile signal on cognitive function in man. Int J Radial Biol 1999;75:447–56.

Santini R, Santini P, Danze J, Le-Ruz P, Scigne M. Investigations on the health of people living near mobile telephone relay stations. Incidence according to distance and sex. Pathol Biol 2002;50:369–73.

Velizarov S, Rashmark P, Kwee S. The effects of radiofrequency fields on cell proliferation are non-thermal. Bioelectrochem Bioenergy 199948: 177–80.

Wechsler D. Wechsler adult intelligence scale-revised. San Antonio, TX: The Psycological Corporation; 1981.

Arabic references

المراجع العربية:

1- المسيري ومدحت عبد المنعم ()(El-Mesairy and Abdel-Moniem (2002): شبكات التليفون المحمول بين التقنية العلمية و المخاطر الصحية. ورشة عمل حول أساسيات التعامل مع محطات التليفون المحمول وإجراءات إصدار التصاريح الخاصة بها من الناحية البيئية والإجرائية. إدارة شئون البيئة. محافظة الدقهلية – جمهورية مصر العربية. ص 6 – 10.

2- بروتوكول وزارة الاتصالات بالتعاون مع وزارة الدولة لشئون البيئة ووزارة الصحة والسكان بجمهورية مصر العربية (2000): الاشتراطات الواجب توافرها عند تركيب المحطات الأساسية للتليفون المحمول –ورشة عمل حول أساسيات التعامل مع محطة التليفون المحمول وإجراءات إصدار التصاريح الخاصة بها من الناحية البيئية. إدارة شئون البيئة. محافظة الدقهلية. ص 2-5.

3- مليكة لويس كامل (1991): مقياس وكسلر بلفيو لذكاء الراشدين والمراهقين. دليل المقياس . مكتبة النهضة المصرية. ص 6.

4- نصير بهنسي محمد(Bahnasy) (2002): تكنولوجيا التليفون المحمول والبيئة. ورشة عمل حول أساسيات التعامل مع محطات التليفون المحمول وإجراءات إصدار التصاريح الخاصة بها من الناحية البيئية. إدارة شئون البيئة. محافظة الدقهلية. ص 15-20.

EXHIBIT M

Nerve Cell Damage to Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones

(Environmental Health Perspective - June, 2003)

EXHIBIT M

Nerve Cell Damage in Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones

Leif G. Salford,[1] Arne E. Brun,[1] Jacob L. Eberhardt,[2] Lars Malmgren,[4] and Bertil R. R. Persson[3]

[1]Department of Neurosurgery, [2]Department of Neuropathology, [3]Department of Medical Radiation Physics, and [4]Department of Applied Electronics, Lund University. The Rausing Laboratory and Lund University Hospital, Lund, Sweden

The possible risks of radio-frequency electromagnetic fields for the human body is a growing concern for our society. We have previously shown that weak pulsed microwaves give rise to a significant leakage of albumin through the blood–brain barrier. In this study we investigated whether a pathologic leakage across the blood–brain barrier might be combined with damage to the neurons. Three groups each of eight rats were exposed for 2 hr to Global System for Mobile Communications (GSM) mobile phone electromagnetic fields of different strengths. We found highly significant ($p < 0.002$) evidence for neuronal damage in the cortex, hippocampus, and basal ganglia in the brains of exposed rats. *Key words:* blood–brain barrier, central nervous system, microwaves, mobile phones, neuronal damage, rats. *Environ Health Perspect* 111:881–883 (2003). doi:10.1289/ehp.6039 available via *http://dx.doi.org/* [Online 29 January 2003]

The voluntary exposure of the brain to microwaves from hand-held mobile phones by one-fourth of the world's population has been called the largest human biologic experiment ever (Salford et al. 2001). In the near future, microwaves will also be emitted by an abundance of other appliances in the cordless office and also in the home. The possible risks of radio-frequency electromagnetic fields (RF EMFs) for the human body is a growing concern for our society (for a review, see Hyland 2000). Most researchers in the field have dwelled on the question of whether RF EMFs may induce or promote cancer growth. Although some have indicated increased risk (Hardell et al. 2002; Repacholi et al. 1997), most studies, including our own, have shown no effects (Salford et al. 1997a) or even a decreased risk (Adey et al. 1999).

The possible risks of microwaves for the human body has attracted interest since the 1960s (i.e., before the advent of mobile phones), when radar and microwave ovens posed a possible health problem. Oscar and Hawkins (1977) performed early studies on effects of RF EMFs on the blood–brain barrier. They demonstrated that at very low energy levels (< 10 W/m^2), the fields in a restricted exposure window caused a significant leakage of ^{14}C-mannitol, inulin, and also dextran (same molecular weight as albumin) from the capillaries into the surrounding cerebellar brain tissue. These findings, however, were not repeated in a study using ^{14}C-sucrose (Gruenau et al. 1982). A recent *in vitro* study has shown that EMF at 1.8 GHz increase the permeability of the blood–brain barrier to sucrose (Schirmacher et al. 2000). Shivers and colleagues (Shivers et al. 1987; Prato et al. 1990) examined the effect of magnetic resonance imaging upon the rat brain. They showed that the combined exposure to RF EMFs and pulsed and static magnetic fields gave rise to a significant pinocytotic transport of albumin from the capillaries into the brain.

Inspired by this work, since 1988 our group has studied the effects of different intensities and modulations of 915 MHz RF EMFs in a rat model where the exposure takes place in a transverse electromagnetic transmission line chamber (TEM-cell) during various time periods. In series of more than 1,600 animals, we have proven that subthermal power densities from both pulse-modulated and continuous RF EMFs—including those from GSM (Global System for Mobile Communications) mobile phones—have the potency to significantly open the blood–brain barrier such that the animals' own albumin (but not fibrinogen) passes out of the bloodstream into the brain tissue and accumulates in the neurons and glial cells surrounding the capillaries (Malmgren 1998; Persson et al. 1997; Persson and Salford 1996; Salford et al. 1992,1993, 1994, 1997b, 2001) (Figure 1). These results have been duplicated recently in another laboratory (Töre et al. 2001). Similar results have been reported by others (Fritze et al. 1997).

We and others (Oscar and Hawkins 1977; Persson et al. 1997) have pointed out that when such a relatively large molecule as albumin can part the blood–brain barrier, so too can many other smaller molecules, including toxic ones, which may escape into the brain because of exposure to RF EMFs. We have hitherto not concluded that such leakage is harmful for the brain. However, Hassel et al. (1794) have shown that autologous albumin injected into the brain tissue of rats leads to damage to neurons at the injection site when the concentration of albumin in the injected solution is at least 25% of that in blood. In the present study, we investigated whether leakage across the blood–brain barrier might cause damage to the neurons.

Materials and Methods

TEM-cells used for the RF EMF exposure of rats were designed by dimensional scaling from previously constructed cells at the National Bureau of Standards (Crawford 1974). TEM-cells are known to generate uniform electromagnetic fields for standard measurements. A genuine GSM mobile phone with a programmable power output was connected via a coaxial cable to the TEM-cell; no voice modulation was applied.

The TEM-cell is enclosed in a wooden box (15 × 15 × 15 cm) that supports the outer conductor and central plate. The outer conductor is made of brass net and is attached to the inner walls of the box. The center plate, or septum, is constructed of aluminum.

The TEM-cells were placed in a temperature-controlled room, and the temperature in the TEM-cells was kept constant by circulating room air through holes in the wooden box.

The specific absorption rate (SAR) distribution in the rat brain has been simulated with the finite-difference time-domain method (Martens et al. 1993) and found to vary < 6 dB in the rat brain.

The rats were placed in plastic trays (12 × 12 × 7 cm) to avoid contact with the central plate and outer conductor. The bottom of the tray was covered with absorbing paper to collect urine and feces.

Thirty-two male and female Fischer 344 rats 12–26 weeks of age and weighing 282 ± 91 g were divided into four groups of eight rats each. The peak output power of 10 mW, 100 mW, and 1,000 mW per cell from the GSM mobile telephone was fed into two TEM-cells simultaneously for 2 hr. This exposed the rats to peak power densities of 0.24, 2.4, and 24 W/m^2, respectively. This exposure resulted in average whole-body SARs of 2 mW/kg, 20 mW/kg, and 200 mW/kg, respectively. For further details about exposure conditions and SAR calculations, see Martens et al. (1993) and Malmgren (1998). The fourth group of rats was simultaneously

Address correspondence to L.G. Salford, Dept. of Neurosurgery, Lund University Hospital, S-221 85 Lund, Sweden. Telephone: 46-46-171270. Fax: 46-46-188150. E-mail: Leif.Salford@neurokir.lu.se

We thank S. Strömblad and C. Blennow at the Rausing Laboratory for excellent technical assistance.

The work was supported by a grant from the Swedish Council for Work Life Research.

The authors declare they have no conflict of interest.

Received 4 October 2002; accepted 28 January 2003.

EXHIBIT M

krpr far 2 hr in nonactivated TEM-cells. The animals were awake during the exposure and could move and turn within the exposure chamber.

Thr animals in each exposure group were allowed to survive for about 50 days after exposure. They were carefully observed daily for neurologic and behavioral abnormalities during this period. at the end of which they were anesthetized and sacrificed by perfusion fixation wirh 4% formaldehyde.

The brains were removed from the skull by nontraumatic technique (resection of bone structures at the skull base, followed by a midline incision horn the foramen magnum to rhc nose) after an extended in *situ* post-mortem fixation time of 30 min. Each brain was sectioned coronally in 1–2-mm-thick slices, which all were rmbrddcd in paraffin, cut in 5-µm sections, and stained for RNA/DNA with cresyl violet to show dark neurons. Applying albumin antibodies (Dakocytomation Norden AB, Älvsjö, Sweden) reveals albumin as brownish spotty or more diffuse discolorations (Salford et al. 1994).

The occurrence of "dark neurons" was judged semiquantitatively by the neuropathologist as 0 (no or occasional dark neurons), I (moderate occurrence of dark neurons), or 2 (abundant occurrence). Thr microscopic analysis was performed blind to the test situation. The Kruskal-Wallis one-way analysis of variance by ranks was used for a simultaneous *statistical test* of rhc *score distributions for the* four exposure conditions. When the null hypothesis could be rejected, comparisons between controls and each of the exposure conditions was made with the Mann-Whitney nonparametric test for independent samples.

Results and Discussion

Controls and test animals alike showed rhe normal diffuse positive immunostaining for albumin in hypothalamus, a kind of built-in method control.

Control animals showed either no positivity or an occasional and often questionable positivity for *albumin outside* rhe *hypothalamus* (Figure IA). In one control animal we observed a moderate number of dark neurons, bur no such change was observed in all rhc other controls.

Exposed animals usually showed several albumin-positive fori around the finer blood *vessels in white and gray matter* (*Figure* 1B). Here the albumin had spread in the tissue between the cell bodies and surrounded neurons, which either contained no albumin or contained albumin in some fori. Scarrered neurons, not associated with albumin leakage between the neurons, were also positive.

Thr cresyl violet staining revealed scattered and grouped dark neurons, which were often shrunken and darkly rtaincd, homogenized with loss of discernible internal cell structures. Somr of these dark neurons were also albumin positive or showed cytoplasmic microvacuoles indicating an active pathologic process. There were no hemorrhages and no discernible glial reaction, astrocytic or microglial, adjacent to changed neurons. Changed neurons were seen in all locations, but especially the cortex, hippocampus, and basal ganglia, mixed in among normal neurons (Figure 2). The percentage abnormal neurons is roughly appreciated to be maximally around 2%. but in some restricted m a they dominated rhe picture.

The occurrence of dark neurons under the different exposure conditions is presented in Figure 3, which show a significant positive relation between EMF dosage (SAR) and number of dirk neurons.

A combincd nonparametric test for rhe four exposure situations simultaneously revealed rhar the distributions of scores differed significantly between rhe groups ($p < 0.002$).

We present here for the first time evidence for neuronal damage caused by nonthermal microwave exposure. The cortex as well as the hippocampus and the basal ganglia in the brains of exposed rats contained damaged neurons. We realize that our study comprises few animals, but the combined results are highly significant and exhibit a clear dose–response relation.

We considered the observed dark neurons not to be artifacts for the following reasons: first, the brains were removed atraumatically and perfusion fixed *in situ*; second, the dark

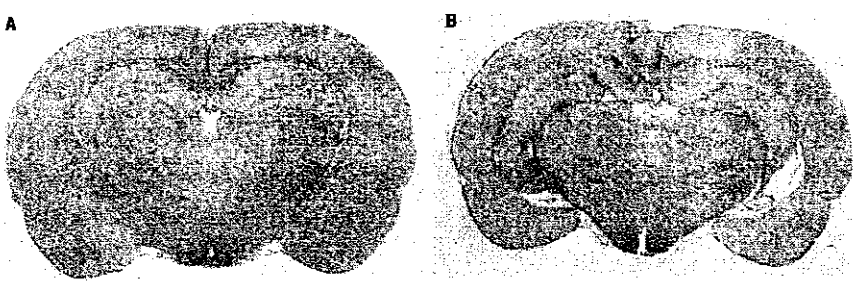


Figure 1. Cross-section of central parts of the brain of (*A*) an unexposed control rat and (*B*) an RF EMF-exposed rat, both stained for albumin, which appears brown. In (*A*), albumin is visible in the central inferior parts of the brain (the hypothalamus), which is a normal feature. In (*B*), albumin is visible in multiple small foci representing leakage from many vessels. Magnification, about ×3.

Figure 2. Photomicrograph 01 sections of brain from an RF EMF-exposed rat stained with cresyl violet. (*A*) Row of nerve cells in a section of the pyramidal cell band of the hippocampus; among the normal nerve cells (large cells) are interspersed *black and shrunken nerve* cells. so-called dark *neurons*. (*B*) The cortex, top left, of an RF EMF-exposed rat showing normal nerve cells (pale blue) intermingled with abnormal. black and shrunken 'dark neurons" at all depths of the cortex, but least in the superficial upper layers. Magnification, ×160.

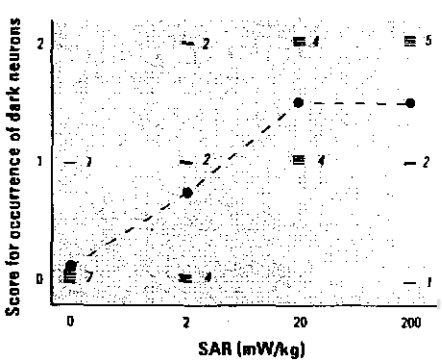


Figure 3. Distribution of scores for the occurrence of "dark neurons" as a function of exposure condition. The dashed line connects mean values for each condition. Numbers in the figure indicate the number of animals in the treatment group with thal score. A simultaneous nonparametric comparison 01 all lour conditions revealed significant differences ($p < 0.002$). As compared to control. $p < 0.2$ lor 2 mW/kg; $p = 0.01$ lor 20 mW/kg; and $p = 0.03$ for 200 mW/kg.

EXHIBIT M

neurons were intermingled with normal-appearing neurons (see Figure 2). Also, the presence of vacuoles in several of the dark neurons is a clear sign that damage occurred in the living animal. We cannot exclude that the neuronal change described may represent apoptotic cell death.

The neuronal albumin uptake and other changes described would seem to indicate serious neuronal damage, which may be mediated through organelle damage with release of not only hydrolytic lysosomal enzymes but also, for example, sequestered harmful material, such as heavy metals, stored away in cytoplasmic organelles (lysosomes).

The time between last exposure and sacrifice is of great importance for the detection of foci of leakage because extravasated albumin rapidly diffuses down to, and beyond, concentrations possible to demonstrate accurately immunohistologically. However, the initial albumin leakage into the brain tissue (seen within hours in ~40% of exposed animals in our previous studies) may start a secondary blood–brain barrier opening, leading to a vicious circle—because we demonstrate albumin leakage even 8 weeks after the exposure.

We chose 12–26-week-old rats because they are comparable with human teenagers—notably frequent users of mobile phones—with respect to age. The situation of the growing brain might deserve special concern from society because biologic and maturational processes are particularly vulnerable during the growth process. The intense use of mobile phones by youngsters is a serious consideration. A neuronal damage of the kind described here may not have immediately demonstrable consequences, even if repeated. In the long run, however, it may result in reduced brain reserve capacity that might be unveiled by other later neuronal disease or even the wear and tear of aging. We cannot exclude that after some decades of (often) daily use, a whole generation of users may suffer negative effects, perhaps as early as in middle age.

Correction

Figure 1 in the original manuscript was cited in "Materials and Methods" and illustrated albumin leakage that we had reported earlier. The figure showed examples of cross-sections of the brains of rats sacrificed immediately after exposure to microwaves. Because this could be misunderstood, in the interest of clarity and with the permission of rhc editor, we have replaced that figure.

The new Figure 1 is now cited in "Results" and shows animals from the present study. Figure 1A illustrates the brain of a sham-exposed control animal, and Figure 1B illustrates an animal exposed to 2 mW/kg for 2 hr.

References

Adey W, Byus C, Cain C, Higgins R, Jones R, Kean C, et al. 1999. Spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fisher 344 rats exposed to 836 MHz modulated microwaves. Radiat Res 152:293–302.

Crawford M. 1974. Generation of standard EM field using TEM transmission cells. IEEE Trans Electromagn Compat EMC 16:189–195.

Fritze K, Sommer C, Schmitz B, Mies G, Hossmen K, Kiessling M, et al. 1997. Effect of global system for mobile communication (GSM) microwave exposure on blood-brain barrier permeability in rat. Acta Neuropathol (Berl) 94:465–470.

Gruenau SP, Oscar KJ, Folker MT, Rapoport SI. 1982. Absence of microwave effect on blood-brain-barrier permeability to [C-14]-labeled sucrose in the conscious rat. Exp Neurol 75:299–307.

Hardell L, Hallquist A, Hansson Mild K, Carlberg M, Påhlson A, et al. 2002. Cellular and cordless telephones and the risk for brain tumours. Eur J Cancer Prev 11:377–386.

Hassel B, Iversen E, Fonnum F. 1994. Neurotoxicity of albumin in-vivo. Neurosci Lett 167:29–32.

Hyland G. 2000. Physics and biology of mobile telephony. Lancet 356:1833–1836.

Malmgren L. 1998. Radio Frequency Systems for NMR Imaging: Coil Development and Studies of Non-Thermal Biological Effects [PhD thesis]. Lund, Sweden:Department of Applied Electronics, Lund University.

Martens L, Van Hese J, De Sutter D, De Wagter C, Malmgren L, Persson BRR, et al. 1993. Electromagnetic field calculations used for exposure experiments on small animals in TEM-cells. Bioelectrochem Bioenerg 30:73–81.

Oscar K, Hawkins T. 1977. Microwave alteration of the blood-brain barrier system of rats. Brain Res 126:281–293.

Persson B, Salford L. 1996. Permeability of the blood-brain barrier in rats induced by continuous wave and pulse-modulated 915 MHz electromagnetic radiation exposure i[illegible] Kuopio Finland, 3–4 September 1995 (Chiabrera A, Juutilainen J, eds). EUDG XIII. Brussels:COST 244, 66–72.

Persson E, Salford L, Brun A. 1997. Blood-brain barrier permeability in rats exposed to electromagnetic fields used i wireless communication. Wireless Networks 3:455–461.

Prato F, Frappier J, Shivers R, Kavaliers M, Zabel P, Drost D, e al. 1990. Magnetic resonance imaging increases the blood brain barrier permeability to 153-gadolinium diethylene triaminepenteacetic acid in rats. Brain Res 523:301–304.

Repacholi M, Basten A, Gebski V, Noonan D, Finnie J, Harris A 1997. Lymphomas in Eμ-*Pim1* transgenic mice exposed t pulsed 900 MHz electromagnetic fields. Radiat Re 147:631–640.

Salford LG, Brun A, Eberhardt J, Malmgren L, Persson B. 1993 Electromagnetic field-induced permeability of the blood brain barrier shown by immunohistochemical methods. In Interaction Mechanism of Low-Level Electromagneti Fields in Living Systems (Nordén B, Ramel C, eds). Oxford *UK:Oxford University Press*, 251–258.

Salford LG, Brun A, Eberhardt J, Persson B. 1993. Permeabilit of the blood-brain barrier induced by 915 MHz electromag netic radiation, continuous wave and modulated at 8, 1 50, 200 Hz. Bioelectrochem Bioenerg 30:293–301.

Salford LG, Brun A, Persson B. 1997a. Brain tumour develop ment in rats exposed to electromagnetic fields used i wireless communication. Wireless Networks 3:463–469.

Salford LG, Brun A, Sturesson K, Eberhardt J, Persson B. 199 Permeability of the blood-brain barrier induced by 915 MH electromagnetic radiation, continuous wave and modulate at 8, 16, 50, and 200 Hz. Microsc Res Techn 27:535–542.

Salford LG, Persson B, Brun A. 1997b. Neurological aspects o wireless communication. In: Non-Thermal Effects of R Electromagnetic Fields (Bernhardt JH, Matthes R, Repacho MH, eds). Munich, Germany:International Commission o Non-Ionizing Radiation Protection, 131–143.

Salford LG, Persson B, Malmgren L, Brun A. 2001. Téléphoni mobile et barrière sang-cerveau. In: Téléphonie Mobile— Effets Potentiels sur la Santé des Ondes Électromagné tiques de Haute Fréquence (Pietteur Marco, ed). Embourg Belgium:Collection Resurgence, 141–152.

Schirmacher A, Winters S, Fischer S, Goeke J, Galla HJ Kullnick U, et al. 2000. Electromagnetic fields (1.8 GHz increase the permeability to sucrose of the blood-brai barrier in vitro. Bioelectromagnetics 21:338–345.

Shivers R, Kavaliers M, Teskey G, Prato F, Pelletier R. 1987 Magnetic resonance imaging temporarily alters blood brain barrier in the rat. *Neurosci Lett* 76:25–31.

Töre F, Dulou P-E, Haro E, Veyret B, Aubineau P. 2001. Two-hou exposure to 2 W/kg, 900 MHz GSM microwaves induce plasma protein extravasation in rat brain. In: Proceeding from the 5th International Congress of the Europea Bioelectromagnetics Association, 6 September 2001 *Helsinki*, Finland (Hietanen M, Jokela K, Juutilainen, J, eds Helsinki:Finnish Institute of Occupational Health, 43–45.

EXHIBIT M

EFFECT OF GSM MOBILE PHONE RADIATION ON BLOOD-BRAIN BARRIER

Dariusz Leszczynski

Bio-NIR Research Croup, *Radiobiology Laboratory, STUK-Radiation and Nuclear Safety Authority, Helsinki, Finland; dariusz.leszczynski@stuk.fi*

ABSTRACT

Some animal studies have suggested that mobile phone radiation may cause increase in blood-brain barrier permeability We have hypothesized (Leszczynski et al. Differentiation, 70, 2002, in press) that the mobile phone radiation-induced increased expression and phosphorylation (activity) of stress protein hsp27 might be the molecular mechanism regulating blood-brain barrier permeability and, possibly, cell apoplosis. Here we present evidence suggesting that mobile phone radialion indeed affects *hsp27-dependent* cytoplasmic distribution of F-actin and stability of stress fibers. This observation supports our hypothesis that mobile phone radiation-induced changes in hsp27 expression/activity might eventually lead to increase in the permeability of blood-brain barrier.

BACKGROUND

The question whether microwave radiation, that is emitted by mobile phones (radio-frequency modulated electromagnetic fields: RF-EMF), might exert any detrimental health effects remains unanswered. Several recently conducted reviews of the to-date published research have concluded rhar there is significant and credible scientific evidence to the fact that RF-EMF induces biological effects [1,2,3,4]. However, it still remains to be determined whether these biological responses could cause health hazard.

The possibility of the induction of cellular stress response by the non-thermal levels of mobile phone radiation has been shown just recently. In vivo, Daniells et al. [5] and de Pomerai et al. [6] have shown that overnight irradiation of nematode worms with RF-EMF (750MHz) at SAR of 0.001Wlkg causes increase in expression of heat shock protein. Fritze et al. [7], using rat model, have shown increase in expression of stress protein hsp70 in brains of animals exposed for 4 hours to RF-EMF (890-915MHz) at SAR of 1.5W/kg. In vitro, Kwee et al. [8] have shown induction of stress protein hsp70, but not hsp27, in transformed human epithelial amnion cells exposed for 20 min. to RF-EMF (960MHz) at SAR of 0.0021Wlkg. Thus, because of the known broad spectrum of physiological processes that are regulated by stress proteins [9], it is possible to suggest that mobile phone radiation-induced aclivation of cellular stress response might affect variety of physiological processes, among them brain tumor development and blood-brain barrier permeability. Having this in mind, French et al. [10] have put forward hypothesis suggesting that repeated exposures of cells to mobile phone radialion over a long period of time might affect tumor development due to the hypothesized chronic up-regulation of the expression levels of cellular stress proteins. However, occurrence of such chronic stimulatory effect on the expression of stress proteins induced by mobile phone radiation, as suggested by French et al. [10], still remains to be experimentally demonstrated.

PREVIOUS STUDY

In our earlier study [11] we have demonstrated that the I-hour non-thermal exposure of human endothelial cell line EA.hy926 to SAR of 2W/kg (900MHz GSM signal) leads, among others, to: (i) changes in phosphorylation status of a large number of proteins, (ii) among them, transient increase in phosphorylation of hsp27 stress response protein, which was prevented by SB203580, a specific inhibitor of p38 mitogen-activated protein kinase (p38MAPK), (iii) transient changes in protein expression levels of hsp27 and p38MAPK.

Over-expression and phosphorylation of hsp27 has been shown to regulate polymerization of F-actin and formation and stability oi stress fibers. This, when occurring in endothelial cells lining brain's capillary blood vessels, might be of importance for the functioning of blood-brain barrier. Stabilization of stress fibers and cytoplasmic distribution of F-actin was shown to cause: (i) cell shrinkage, that might lead to opening of spaces between cells, (ii) increase in the permeability and pinocytosis of endothelial monolayer, (iii) increase in formation of the so called "apoptosis-unrelated" blebs on the surface of endothelial cells, which eventually might obstruct blood flow through capillary blood vessels, (iv) stronger responsiveness of endothelial cells to estrogen and, when stimulated by this hormone, to secrete larger than normally amounts of basic fibroblast growth factor (bFGF) which might, in endocrine manner, stimulate de-

differentiation and proliferation of endothelial cells and possibly led to the associated with cell's proliferative state - **cell** *shrinkage* and unveiling of basal membrane.

The possibility ofthe effect of RF-EMF exposure **on** blood-brain barrier permeability has been suggested earlier by in vivo [12] and in vitro [13] studies. However, there are also reports where authors claim that the non-thermal **levels** of RF-EMF radiation do not affect blood-brain barrier permeability [14,15]. The no-effect, which is claimed by Fritze et al. [14], is not so straight forward. The authors have observed stress response and increased permeability of the blood-brain barrier immediately after the **end** of irradiation. This effect was, however short lasing.. Therefore, it remains unclear what would be the blood-brain barrier response to the repeated exposures lo mobile phone radiation because the effect of repeated exposures was not examined. The increased blood-brain barrier permeability due lo increase of pinocytosis was suggested by Neubauer et **al.** [16] who have demonstrated increase in pinocytosis of cerebral conex capillaries that were exposed to 2.45 GHz microwave radiation. Finally, the recently reponed study by Töre et al. [17] has shown that 2 hour exposure of rats to RF-EMF (900MHz) at SAR of 2W/kg (averaged over the brain) causes increase in the permeability of blood-brain barrier. The molecular mechanism **and** the cellular signaling pathways involved in the induction of blood-brain barrier permeability are still unknown.

Activated (phosphorylated) hsp27 has been shown to inhibit apoptosis by forming complex with the apoptosome (complex of Apaf-1 protein, pro-caspase-9 and cytochrome *c*), or some of its components, and preventing proteolytic activation of pro-caspase-9 into active form of caspase.9 [18,19]. This, in turn, prevents activation of pro-caspase-3 which is activated by caspase-9. Thus, induction of the increased expression and phosphorylation of hsp27 by the RF-EMF exposure might lead to inhibition of the apoptotic pathway that involves apoplosome and caspase-3. This event, when occurring in RF-EMF exposed brain cells that underwent either spontaneous **or** external factor-induced transformation/damage, could support survival **of** the transformed/damaged cells.

HYPOTHESIS

Based on the known cellular role of over-expressed/phosphorylated hsp27 we have proposed a hypothesis [11] that: the activation (phosphorylation) of hsp27 by mobilc phone radiation might be the molecular mechanism (i) regulating increase in blood-brain barrier permeability, which would explain, observed in some animal experiments, increase in blood-brain barrier permeability, and (ii) regulating apoptosis through interference with the cytochrome c/caspase-9/caspase-3 parhway (Figure I).

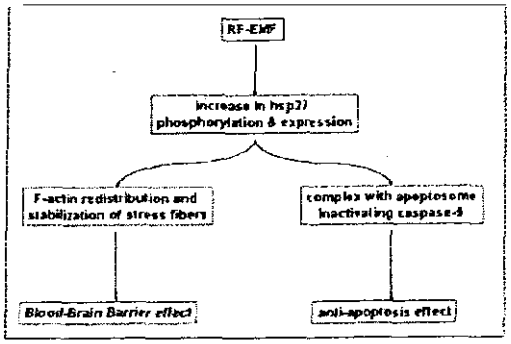


Fig. 1. Hypothetical flow of events that might occur in cells in response to mobile phone radiation.

OBJECTIVE

The present study was undertaken lo determine whether physiological responses of endothelial cells, which are associated with the hsp27 expression and phosphorylation and might affect permeability of blood-brain barrier (stability of stress fibers, cell size/shape), occur in the mobile phone radiation exposed cultures of human endothelial cell line EA.hy926.

MATERIAL AND METHODS

Human endothelial cell line EA.hy926 cells, grown on microscope cover slides, were exposed for 1h to 900MHz GSM signal at an average **SAR** of 2W/kg (range 1.8 – 2.5 **Wlkg). Temperature** of cell cultures remained throughout

irradiation period at 37±0.3°C thus the effects reponed here are of non-thermal nature. Cells on cover slides were fixed either immediately or 1h aher the end of irradiation. The expression of hsp27 was determined by indirect immunohistochemistry in order to confirm that the cells respond to irradiation in the same way as in the previous study [11]. The appearance of cells (size, shape) and cytoplasmic panern of F-actin distribution (stabilization of stress fibers) was determined by staining of the cells with fluorescent-dye (AlexaFluor) labeled phalloidin.

RESULTS AND DISCUSSION

As expected, 1h exposure of cells to mobile phone radiation increased expression of hsp27. However, in order to increase hsp27 expression by heat shock was required 3h incubation of cells at 43°C (1h exposure had no effect). This observation, together with the measurements showing that temperature of medium was throughout RF-EMF exposure period at 37±0.3°C, suggest that the observed here effects are of non-thermal nature.

The stability of stress fibers, as determined by the panern of staining with phalloidin-AlexaFluor, increased aher 1h inadiation and did not decline during the 1h of post-irradiation incubation. Induction of the stability of stress fibers caused cells to shrink. In cells expressing high levels of hsp27, the cell edges were brightly stained with phalloidin-AlexaFluor, what indicates re-localization of F-actin to cell ruffles. These cells rounded-up and cells contacted in-between only through thin pseudopods. In cells expressing lower levels of hsp27, network of stress fibers was seen throughout the cytoplasm but not in the ruffles.

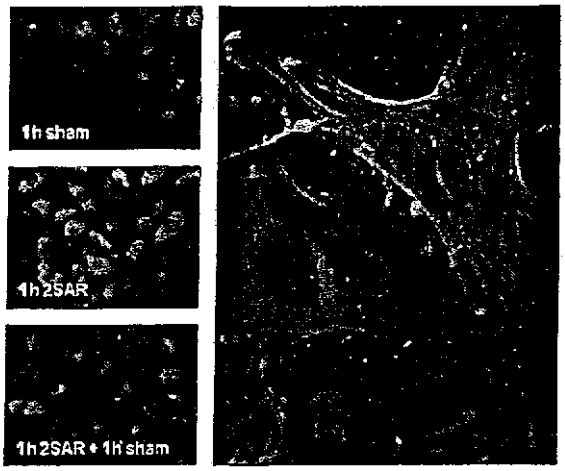


Fig. 2. Expression panern of F-actin in EA.hy926 cells detected using phalloidin-AlexaFluor staining (green fluorescence) and hsp27 using indirect immunofluorescence (red color). Left panel: cells exposed for 1h to sham, cells exposed for 1h at 2W/kg (2SAR), and cells exposed for 1h at 2W/kg followed by 1h exposure to sham. Right panel: cell expressing high level of hsp27 has F-actin in cell ruffles whereas cell expressing low level of hsp27 has F-actin in form of stress fibers distributed throughout cytoplasm (notice difference in stress fiber density over the nuclear region in both cells).

The observed here, hsp27-related changes in cytoplasmic distribution of F-actin are apparently outcome of two phenomena: hsp27 over-expression and hsp27 phosphorylation. These observed changes suppon the hypothesis that the hsp27/p38MAPK stress signaling pathway might be the molecular mechanism regulating mobile phone radiation-induced permeability of blood-brain barrier.

CONCLUSIONS

The proposed above intra-cellular mechanism for the mobile phone radiation-increased permeability of the blood-brain barrier is a hypothesis but as such it is reasonably supported by the evidence concerning both effects of microwaves on stress response and effects of hsp27 (increased expression and activity) on cell physiology. Furthermore, it appears that the physiological changes caused by hsp27 phosphorylation indeed take place in endothelial cells (stress fibers' expression, cell size/shape changes). These events, when occurring repeatedly (on daily basis) over the long period of time *(years)* might become health hazard because ofthe possible accumulation of brain tissue damage.

ACKNOWLEDGEMENTS

Funding for the project war provided by EU 5th Framework Programme (REFLEX project) and Finnish Technology Center - TEKES (LaVita project). Hanna Tammio of Bio-NIR Research Group is thanked for exceptionally skilful execution of the experiments. Present and former members of the Bio-NIR Research Group, Sakari Joenväärä, Jukka Reivinen, Reetta Kuokka, and Pia Konnuri are thanked for help in execution of experiments and for stimulating discussions.

REFERENCES

[1] Jokela K, Leszczynski D, Paile W, Salomaa S, Puranen L, Hyysalo P. (1999). Radiation safety of handheld mobile phones and base Stations. STUK-A161 Repon, OY Edita Ab Helsinki, Finland

[2] The Royal Society of Canada Repert. (1999) A review of the potential health risks of radiofrequency fields from wireless telecommunications devices. The Royal Society of Canada, 225 Metcalfe #308, Ontario, Canada, (http://www.rsc.ca)

[3] Stewart Repon (2000). Mobile Phones and Health. Repon of Independent Expert Group on Mobile Phones. National Radiation Protection Board NRPB, London; UK (http://www.iegmp.org.uk)

[4] Zmirou Repon to the French Health General Directorate. (2001), (http://www.sante.gouv.fr/htm/dossiers/telephon_mobil/index.htm)

[5] Daniells C, Duce I, Thomas D, Sewell P, Tattersall J, dePomerai D. (1998). Transgenic nematodes as biomonitors of microwave-induced stress. Mutat. Res. 399, 55-64

[6] de Pomerai D, Daniells C, David H, Allan J, Duce I, Mutwakil M, Thomas D. Sewell P, Tattersall I, Jones D. Candido P. (2000). Nan-thermal heat shock response to microwaves. Nature 405: 417-418

[7] Fritze K, Wiessner C, Kuster N, Sommer C, Gass P, Hermann DM, Kiessling M, Hossmann KA. (1997). Effect of global system for mobile Communication microwave exposure on the genomic response of the rat brain. Neuroscience 81: 627-639

[8] Kwec S, Raskmark P, Velizarov S. (2001) Changes in cellular proleins due to environmental non-ionizing radiation. I. Heat shock proleins. Electro- Magnetobiology 20: 1061-1072

[9] Tibbles LA, Woodgen JR. (1999). The stress-activated protein kinase pathways. Cell. Mol. Life Sci. 55, 1230-1254

[10] French PW, Penny R, Laurence JA, McKenzie DR. (2001). Mobile phones, heat shock proteins and cancer. Differentiation 67: 93-97

[11] Leszczynski D, Joenväärä S, Reivinen J, Kuokka R. (2002), Non-thermal activation of hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. Differentiation, 70, in press

[12] Salford LG, Brun A, Sturesson K, Eberhard JL, Persson BR. (1994). Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50, and 200 Hz. Microsc. Res. Tech, 15:535-542

[13] Schinmacher A, Winters S, Fisher S, Goeke J, Galla HJ, Kullnick U, Ringelstein EB, Stogbauer F. (2000). Electromagnetic fields (1.8 GHz) increase the permeability to sucrose of the blood-brain barrier in vitro. Bioelectromagnetics 21: 338-345

[14] Fritze K, Sommer C, Schmitz B, Mies G, Hossman KA, Kiessling M, Wiessner C. (1997a) Effect of global system for mobile communication (GSM) microwave exposure on blood-brain barrier permeability in rat. Acta Neuropathol. 94, 465-470

[15] Tsurita G, Nagawa H, Ueno S, Watanabe S, Taki M. (2000) Biological and morphological effects on the brain after exposure of rats to a 1439MHz TDMA field. Bioelectromagnetics 21, 364-371

[16] Neubauer C, Phelan AM, Kues H, Lange DG. (1990). Microwave irradiation of rats at 2.45 GHz activates pinocytotic-like uptake of tracer by capillary endothelial cells of cerebral conex. Bioelectromagnetics 11: 261-268

[17] Töre F, Dulou PE, Haro E, Veyrel B, Aubineau P. (2001). Two-hour exposure to 2-W/kg, 900-MHZ GSM microwaves induces plasma protein extravasation in rar brain and dura maner. Proceedings of the 5th International congress of the EBEA, pp43-45

[18] Pandey P, Farber R, Nakazawa A, Kumar S, Bharti A, Nalin C, Weichselbau R, Kufe D, Kharabanda S. (2000). Hsp27 functions as a negative regulator of cytochrome c-dependent activation of procarpare-3. Oncogene 19: 1975-1981

[19] Concannon CG, Orrenius S, Samali A. (2001). Hsp27 inhibits cytochrome c-mediated caspase activation by sequestering both pro-caspase-3 and cytochrome c. Gene Expression 9, 195-201

EXHIBIT M

Effect of GSMobile Phone Radiation on Blood Brain Barrier

*(Bio-NIR **Research Group - Helsinki, Finland)***

EXHIBIT M

EXHIBIT M

EFFECT OF GSM MOBILE PHONE RADIATION ON BLOOD-BRAIN BARRIER

Dariusz Leszczynski

Bio-NIR Research Group, Radiobiology Laboratory, STUK-Radiation and Nuclear Safety Authority, Helsinki, Finland; dariusz.leszczynski@stuk.fi

ABSTRACT

Some animal studies have suggested that mobile phone radiation may cause increase in blood-brain banier permeability. We have hypothesized (Leszczynski et al. Differentiation, 70, 2002, in press) that the mobile phone radiation-induced increased expression and phosphorylation (activity) of stress protein hsp27 might be the molecular mechanism regulating blood-brain barrier permeability and, possibly, cell apoptosis. Here we present evidence suggesting lhat mobile phone radiation indeed affects hsp27-dependent cytoplasmic distribution of F-actin and stability of stress fibers. This observation supports our hypothesis that mobile phone radiation-induced changes in hsp27 expression/activity might eventually lead to increase in the permeability of blood-brain banier.

BACKGROUND

The question whether microwave radiation, that is emitted by mobile phones (radio-frequency modulated fields: RF-EMF), might exert any detrimental health effects remains unanswered. Several recently conducted reviews of the to-date published research have concluded that there is significanr and credible scientific evidence to the fact that RF-EMF induces biological effects [1,2,3,4]. However, it still remains to be determined whether these biological responses could cause health hazard.

The possibility of the induction of cellular stress response by the non-thermal levels of mobile phone radiation has been shown just recently. In vivo, Daniells et al. [5] and de Pomerai et al. [6] have shown that overnight irradiation of nematode *worms* with RF-EMF (750MHz) at SAR of 0.001W/kg causes increase in expression of heat shock protein. Fritze et al. [7], using rat model, have shown increase in expression of stress protein hsp70 in brains of animals exposed for 4 hours to RF-EMF (890-915MHz) at *SAR* of 1.5W/kg. In vitro, Kwee et al. [8] have shown induction of stress protein hsp70, but not hsp27, in transformed human epithelial amnion cells exposed for 20 min. to RF-EMF (960MHz) at SAR of 0.0021W/kg. Thus, because of the known broad spectrum of physiological processes that are regulated by stress proteins [9], it is possible to suggest that mobile phone radiation-induced activation of cellular stress response might affect variety of physiological processes, among them brain tumor development and blood-brain barricr permeability. Having this in mind, French et al. [10] have put forward hypothesis suggesting that repeated exposures of cells to mobile phone radiation over a long period of time might affect tumor development due to the hypothesized chronic up-regulation of the expression levels of cellular stress proteins. However, occurrence of such chronic stimulatory effect on the expression of stress proteins induced by mobile phone radiation, as suggested by French et al. [10], still remains to be experimentally demonstrated.

PREVIOUS STUDY

In our earlier study [11] we have demonstrated that the 1-hour non-thermal exposure of human endothelial cell line EA.hy926 to SAR of 2W/kg (900MHz GSM signal) leads, among others, to: (i) changes in phosphorylation status of a large number of proteins, (ii) among them, transient increase in phosphorylation of hsp27 stress response protein, which was prevented by SB203580, a specific inhibitor of p38 mitogen-activated protein kinase (p38MAPK), (iii) transient changes in protein expression levels of hsp27 and p38MAPK.

Over-expression and phosphorylation of hsp27 has been shown to regulate polymerization of F-actin and formation and stability of stress fibers. This, when occurring in endothelial cells lining brain's capillary blood vessels, might be of importance for the functioning of blood-brain barrier. Stabilization of stress fibers and cytoplasmic distribution of F-actin was shown to cause: (i) cell shrinkage, that might lead to opening of spaces between cells, (ii) increase in the permeability and pinocytosis of endothelial monolayer, (iii) increase in formation of the so called "apoptosis-unrelated" blebs on the surface of endothelial cells, which eventually might obstruct blood flow through capillary blood vessels, (iv) stronger responsiveness of endothelial cells to estrogen and, when stimulated by this hormone, to secrete larger than normally amounts of basic fibroblast growth factor (bFGF) which might, in endocrine manner, stimulate de-

differentiation and proliferation of endothelial cells and possibly led to the associated with cell's proliferative stale · cell shrinkage and unveiling of basal membrane.

The possibility of the effect of **RF-EMF** exposure on blood-brain barrier permeability has been suggested earlier by in vivo [12] and in vitro [13] studies. However, there are also reports where authors claim that the non-thermal levels of RF-EMF radiation do not affect blood-brain barrier permeability [14,15]. The no-effect, which is claimed by Fritze et al. [14], is not so straight forward. The authors have observed stress response and increased permeability of the blood-brain barrier immediately after the end of irradiation. This effect was, however short lasting. Therefore, it remains unclear what would be the blood-brain barrier response to the repealed exposures lo mobile phone radiation because the effect of repeated exposures was not examined. The increased blood-brain banier permeability due to increase of pinocytosis was suggested by Neubauer et al. [16] who have dcmonstrated increase in pinocytosis of cerebral conex capillaries that were exposed to 2.45 GHz microwave radiation. Finally, the recently reponed study by Töre et al. [17] has shown that 2 hour exposure of rats Io RF-EMF (900MHz) at SAR of 2W/kg (averaged over the brain) causes increase in the permeability *of* blood-brain barrier. The molecular mechanism and the cellular signaling pathways involved in the induction of blood-brain barrier permeability are still unknown.

Activated (phosphorylated) hsp27 has been shown to inhibit apoplosis by forming complex with the apoptosome (complex of Apaf-1 protein, pro-caspase-9 and cytochrome *c*), or some of its components, and preventing proteolytic activation of pro-caspase-9 into active form of caspase-9 [18,19]. This; in turn, prevents activation of pro-caspase-3 which is activated by caspase-9. Thus, induction of the increased expression and phosphorylation of hsp27 by the RF-EMF exposure might lead to inhibition of the apoptotic pathway that involves apoplosome and caspase-3. This event, when occurring in W-EMF exposed brain cells that underwent either spontaneous or external factor-induced transformation/damage, could suppon survival of the transformed/damaged cells.

HYPOTHESIS

Based on the known cellular role of over-expressed/phosphorylated hsp27 we have proposed a hypothesis [11] that: the activation (phosphorylation) of hsp27 by mobile phone radiation might be the molecular mechanism (i) regulating increase in blood-brain barrier permeability, which would explain, observed in some animal experiments, increase in blood-brain barrier permeability, and (ii) regulating apoptosis through interference with the cytochrome *c*/caspase-9/caspase-3 *pathway* (**Figure** 1).

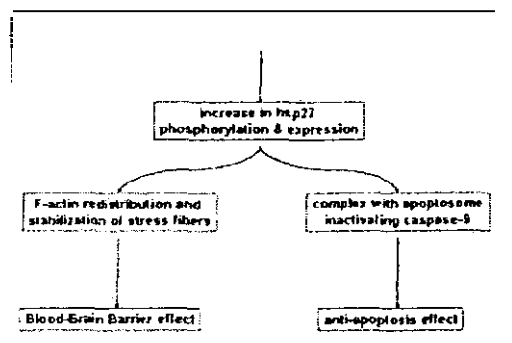


Fig. 1. Hypothetical flow of events that might occur in cells in response to mobile phone radiation,

OBJECTIVE

The present study was undertaken to determine whether physiological responses of endothelial cells, which are associated with the hsp27 expression and phosphorylation and might affect permeability *of* blood-brain barrier (stability of stress fibers, cell size/shape), occur in the mobile phonc radiation exposed cultures *of* human endothelial cell line EA.hy926.

MATERIAL AND METHODS

Human endothelial cell line EA.hy926 cells, grown on microscope cover slides, were exposed for 1h to 900MHz GSM signal at an average SAR of 2W/kg (range 1.8 – 2.5 W/kg). Temperature of cell cultures remained throughout

irradiation period at 37±0.3°C thus the effects reponed here are of non-thermal nature. Cells on cover slides were fixed either immediately or 1h aher the end of irradiation. The expression of hsp27 was determined by indirect immunohistochemistry in order to confirm that the cells respond to irradiation in the same way as in the previous study [11]. The appearance of cells (size, shape) and cytoplasmic pattern of F-actin distribution (stabilization of stress fibers) was determined by staining of the cells with fluorescent-dye (AlexaFluor) labeled phalloidin.

RESULTS AND DISCUSSION

As expected, 1h exposure of cells to mobile phone radiation increased expression of hsp27. However, in order to increase hsp27 expression by heat shock was required 3h incubation of cells at 43°C (1h exposure had no effect). This observation, together with the measurements showing that temperature of medium was throughout RF-EMF exposure period at 37±0.3°C, suggest that the observed here effects are of non-thermal nature.

The stability of stress fibers, as determined by the panern of staining with phalloidin-AlexaFluor, increased after 1h irradiation and did not decline during the 1h of post-irradiation incubation. Induction of the stability of stress fibers caused cells to shrink. In cells expressing high levels of hsp27, the cell edges were brightly stained with phalloidin. AlexaFluor. what indicates re-localization of F-actin to cell ruffles. These cells rounded-up and cells contacted in-between only through thin pseudopods. In cells expressing lower levels of hsp27, network of stress fibers was seen throughout the cytoplasm but not in the ruffles.

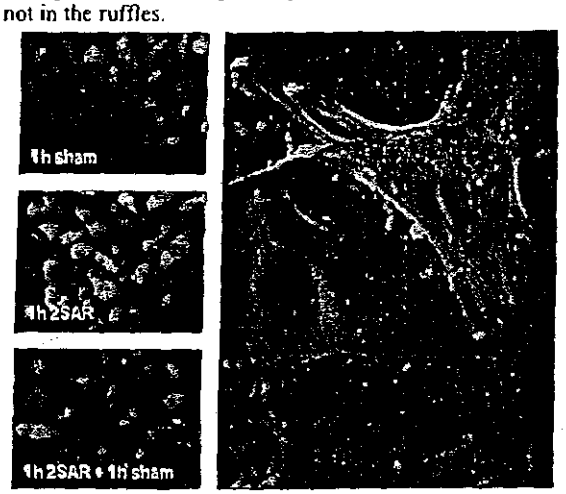


Fig. 2. Expression panern of F-actin in EA.hy926 cells detected using phalloidin-AlexaFluor staining (green fluorescence) and hsp27 using indirect immunofluorescence (red color). Left panel: cells exposed for 1h to sham, cells exposed for 1h at 2W/kg (2SAR), and cells exposed for 1h at 2W/kg followed by 1h exposure to sham. Right panel: cell expressing high level of hsp27 has F-actin in cell ruffles whereas cell expressing low level of hsp27 has F-actin in form of stress fibers distributed throughout cytoplasm (notice difference in stress fiber density over the nuclear region in both cells).

The observed here, hsp27-related changes in cytoplasmic distribution of F-actin are apparently outcome of two phenomena: hsp27 over-expression and hsp27 phosphorylation. These observed changes support the hypothesis that the hsp27/p38MAPK stress signaling pathway might be the molecular mechanism regulating mobile phone radiation-induced permeability of blood-brain barrier.

CONCLUSIONS

The proposed above intra-cellular mcchanism for the mobile phone radiation-increased permeability of the blood-brain barrier is a hypothesis but as such it is reasonably supported by the evidence concerning both effects of microwaves on stress response and effects of hsp27 (increased expression and activity) on cell physiology. Furthermore, it appears that the physiological changes caused by hsp27 phosphorylation indeed take place in endothelial cells (stress fibers' expression, cell size/shape changes). These events, when occurring repeatedly (on daily basis) over the long period of time (years) might become health hazard because ofthe possible accumulation of brain tissue damage.

EXHIBIT M

ACKNOWLEDGEMENTS

Funding for the project was provided by EU 5th Framework Programme (REFLEX project) and Finnish Technology Center - TEKES (LaVita project). Hanna Tammio of Bio-NIR Research Group is thanked for exceptionally skilful execution oi the experiments. Present and former members of the Bio-NIR Research Group, Sakari Joenväärä, Jukka Reivinen, Reena Kuokka, and Pia Konnuri are thanked for help in execution of experiments and for stimulating discussions.

REFERENCES

[1] Jokela K, Leszczynski D, Paile W, Salomaa S, Puranen L, Hyysalo P. (1999). Radiation safety of handheld mobile phones and base stations. STUK-A161 Repon, OY Edita Ab Helsinki, Finland

[2] The Royal Society of Canada Repon. (1999) A review of he potential health risks of radiofrequency fields from wireless telecommunications devices. The Royal Society of Canada, 225 Metcalfe #308, Ontario, Canada, (http://www.rsc.ca)

[3] Stewart Report (2000). Mobile Phones and Health. Repon of Independent Expert Group on Mobile Phones. National Radiation Protection Board NRPB, London, UK (http://www.iegmp.org.uk)

[4] Zmirou Repon to the French Health General Directorate. (2001), (http://www.sante.gouv.fr/htm/dossiers/telephon_mobil/index.htm)

[5] Daniells C, Duce I, Thomas D, Sewell P, Tanersall J, dePomerai D. (1998). Transgenic nematodes as biomonitors of microwave-induced stress. Mutat. Res. 399, 55-64

[6] de Pomerai D, Daniells C, David H, Allan J, Duce I, Mutwakil M, Thomas D, Sewell P, Tattersall J, Jones D, Candido P. (2000). Non-thermal heat shock response to microwaves. Nature 405: 417-418

[7] Fritze K, Wiessner C, Kuster N, Sommer C, Gass P, Hermann DM, Kiessling M, Hossmann KA. (1997). Effect of global system for mobile communication microwave exposure on the genomic response of the rat brain. Neuroscience 81: 627-639

[8] Kwec S, Raskmark P, Velizarov S. (2001) Changes in cellular proteins due to environmental non-ionizing radiation. I. Heat shock proleins. Electro- Magnetobiology 20: 1061-1072

[9] Tibbles LA, Woodgen JR. (1999). The mess-activated protein kinase pathways. Cell. Mol. Life Sci. 55, 1230-1254

[10] French PW, Penny R, Laurcncc JA, McKenzie DR. (2001). Mobile phones, heat shock proteins and cancer. Differentiation 67: 93-97

[11] Leszczynski D. Joenväärä S, Reivinen J, Kuokka R. (2002), Non-thermal activation of hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. Differentiation, 70, in press

[12] Saliord LG, Brun A, Sturesson K, Eberhard JL, Persson BR. (1994). Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation. continuous wave and modulated at 8, 16, 50, and 200 Hz. Microsc. Res. Tech. 15: 535-542

[13] Schirmacher A, Winters S, Fisher S, Goeke J. Galla HJ, Kullnick U, Ringelstein EB, Stogbauer F. (2000). Electromagnetic fields (1.8 GHz) increase the permeability to sucrose of the blood-brain barrier in vitro. Bioelectromagnetics 21: 338-345

[14] Fritze K, Sommer C, Schmitz B, Mies G, Hossman KA, Kiessling M, Wiessner C. (1997a) Effect of global system for mobile communication (GSM) microwave exposure on blood-brain barrier permeability in rat. Acta Neuropathol. 94, 465-470

[15] Tsurita G, Nagawa H, Ueno S, Watanabe S, Taki M. (2000) Biological and morphological effects on the brain afier exposure of rats to a 1439MHz TDMA field. Bioelectromagnetics 21, 364-371

[16] Neubauer C, Phelan AM, Kues H, Lange DG. (1990). Microwave irradiation of rats at 2.45 GHz activates pinocytotic-like uptake of tracer by capillary endothelial cells of cerebral cortex. Bioelectromagnetics 11: 261-268

[17] Töre F, Dulou PE, Haro E, Veyret B, Aubineau P. (2001). Two-hour exposure to 2-W/kg, 900-MHZ GSM microwaves induces plasma protein extravasation in rat brain and dura maner. Proceedings of the 5th International congress of the EBEA, pp43-45

[18] Pandcy P, Farber R, Nakazawa A, Kumar S, Bharti A, Nalin C, Weichselbau R, Kufe D, Kharabanda S. (2000). Hsp27 functions as a negative regulator or cytochrome c-dependent activation of procaspase-3. Oncogene 19: 1975-1981

[19] Concannon CG, Orrenius S, Samali A. (2001). Hsp27 inhibits cytochrome c-mediated caspase activation by sequestering both pro-caspase-3 and cytochrome c. Gene Expression 9, 195-201

EXHIBIT M

Genetic Effects of Nonionizing Electromagnetic Fields

(Henry Lai - University of Washington)

EXHIBIT M .

Paper presented at the "International Workshop on Biological Effects of Ionizing Radiation, Electromagnetic Fields and Chemical Toxic Agents" in Sinaia, Romania, October 2-6,2001.

Genetic Effects of Nonionizing Electromagnetic Fields

Henry Lai
Bioelectromagnetics Research Laboratory
Department of Bioengineering
University of Washington
Seattle, WA
USA

Nonionizing electromagnetic fields (EMF) have photon energy less than 10eV, a level not sufficient to produce ions by ejection of orbital electrons from atoms. The biological effects of two types of nonionizing electromagnetic fields are being studies intensely: extremely-low-frequency (ELF) electromagnetic field and radiofrequency radiation. Extremely-low-frequency EMF covers the frequency range of 3 Hz to 3 KHz. The most intensely studied frequency is the power frequency of 50/60 Hz. Electric appliances and power lines emit 50/60 Hz EMF. Radiofrequency radiation (RFR) covers a frequency range between 10 KHz to 300 GHz. Different frequencies of RFR are used in different applications. For example, the frequency range of 5.4 to 16 KHz is used in AM radio transmission, while 76 to 108 MHz is used for FM radio. Mobile phone technology uses frequencies between 800 MHz and 3 GHz. And RFR of 2450 MHz is used in microwave cooking.

Genetic effects of ELF-EMF and RFR have been reported in various studies [e.g., Garaj-Vrhovac et al., 1991; Maes et al., 1993; Sarkar et al., 1994; Simko et al., 1998; Zotti-Martelli et al., 2000]. However, since the energy of nonionizing EMF is not sufficient to break chemical bonds directly, the effects have to be caused by indirect mechanisms. In this brief paper, I have described the research we carried out in our laboratory on genetic effects of nonionizing EMF. We studied mainly effects of ELF- EMF and RFR on **DNA** strand breaks in brain cells of rats exposed in vivo. Details of the exposure systems used in our studies have been described by Guy et al. [1979] and Lai et al. [1993]. In bioelecromagnetics research, it is very important that the exposure system he well characterized particularly with regard to energy absorption and field uniformity.

The microgel electrophoresis assay (comet assay) [cf. Singh, 1996] was used lo measure single and double strand **DNA** breaks in brain cells of the rat. The assay can be used lo evaluate **DNA** strand breaks in a single cell and can detect one break per 2×10^{10} daltons of **DNA,** which is more sensitive than other available methods of strand break detection. The assay involves making microgel with isolated cells dispersed in low-melting temperature agarose on a microscopic slide. Cells are then lysed with high salt and detergent, and then treated with enzymes lo remove RNA and proteins, so that only **DNA** remains. The slide is then subjected lo electrophoresis and the extent of **DNA** fragment migration from the nucleus is used an index of **DNA** breaks. If the electrophoresis is done at highly alkaline pH (>13), the paired strands of DNA separate prior to electrophoresis and single strand breaks will be detected. Under neutral pH

EXHIBIT M 1

conditions, the DNA strands remain joined and any fragment migrated out must have resulted from double strand breaks. In isolated human lymphocytes, the assay can detect single and double strand DNA breaks caused by 5-10 cGy and 10-15 cGy ofx-rays, respectively.

We investigated the effects of 60-Hz magnetic field exposure on DNA in brain cells of the rat [Lai and Singh, 1997a]. We observed an increase in DNA single strand breaks afier 2 hrs of exposure to a magnetic field at an intensity of 0.1, **0.25,** or 0.5 millitesla (mT) (0.1 mT = 1 gauss), whereas an increase in double strand breaks was observed at **0.25** and 0.5 mT, but not at 0.1 mT. The effect is proportional to the intensity of the magnetic field. Similarly, exposure to RFR **(2450** MHz, at a whole body specific absorption rate (SAR) of 0.6 and **1.2** W/kg) for 2 hrs caused **an** increase in both single and double strand breaks in DNA of brain cells in the rat [Lai and Singh, 1995, 1996]. Another interesting finding from our research is that time and intensity can interchange in exerting effects of magnetic fields. By increasing the duration of exposure to 24 hrs, increases in single and double strand DNA breaks could be observed in brain cells of rats exposed to a 60-Hz magnetic fields at an intensity of 0.01 mT, whereas a 2-hr exposure at the same intensity had no significant effect.

From the microgel electrophoresis assay, exposure to a 60-Hz magnetic field at 0.25 mT for 2 hrs or to 2450-MHz RFR at an average SAR of 1.2 W/kg for 2 hrs produces a similar DNA migration in brain cells as that caused by 25 cGy of X-rays, i.e., an average of 250 strand breaks per cell. However, it is not likely that the three entities cause DNA breaks by similar mechanism and produce the same types of DNA damage.

It must be pointed out that the 0.1-0.5 mT magnetic field intensities used in our study are much higher than the levels most people encounter in daily life. However, they are still within the limits contained in current magnetic field exposure guidelines and can be encountered in occupational situations. For example, the International Nonionizing Radiation Committee of the International Radiation Protection Association guidelines for maximum levels of magnetic field exposure in occupational situations are 0.5 mT for workday exposure and **5** mT for shon-term exposure, whereas for the general public it is 0.1 mT for 24 hrs per day exposure and 1 mT for exposure for a few hrs per day. Regarding RFR exposure, one can get an *SAR* of 6-8 W/kg per gm of tissue in certain **parts** of the head when using a mobile phone.

In further research, we found that treatment of rats before exposure with free radical scavengers blocked the effects of EMF (ELF-EMF and RFR) on DNA [Lai and Singh, 1997b,c]. This suggests that EMF enhances free radical activity in cells, which in **turn** lead to DNA damage. We also found that EMF exposure caused DNA-protein and DNA-DNA crosslinks [Singh and Lai, 1998] and increased apoptosis and necrosis in brain cells of the rat. Furthermore, we found that pretreating rats with an iron-chelator could block the effects of EMF exposure on DNA.

In addition lo our experiments, using the microgel electrophoresis assay, Ahuja et al. [1997, 1999], Phillips et al. [1997], and Svedenstal et **al.** [1999a,b] have also reported an increase in DNA strand breaks in cells after magnetic field exposure. Interestingly, Svedenstal et al [1999a] observed an increase in DNA strand breaks in brain cells of mice after 32 days of exposure to magnetic fields at a low intensity of 7.5 microtesla. Changes in DNA in cells exposed to *RFR*, **as** detected by the microgel electrophoresis **assay.** have also been reported by Phillips etal. [1998] and Verschaeve et al. [1994].

EXHIBIT M

From the results of the above research, we hypothesize that **EMF** initiates an iron-mediated process (Fenton reaction) that increases hydroxy free radical formation in cells, leading to DNA strand breaks and cell death. Cells with high rates of iron intake, e.g., proliferating cells, cells infected by DNA virus, and cells with high metabolic rates such as brain cells, would be more susceptible to the effects of **EMF.** For proliferating cells, the mosl vulnerable time should be during the G_1/S phases of the cell cycle, when transferrin receptors are expressed and iron influx is high. Hydroxy radicals are generated from hydrogen peroxide via the Fenton reaction in the presence **of** iron. Cells with high metabolic rate generate high amount **of** hydrogen peroxide via the mitochondrial electron transport pathway and thus are more vulnerable to **EMF.** On the other hand, possible harmful effect of EMF exposure could also depend on the capability of cells to store iron in ferritin. For example, liver cells would be less susceptible to EMF, even though they have high iron influx, because they contain high amount offemtin.

Cancer cells are known to have a higher concentration of transferrin receptors on their cell surface and uptake a large amount **of** iron. In a series of experiments, effects of exposure to a 60-Hz magnetic field on cancer cells were investigated. Molt-4 cells, a type of human lymphoblastoid cells, were exposed to a 60-Hz magnetic fields (0.25 *mT*) for **2** *hrs in* a medium supplemented with holotransferrin, a protein that transports iron into cells. **A** significant decrease in cell count was observed after exposure when compared to that of non-exposed samples. The effect lasted for at least **22** hrs afier exposure. Magnetic field alone (without holotransferrin) was ineffective. In addition, similar magnetic field/holotransferrin treatment had only a slight effect on normal human lymphocytes. These data indicate that when intracellular iron concentration is increased, cancer cells become more susceptible to an alternating magnetic field, resulting in cell death or cell cycle arrest. Thus, low frequency alternating magnetic fields may be useful for cancer treatment. In studies by the late Charles Hannan and his associates, the growth rate of implanted tumors in mice was significantly decreased by exposure to a pulsed magnetic field (1 hr per day at an average intensity of 0.5 mT) [Hannan el al., 1994]. The field also enhanced the potency of the anti-tumor compound daunorubicin on implanted multi-drug resistant tumor in mice in vivo [Liang et al., 1997]. More recently, Santi Tofani and his associates [2001] in Italy reported an increase in cell death morphologically consistent with apoptosis in two transformed cell lines (WiDr human colon adenocarcinoma and human breast adenocarcinoma) exposed to magnetic fields of more than 1 mT. No toxic morphological changes were observed in non-transformed cells (MRC-5 embryonal lung fibroblast) after the same exposure. In addition, nude mice bearing WiDr ***tumors*** subcutaneously treated with daily exposure of magnetic fields showed a significant tumor growth inhibition **(up** to 50%).

References

Ahuja YR, Bhargava **A,** Sircar S, Rizwani **W,** Lima S, Devadas **AH,** Bhargava SC. (1997) Comet assay to evaluate DNA damage caused by magnetic fields. In: Proceedings of the Intemadonal Conference on Electromagnetic Interference and Compatibility, Hyderabad, India, pp. 273-276.

Ahuja YR, Vijayashree B, Saran R, Jayashri EL, Manoranjani JK, Bhargava SC. **(1999)** In vitro ***effects*** of low-level, low-frequency electromagnetic fields on DNA damage in human leucocytes by comet assay. Indian J Biochem Biophys 36:318-322.

EXHIBIT M

Garaj-Vrhovac V, Horvat D, Koren Z. (1991) The relationship between colony-forming ability, chromosome aberrations and incidence of micronuclei in V79 Chinese hamster cells exposed to microwave radiation. Mutat Res 263:143-149.

Guy AW, Wallace J, McDougall JA. (1979) Circular polarized 2450-MHz waveguide system for chronic exposure of small animals to microwaves. Radio Sci 14(6S):63-74.

Hannan CJ, Liang Y, Allison JD, Pantazis CG, Searle JR. (1994) Chemotherapy of human carcinoma xenografts during pulsed magnetic field exposure. Anticancer Res 14:1521-1524.

Lai H, Singh NP. (1995) Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells. Bioelectromagnetics 16:207-210.

Lai H, Singh NP. (1996) DNA Single- and double-strand DNA breaks in rat brain cells after acute exposure to low-level radiofrequency electromagnetic radiation. Int J Radiat Biol 69:513-521.

Lai H, Singh NP. (1997a) Acute exposure to a 60-Hz magnetic field increases DNA strand breaks in rat brain cells. Bioelectromametics 18:156-165.

Lai H, Singh NP. (1997b) Melatonin and N-tert-butyl-α-phenylnitrone blocked 60-Hz magnetic field-induced DNA single and double strand breaks in rat brain cells. J Pineal Res 22:152-162.

Lai H, Singh NP. (1997c) Melatonin and a spin-trap compound blocked radiofrequency radiation-induced DNA strand breaks in rat brain cells. Bioelectromagnetics 18:446-454.

Lai H, Horita A, Guy AW. (1993) Effects of a 60-Hz magnetic field on central cholinergic systems of the rat. Bioelectromametics 14:5-15.

Liang Y, Hannan CJ, Chang BK, Schoenlein PV. (1997) Enhanced potency of daunorubicin against multidrug resistant subline KB-Ch^{R}-8-5-11 by a pulsed magnetic field. Anticancer Res 17:2083-2088.

Maes A, Verschaeve L, Arroyo A, De Wagter C, Vercmyssen L. (1993) In vitro cytogenetic effects of 2450 MHz waves on human peripheral blood lymphocytes. Bioelectromagnetics 14:495-501.

Phillips JL, Campbell-Beachler M, Ivaschuk O, Ishida-Jones T, Haggnen W. (1997) Exposure of molt-4 lypmhoblastoid cells to a 1 g sinusoidal magnetic field at 60-Hz: effects on cellular events related to apoptosis, In: 1997 Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery, and Use of Electricity; W/L Associates, Ltd, Frederick, MD.

Phillips JL, Ivaschuk O, Ishida-Jones T, Jones RA, Campbell-Beachler M, Haggren W. (1998) DNA damage in Molt-4 T-lymphoblastoid cells exposed to cellular telephone radiofrequency fields in vitro. Bioelectrochem Bioenerg 45:103-110.

Sarkar S, Ali S, Behari J. (1994) Effect of low power microwave on the mouse genome: a direct DNA analysis. Mutat Res 320:141-147.

Simko M, Kriehuber R, Weiss DG, Luben RA. (1998) Effects of 50 Hz EMF exposure on micronucleus formation and apoptosis in transformed and nontransformed human cell lines. Bioelectromagnetics 19:85-91.

Singh NP. (1996) Microgel electrophoresis of DNA from individual cells: principles and methodology. In: "Technology for Detection of DNA Damage and Mutation", edited by J. Pfeifer, Plenum Press, New York, pp. 3-24.

Singh NP, Lai H. (1998) 60 Hz magnetic field exposure induces DNA crosslinks in rat brain cells. Mutat Res 400:313-320.

EXHIBIT M

Cellular Phone Radiation and Potential Risks to the Human Brain

(Anti-Aging Medical News - Winter - 2002)

EXHIBIT M

WINTER 2002

THE OFFICIAL NEWSLETTER OF THE AMERICAN ACADEMY OF ANTI-AGING MEDICINE

Anti-Aging Medical News

Commencing A Year-Long Celebration of Ten Years Since the Founding of A4M and the Science of Anti-Aging Medicine

IN THIS ISSUE:

Cellular Phone Radiation and Potential Risks to the Human Brain:

A Review of the Scientific Literature

Introduction

The notion that cellular phone radiation emissions might result with adverse health effects is the 21st century's first great environmental challenge. By most admissions from experts and advocates on both sides of the issue, the introduction of broad-scale public exposure to radiofrequency and microwave radiation by the use of cellular phone technology represents uncharted territory.

According to the wireless industry's trade association, Cellular Telecommunications & Internet Association, at the time of this writing, 137,458,902 Americans were cellular phone subscribers. This number has

Continued on page 3

Cellular Phone Radiation & Human Brain

Continued from page 1

skyrocketed since the advent of low-priced phones and service plans became widely available to the general public in the mid-1990s. Some estimates report that there are 1 million new subscribers every month. (See Figure 1.)

Worldwide, it is estimated that over 400 million people now use cellular phones, and by 2005 that number will rise to 1.3 billion. At the same time, this technology is now giving rise to important questions about possible long-term health consequences of cellular phone use. Because of the immense numbers of present and future users, some scientists and public health experts are worried that even if only a small percentage are adversely affected, that could still equate to a public health issue of epidemic proportions.

This article surveys die scientific literature relating to the possible adverse effects of exposure to cellular phone radiadon to the human brain. There is, additionally, a sufficient body of evidence rhat also suggests an association between these emissions and:

- general malaise
- immune system dysfunction
- sexual and reproductive issues
- changes in the central nervous system and cardiovascular system
- elevations in blood pressure
- skin damage
- changes in red blood cells, possibly leading to kidney stones or heart disease

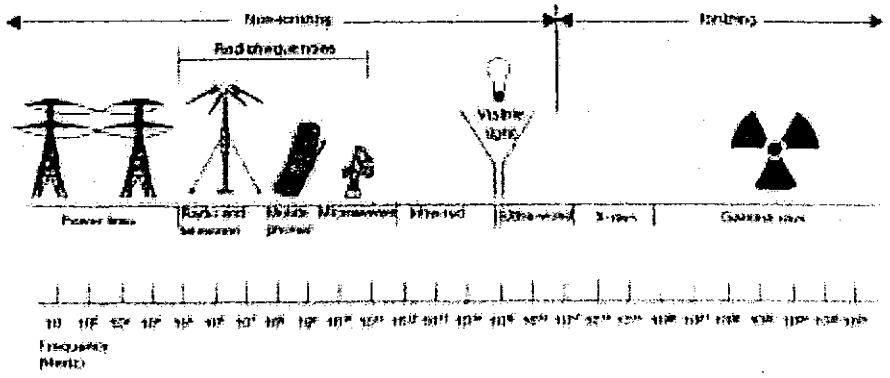


Figure 2 Electromagnetic Spectrum

From "Report to Congressional Requesters: Telecommunications - Research and Regulatory Efforts on Mobile Phone Health Issues" (Report GAO-01-545), US Government Accounting Office, May 2001.

Cellular Phone Radiation
Electromagnetic Fields

Electromagnetic fields (EMFs) are waves of electric and magnetic energies that travel together, at the speed of light, and they permeate the world around us. Electromagnetic fields represent one of die most common and fastest growing environmental influences, and exposure in all populations of the world will continue to increase with the advancing availability of technology.

The electromagnetic (EM) spectrum groups radiation into two types (see Figure 2):

- "Ionizing" - having energy levels sufficiently high enough to strip electrons from atoms and molecules (resulting in "ionization".. It is well established that exposure to ionizing radiation can cause serious biological damage, including the production of cancers.
- "Non-ionizing" - of an insufficient energy to cause ionization. Within the "non-ionizing" portion of the EM spectrum. radiofrequency (RF) radiation includes bands used by radio and television, cellular

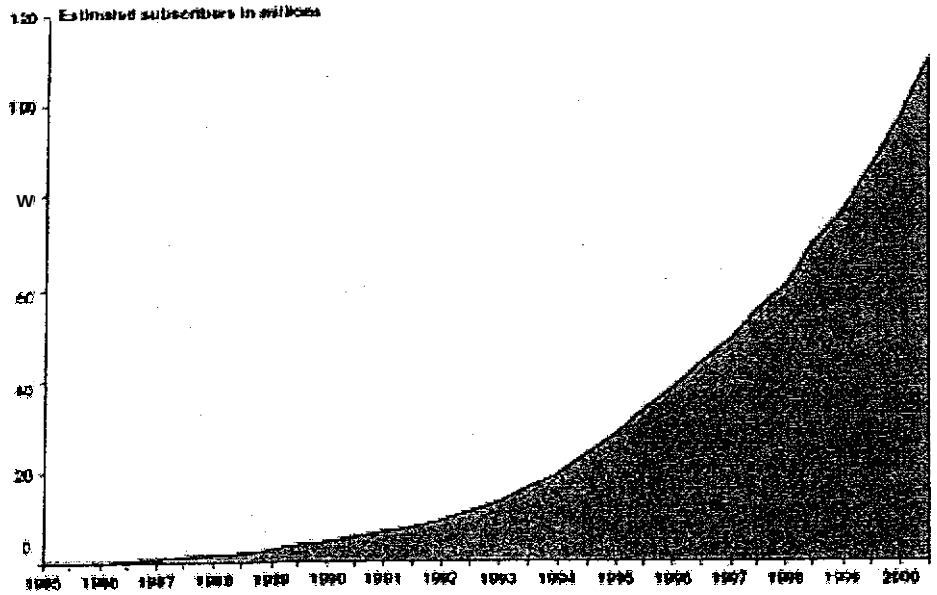


Figure 1 Growth in Cellular Phone Subscribership

From "Report to Congressional Requesters: Telecommunications - Research and Regulatory Efforts on Mobile Phone Health Issues" (Report GAO-01-545), US Government Accounting Office, May 2001.

Continued on page 1

AAMN Editorial Note: This article is an excerpt from the new book, Cellular Phones: Medical Menaces of a Modern-Day Convenience, b Dr. Robert Goldman and Dr. Ronald Klatz, the physician founders of the A4M. Their keen interest in emerging risk factors that compromise either the quantity or quality of the human lifespan bar prompted them to spearhead an educational initiative on the subject of the potential biological hazards of cellular phone radiation. Visit The World Health Network, www.worldhealth.net, for availability details on the release of this must-read book.

EXHIBIT M • 3

Cellular Phone Radiation & Human Brain

Continued from page 3

phones, and microwaves. RF, particularly at the high end of the cellular phone band and in the microwave band, can rapidly heat biological tissue. This heating ("thermal effect") can cause harm by increasing body temperature, disrupting behavior, and damaging biological tissue. Early in the short history of cellular phones, scientists suspected that the radiation caused damage by heating, but subsequently "non-thermal" effects have become of greater concern (see *Mechanisms of Damage* below).

RF Fields

Radio frequency (RF) fields are used in many facets of everyday life, such as radio and television transmission, mobile telecommunications - namely pagers and cellular telephones, some medical diagnostic and treatment equipment, and in industry for heating and sealing materials. The biological effects of RF are not well understood because the prominence of this form of radiation is a relatively new addition to our everyday EMF landscape.

"Cellular telephones are the most radiative appliance we have ever invented apart from the microwave oven and people are putting them by their heads - arguably the most sensitive part of the body," stated bio-electromagnetics scientist Roger Coghill, who continued that "cellular phones emanate microwave radiation, and human brains may absorb up to 60 percent of that energy." Indeed, the cellular phone is, essentially, a low-powered radiotransceiver (combination transmitter and receiver). With the widespread public adoption of cellular phones, there has been a particular focus of attention on potential problems associated with "near field RF exposure" - namely, exposure to the head from the phone.

Types of Cellular Phones & Radiation Emissions

There are three types of cellular phones, categorized based on the radiofrequency at which they transmit and receive. From a health perspective, the signals from each of these technology types are more similar than different in terms of potential biological impact:

- Analog cellular phones: operate at frequencies between 824 MHz and 894 MHz. As energy hogs, analog phones beam eight times as much energy into the user's head as digital phones do.
- Digital cellular phones: operate at frequencies between 800 and 900 MHz.
- Digital PCS (personal communication system) phones: in the US, PCS operates in the range of 1850 MHz to 1990 MHz.

NOTE: Global System Mobile (GSM) is the digital standard that operates worldwide outside of the United States. It operates at 900 and 1800 MHz in Europe and Asia, and at 1900 MHz in the US.

The amount of radiation emitted by cellular phones depends on a number of factors:

- The Specific Absorption Rate (SAR) of the unit. The SAR is the amount of RF energy ahsorhed from the phone into the local tissues. SAR varies hy cellular phone manufacturer and model, but in the US, all FCC-compliant phones must have a maximum SAR less than 1.6 watts per kilogram (W/kg). Information on SAR for a specific phone model can he obtained for many recently manufactured phones by visiting the Internet address, www.fcc.gov/oet/fccid, and keying in the FCC identificdtion number for rhar unit.
- Number of "cells" in a geographical area, which depends upon the cellular phone traffic in that area. Large cities may have many cells per square mile, whereas a less-populated, rural area may have a single cell stretching over several square miles. The farther away a cell phone antenna is from its base station, the higher the power level needed to maintain the connection Very small cells are therefore associated with much lower exposures.
- Each geographical cell has a different number of available channels. Cellular phones operate ideally with the least amount of interference from neighboring channels. To help achieve optimal operation, cellular phones automatically step down to the lowest power level available that still maintains a connection with the base station. On the other hand, any physical obstacle, such as buildings or trees, interfering with

Continued on page 6

"There is currently insufficient scientific basis for concluding that wireless communication technologies are *safe* or that they pose a *risk* to millions of users."

– US Federal Drug Administration, February 8, 2000

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 5

the connection between base station and cell phone forces the base station to increase the power sent to that phone. Therefore the amount of power sent from a base station to a particular cellular phone can vary, even within a single call.

Note that for all types of cellular phones, the emissions are highest when the device is anempting to establish a connection (initialization), followed by when it is anempting to receive or transmit signals. "Stand-by" mode is generally associated with lower radiation emission.

Your Brain on Cellular Phones

Various research indicates that between 20% to 60% of the energy eniined from a mobile phone is absorbed by the user's head. The percentage absorbed depends on the design of the phone, type of aerial or antenna (the stubby ones which you can not extend are worse because they concentrate energy into the user's brain), and how far it is io the nearest base-station (the weaker the base station signal, the more the phone will power up to maintain contact with the network).

Figure 3 is an image of a computer model of a human head in cross-section showing the distribution of the energy absorbed from a cellular telephone handset radiating 600 mW at 835 MHz. Most of the energy is absorbed within the first 1 to 2 cm (0.4 to 0.5 in.) beneath the surface of the skull.

Mechanisms of Damage

Cellular phone use can heat up hrain structures. An Australian government discussion paper issued in March 1997 warned that "There is evidence that localized hot *spots* of energy deposition in the brain may occur as a consequence of internal rrflections" that perprtuate the radiation after it enters the head. This 'thermal" hiological effect is characterized by irreversible damage to the most basic components in cells of Living organisms: raising the temperature of cells by as little as a fraction of one degree Fahrenheit can be "genotoxic" - that is, cause damage to cellular genetic material. In the earlier years of cellular phone health hazards research, it was suspected that RF radiation caused DNA breakage. DNA breakage can cause problems with replication of the molecule, thus impairing cell division and causing problems to tissue and organs. More alarmingly, the DNA damage may show up as mutations that can be replicated and passed on to other cells, a mechanism that is suspected to contribute to cancer. Noted EMF expert Dr. Henry Lai of the University of Washington (USA) has published several papers (1995, 1996, 1997a, 1997b) in which he observed that DNA damage occurred in the brain cells of live rats after only two hours of relatively low-level microwave exposure. The lowest intensity at which Dr. Lai identified DNA strand breaks was well within the range of the electromagnetic range of cellular phones, and most closely matched to that of the popular PCS-type phones.

Recently, however, scientists have revised their suspicions relating to how cellular phone radiation causes genetic damage. A series of studies found that human blood cells could be damaged by the formation and accumulation of micronuclei - smaller versions of the cell nucleus that compete with the main nucleus, thereby altering proper cell function and division. Cells exposed io cellular phone radiation became unable to repair their broken DNA, thus producing micronuclei. In 3 compilation of research (1998) edited by public health expert Dr. Carlo, separate teams led by Drs. Donner, Tice, and Lai all have reported that

Continued on page 8

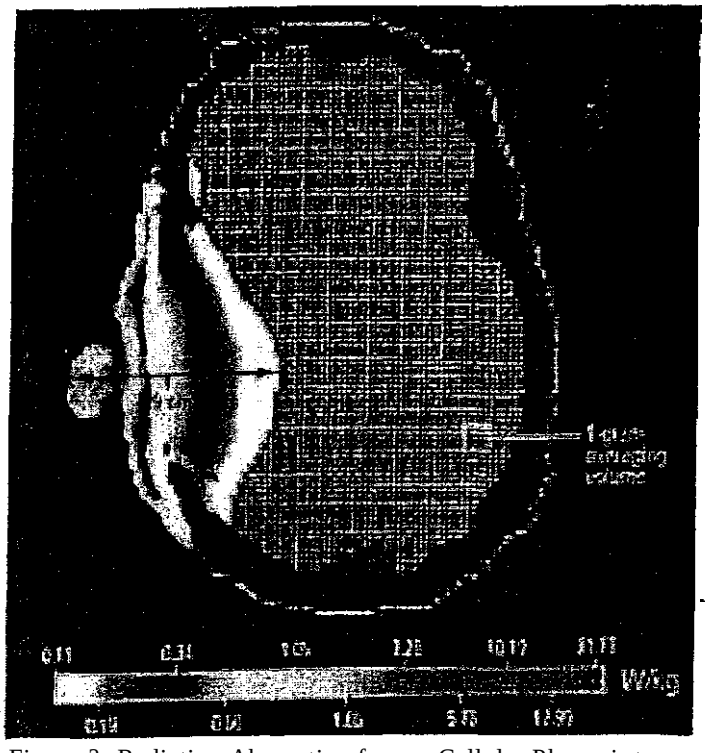


Figure 3 Radiation Absorption from a Cellular Phone into the Human Head

From Foster K and Moulder J, "Are mobile phones safe?," *IEEE Spectrum*, August 2000.

"For the first time in history, we are holding a high-powered transmitter against the head. when YOU talk on Your mobile phone, (you use radiation in) a range that's right in the middle of microwave territory."

- Dr. Ross Adey, one of the world's most respected and senior research scientists, interview with *PC Computing*, Nov. 30, 1999

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 6

genetic damage to hunian blood cells. nianifesting as micronucleus formation, could "unequivocally" result from "all cellular phone technologies."

Based on more recent studies, scientists presently suspect that the temperamre rises in cells induced by RF radiation typical of cellular phones can cause other types of thermal stress. Dr. Mason and colleagues reported (1997) that two areas of the brain - the hypothalamus (responsible for maintaining balance of the nervous and endocrine systems) and caudate nucleus (responsible for coordinating movement) - were particularly sensitive to thermal stress. In this study, the resenrchers observed that rises in the temperamre of cells in the brain, resulting from cellular phone emissions, caused distinct alterations in levels of amino acids - building blocks of neurotransmitters, the chemicals involved in communications between brain cells and the brain and the nervous system.

It is important to be aware that the main biological effect of cellular phone radiation may not be in heating-related damage. Indeed, these "non-thermal" biological effects are mechanisms that may account for the role of RF radiadon in diseases including cancer, respiratory ailments, and infertility. On this possibility, Dr. John Stather, the Assistant Director of the United Kingdom's National Radiation Protecdori Board (NRPB) remarked: "Until recently we believed any harmful effects from microwaves were due to their heating effects, which would he negligible at the low powers used by mobile phones. Now there might be another effect ai work and we are much less certain."

An important type of non-thennal effect of cellular-phone type radiation involves the blood-brain barrier (BBB). Research from Lund University (Sweden) (1999) tracked the migration of albumin across the BBB in rats that were exposed to cellular phone radiation. Albumin is a protein that is naturally present in the blood but not in the brain; previous studies have shown that brain nerve cells that are exposed to albumin die. The researchers found that albumin leaked through the rats' BBB after cell phone radiation exposure. Even when the microwaves were not strong enough to heat up the rats' heads, the sciendsts detected the effect deep in the center of their brains. The researchers remarked that the length of time using a cellular phone was irrelevant, the BBB was opened at once upon exposure. Moreover, the albumin remained in the rat brains for several days. As a result of these findings, the team warned that their study indicates that molecules of equal or smaller size to albumin could also get into the brain. According to the researchers, this increased permeability could:

- allow certain proteins found in the blood to cross into the brain, causing autoimmune diseases such as multiple sclerosis
- result in damaged nerve cells that may be implicated in demenna, premature aging, and Parkinson's disease
- result in inflamed brain cells that may be indirectly be linked to Alzheimer's disease
- allow the brain to become exposed to niedicdtions not normally allowed past the BBB and thus possibly cause unexpected damage

Because the BBB of humans and rats ai-e similar in function, medical experts urged for attention to this study. Professor Leif Salford, the lead researcher and a neurologist, remarked that: "We saw opening of the blood-hrain barrier even after a short exposure to radiation at the same level as mobile phones. We're seeing extremely small amounts of protein and we don't *know* how dangerous it is."

Subsequent research at the University of Munster (Germany) (2000) found that radiation at the high-end of the range for cellular phones significantly increased the permeability of the RBB to sucrose, a sugar molecule that, like certain proteins, is safe in the blood but not in the brain. Additionally a report (1999) from Canada's Radiation Protection Bureau cautioned that RF radiation can "increase the permeability of the blood-brain-barrier and modulate the action of some psychoactive drugs."

Studies on the non-thermal effects of cellular phone radiation also have focused on heat shock proteins (HSPs). While there are a wide range of heat shock proteins that our brains can make, they all perform a similar

Continued on page 11

Cellular Phone Radiation & Human Brain

Continued from page 3

function - to hind to unfolded proteins, which are not useful to cells, and refold them. On a normal basis, the brain releases HSPs as a defensive mechanism in response to heat stress and chemical toxins, triggers that can cause proteins to unfold. The HSP response can be activated by a brief non-thermal radiation at RF and microwave frequencies, and can rake a number of hours to disappear out of the system. This is disconcerting for heavy users of cellular phones for **two** reasons. First, some scientists suspect that heat shock proteins may be chronically present, and, over a number of years, may increase the risk of cancer. Secondly, some scientists believe that in heavy cellular pbonr users, repeated activation of the heat *shock* protein response causes the mechanism to shut down, making it unavailable when must needed. As a result, the normally protective HSP response can become a health problem, as indicated by the following studies:

. Microwaves at non-thermal power levels have been shown to elicit the heat shock protein response in organisms. (Daniells 1998, De Pomerai 1999)

. Fertility of organisms is altered hy the HSP response (De Pomerai *1999,* 2002)

. Microwave radiation can cause physiological changes in brains and brain cells

. In a review of research on heat shock proteins and their role in cancer, Dr. Jolly (2000) found evidence that repeated activation of HSPs could cause cells to become cancerous.

"Gradually, cells don't work properly, so the life process becomes less efficient."

- Dr De Pomerai, Nottingham University School of Biological Sciences (United Kingdom), 1999, commenting an continual cellular phone use

Reponing on findings (2002) of a two-year long study, Dr. Darius Leszczynski at Finland's Radiation and Nuclear Safety Authority found **that** an hour of cellular phone exposure shrinks humin BBB cells in culture, causing gaps between the cells through which toxins could enter the brain. Additionally, the activity of one HSP in particular - HSP27 - was markedly increased. Because HSP27 is associated with thr proper functioning of the BBB. these findings are suggestive that RF radiation could promote permeability of the BBB through overactivity of a HSP.

Continued on page 12

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 11

Cancer

There has been a fair amount of respectable research documenting at least a weak associadon between prolonged and/or intense exposures to various types of electromagnetic fields and the onset of brain cancer, leukemia, and lymphoma. Overall. the data available to-date on RF radiation and cancer are too inconsistenr to establish a direct and indisputable cause-and-effect relationship. However, taken as a whole, the body of evidence of associadon between cellular phone radiation and cdncer is substantial enough to raise concern.

The first laboratory study to associate cellular phone radiation with an increased rate of cancer was published by a team of scientists from Royal Adelaide Hospital. Dr. Repacholi and colleagues (1997) conducted an 18-month long study using 200 lymphoma-prone mice as highly sensitive detectors of possible cancer promotion over their lifespan. Half of the animals were exposed and half not, to pulsed digital phone radiation (GSM-type) at a power density roughly equal to a cellular phone transmitting for two 30-minute periods each day. Dr. Repacholi found that cancer rates doubled in the exposed group - lymphomas were the major type of tumor that occurred with increased incidence. Extrapolating from the United Kingdom's National Radiation, Protection Board figures, most GSM digital cellular phones put out between 10 to 30 times more radiation into the user's head than to which the mice in Dr. Repacholi's study were exposed. Many scientisu agree that if there are cancer connections with the use of cellular phones, they are most likely to be expressed in adult leukemias, which typically take between 10 and 30 years to appear and he diagnosed. As a result, it is unlikely that the cancer trend will begin to appear for another three to five years, at the earliest. Extended period chronic exposure to radiation of the type eniined by cellular phones may be already wreaking havoc on the human organism

Data on the effects of analog (Nordic Mobile Telephone [NMT]-type) cellular phones is expected to yield the first broad-based findings on possible cancer trends in humans. This is because the NMT technology was adopted in the early 1980s, giving it a ten-year head start over the now-preferred digital (GSM-type) system. In one of the first case-controlled studies of humans and cellular phones, studying residents of Sweden - one of the first countries to engage in widespread cellular phone use -

Swedish cancer specialist Dr. Lennart Hardell and colleagues at the Orebro University Hospital found (1999) an increased risk of the occurrence of tumor in the temporal (side) or occipital (back) area of the brain, on the same side as the cellular phone had been used. Regardless which side of the head it was held against, the risk of a brain rumor increased by almost 2 1/2 rimes in analog phone users. In a follow-up case-control study with exposure assessed by questionnaires, Dr. Hardell (2000) again and separately determined that "use of a cellular telephone was associated with an increased risk in the anatomic area with highest exposure." On his findings, Dr. Hardell has commented that "there is a biological indication that there is a problem ... I think that until we have the definite conclusion, the definitive results of much larger studies, we need to minimize exposure to human beings."

A study (1999) conducted by Dr. Joshua Muscat and colleagues at the American Health Foundation (New York USA), is suggestive of potential risk The team collected data on newly diagnosed cases of brain cancer from five hospitals across the United States, and analyzed the Juration and frequency of cellular phone usage in these patients. The majority of the brain cancers in the study were found to he outside of the 2- to 3- inch exposure pattern that is accepted as the depth of RF radiation penetration frorn a cellular phone (see Fig. 3). However, by cross-correlating the cellular phone usage interviews, the researchers identified a statistically significant increase in risk of neurocytoma - a type of hrain tumor that grows froin the outside edges of the brain inward - with cellular phone use. Additionally, those patients who reported using their phone on the right side of the head had a significant increase in tumors on that side of the head.

In a study conducted by Dr. Dreyer and colleagues (1999), the rate of hrain cancer mortality in hand-held cellular-phone users, as compared with car phone users (antenna is physically dewched and located outside the rear of the car), was nearly three dines greater.

A 20-year study of servicemen in Poland (2000) has established the strongest link yet between mobile phones and cancer. It correlated a high cancer death rate among soldiers exposed to microwave radiarion - the same as that emitted by cellular phones. This research is widely acknowledged as the world's the first significant study to demonstrate a link between humans, microwave radiation and Cancer. In the study, conducted at the Military Institute of Hygiene and Epidemiology in Warsaw and led by

Continued on page 16

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 12

Dr. Stanislaw Szmigielski, the researchers reviewed the medical records of hundreds of thousands of servicemen, 3% of whom were exposed to the radiation, including at frequencies and modes similar to cellular phone emissions, between 1970 and 1990. It then compared their medical histories and death rates to a group of soldiers who were not. Researchen found those exposed - largely through using military equipment - were more likely to get some cancers. They were abo more likely to develop a whole range of cancers 10 years earlier than those who had not been. There were higher death rates from cancers of the skin, brain, blood, digestive system, blood and lymphatic system among the exposed group.

Dr. W. Ross Adey from University of California (USA) (2000) reported that a pregnant rat's exposure to phone-like radiation at any of three power levels alters the activity of an enzyme - ornithine decarboxylase, associated with cancer onset - in the fetuses' brains. Dr. Adey suggests that the increased enzyme activity may explain tumors observed in ram exposed to RF energy for extended periods of time.

A large-scale study in Denmark (2001) linked data on all of the 420,095 cellular phone users in that country between 1982 and 1995 to the Danish Cancer Registry. *Study* investigators, led by Dr. Johansen, did nut find an increased risk of developing brain rumors overall. They also did not find that brain rumors occurred with greater frequency on the side of the head for which cellular phone usen reponed using the device. Additionally, Dr. Johansen and team did not find any significant association with other cancers, including salivary gland. eye, leukemia, and 22 other cancer types. However, this registry-based approach to brain rumor analysis came under scrutiny when Dr. Auvinen and colleagues from the Finnish Cancer Registry reponed (2002) that this technique has "limited value in risk assessment of cellular phone use owing to lad. of information on exposure."

In an epidemiological rmdy by Dr. Inskip and colleagues (2001), the researchers compared *i82* brain cancer patients diagnosed in Phoenix (Arizona USA), Boston (Massachusetts LISA), and Pittsburgh (Pennsylvania USA) between 1994 and 1998, and compared them with age- and sex-matched conuols. Dr. Inskip found no evidence of increased risk for people using cellular phones on any regular basis, and rumors did not occur at a greater rate on the side on which the phone was used. It is important to note that the method by which the researchers defined cellular phone use may have been somewhat flawed: *the* make and model of the phone was not collected, as the researchers believed that other variables that were more significant were not able to be collected, namely the distance of the usen from the nearest base station at each time a call was made.

"When you have 200 million people who are being exposed to cell phones, you can't wait around for the slow scientific process to work

– Dr. George Carlo, public health expert and head of the cellular phone industry's Wireless Technology Research program, interview with *Wired Magazine*, June 21, 19W

Dr. Stang and colleagues from the University of Essen (Germany) *(2001)* found that mobile phone use may be associated with cancer of the eye. The researchers conducted 3 hospital-bared analysis of the relationship between uveal melanoma (a type of eye cancer) and occupational exposures to different sources of electromagnetic radiation. They interviewed a total of 118 men and women with uveal melanoma and 475 healthy counterparts. Dr. Stang found a significantly elevated risk for those people whose jobs involved heavy or extended use of radiofrequency/microwave transmitting devices such as radio sets and cellular phones. The team was able to rule out other sources of electromagnetic radiation (high-voltage lines, electrical machines, complex electrical environments, computer monitors. and radar units) as contributing to eye *cancer.*

Dr. Muscat and the American Health Foundation published (2002) a repon that found no correlation between acoustic neuromas (rumors of the inner ear) and cellular phone me. However, a number of shortcomings with this study have been idendfied. Fim, the study onlv included infrequent cellular phone users, as opposed to individuals who use cellular phones more often and/or every day. Secondly, the srudy group consisted only of 90 cases, which, according to Dr. Carlo, is too small a group from which to extrapolate to make a public health statement

Continuing on his works published in 1999 and 2000, Dr. Hardell and colleagues again found (2002) a higher incidence of brain m o r s on the sides of heads most frequently involved in hand-held cellular phone use. The most frequently found tumor type of with this lateral association was acoustic neuroma.

Analog NMT cellular phones were found to place users at a noticeably increased risk of developing brain rumors than those who did not use the phones, according to a startling large-scale snidy (2002) conducted by Dr. Kjell Hanson Mild of the *Swedish Institute* for Working Life and Dr. Hardell of Orebro University Hospital (Sweden). The researchers studied data on 1,617 Swedish patients diagnosed with brain tumors between *199i* and 2000 and age- and sex-marched controls. Those brain cancer patients who used NMT cellular phones had a 30% higher risk of developing brain rumors. For people using *the* phones for more than 10 years, the risk shot up dramatically to *80%.* As for the location of the m o r s, the risk was 2.5 times higher for the same side as the phone was used, and specifically a 3.5 times greater risk was found for auditory nerve rumors to occur.

Cognitive Functions

In addition to a potential for cancers in the brain, non life-threatening brain changes - namely cognitive alterations - can also result from cellular phone emissions. It is imporrant tu be aware that changes in memory, learning, reaction time, etc. may persist well after the exposure itself. In a series of experiments with 24 volunteers exposed to RF radiation typical of cellular phones, Dr. Lebedeva and colleagues from the Russian Academy of Sciences (2000) found it caused direct stimulation of the cerebral cortex - the region

Continued on page 21

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 16

of the brain responsible lor consciousness and the complex thinking processes in humans - which continued even after exposure was stopped.

Memory

A number of studies implicate cellular phone radiation in causing adverse memory changes. Dr. Rick Hold and colleagues from the Defense Establishment Research Agency (United Kingdom) (1998) discovered that cellular phone signals disrupt the parr of the brain that controls memory and learning. The researchers found that the "signals made no difference in their measurements for a short time, but then readings plunged off the graph ... the effect would have caused sudden memory loss and confusion."

In research conducted by Dr. Lai (2000), he found that microwaves similar to those emitted by cellular phones impaired long-term memory Dr. Lai subjected 100 ran to a swimming maze in which they all learned to find hidden safety platforms in a pool of cloudy water. Afterwards, he exposed some of

the ran to shon bursts of low-level microwaves. When they were challenged to navigate the maze again, the exposed ran forgot the location of the safety platforms, while the unexposed rats retained their spatial niernorirs. Dr Lai remarked on his findings that "die long-term memory of virtually all the exposed ran appeared to have been affected. Short-term memory loss is just

Continued on page 32

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 21

being enable to remember something which you have just done or glanced at. Long-term memory is something which has been learned or recalled and stored in the brain. The data from this latest study is certainly a cause for concern."

Dr. Kraus and colleagues from the University of Turku Finland) (2000) found that high-frequency cellular phone radiation significantly modified several aspects of hnin responses during a memory task.

Learning

Nitric oxide is a pas that mediates cell-todl communication in the brain. Nimc oxide is produced by an enzyme, nitric oxide synthase (NOS). Increased levels of NOS are released hg the hippocampus and cerebellum areas of the brain tu promote the learning process. A study by Dr. Ding and team found (1998) that the number of NOS neurons, as well as the extent of their activity, was decreased as .won as I 112 hours after exposure to RF radiation As a result, Dr. Ding observed that the rats' ability to learn was obstructed.

"Anyone who uses a (cellular) phone extensively runs a risk of adverse health effects. We estimate that 10 percent of the population may be at risk of milder effects such as headaches and loss of concentration."

- United Kingdom consumer advocacy group Powerwatch, interview with *The Express* (London), April 4,2000

Reaction Time

In a British government-funded study, Dr. Alan Preece of Bristol University (United Kingdom) (1999) tested the memory and reaction times to visual stimuli. Thirty-six university volunteers were exposed to 20 to 30 minutes of mobile phone type radiation, then asked to make decisions that relied on the visual cortex - the pan of the hrain involved in processing visual cues. RF emissions from both digital and analog signals correlated with a reduction in the time it took users to answer simple questions. The improvement was small, just 15 milliseconds. A separate study, conducted in Finland, also recorded a simular drop in reaction time among people during RF exposures. Dr. Preece proposes that the quickened reaction times demonstrate that cellular phone emissions are biologically active, suggesting that the RF radiation stimulates production of

Continued on page 29

EXHIBIT M.

Cellular Phone Radiation & Human Brain

Continued from page 22

heat shock proteins (see *Mechanisms* above), and therefore bloodflow, in the angular **gyrus** - the area of the **brain** chat is involved in decision making. **Dr.** Preece cautions that the shon-lived **benefit** to reaction time is not considered to outweigh the potential damage caused by repeated or chronic stimulation of the HSP mechanism.

Completion of Tasks

Much alarm has been given to the dangers of **driving** an automobile while using the cellular phone. The National Conference **of** Sate Legislatures estimates 600 tu 1,000 such needles tragedies occurred in 2001, and that as many as 2,000 *motorists* could be killed annually hy 2004 by distracted drivers. Nationally, officialsbelieve up to **30%** of crashes are caused by driver distractions thar include mobile communication devices. The National Highway Transportation **Safety** Board reported that in 1995, when **here** were 33 million cellular phone subscribers in the United *States*, an estimated 3,837 **car** crashes were the result of **driven** using hand-held cellular phones. The idea of being "driven to distraction" may **have** a partial biological basis. *Two studies* support this notion:

- **Dr.** Eulitz and colleagues reponed (1998) that pulsed (ie, digital) cellular phone emissions altered the brain's response to auditory stimuli. The effect manifested when humsn **volunteers** wrre asked to complete tasks involving sound, while being exposed to cellular phone radiation. The effect was more pronounced with increasingly higher digital frequencies.
- **Dr.** Freude (1998) found thar exposure to cellular phone radiation caused a significant decrease in the activity of **certain** regions of **the** hrain. The effect manifested when human volunteers attempted to complete a complex visual task involving thinking **skills,** while being exposed to cellular phone radiadon. Subsequent research by the same group (2000) reconfirmed **the** earlier study data, stating that **here** is "a selected

EMF **effect on** particular aspects of human information processing."

Continued on page 30

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 29

Sleep

Fairly low levels of electromagnetic radiation have been shown to alter the human body's sleep rhythms. Dr. Mann (1996) showed that in alseep volunteers, cellular phone radiation exposure can shonen the stage of REM sleep. When Dr. Borbely and colleagues (1999) exposed healthy young men and women to alternating 15-minute on/off intervals of digital-frequency cellular radiation during an overnight sleep, they experienced an increase in non-REM sleep and a reduction in the amount of waking time after sleep. Taken together these srudies indicate that cellular phone radiation modifies the brain panerns associated with sleep. Such alterations may impact learning, given that the loss of REM sleep and increase in non-REM sleep may reduce attention and inaease fatigue.

A world-renowned sleep laboratory ar the University of Zurich reponed (2000) that using cellular phones just before going to sleep can disturb the normal sleeping EEG panerns. The researchers found that exposing volunteers to digital GSM-type cellular phone radiation for 30 minutes while awake significantly alters their EEG activity after they fall asleep, compared to unexposed conuols. In an accompanying editorial, Dr. Michael Petrides notes thar "the currently available literature suggests that some aspects of cognitive function and some direct measures of brain physiology may be affected hy exposure to electromagnetic fields of the type emitted by cellular telephones."

FACT

In the United States, the Federal Communications Commission (FCC) has issued safety guidelines for RF environmental exposure since 1985. The FCC, however, maintains that its guidelines are not safety regulations, because FCC is not a health and safety agency.

Cellular phone radiation may depress levels circulating levels of the hormone melatonin. In the case of people living near cellular phone masts, the effecu on sleep can he dramatic. The University of Berne studied (1995) residents near the Schwarzenburg (Switzerland) short-wave radio transmitter. The transmitter operated in continuous mode at a frequency and modulation that approximated today's cellular phone transmitting masts. The researchers found that even the must modest doses of radiation exposure caused changes in sleep quality - which then adversely affected learning abilities. These effect.were reversed when the mast was not operating for several days. Additionally, cattle living near the radio transmitter were found to have significantly elevated levels of melaronin when the mast was not operational. Since there was no reason to suppose that human nocturnal melatonin levels were not similarly reduced when the transmitter was operating. and that scientists know that peaks in nocturnal

Continued on page 37

EXHIBIT M

Cellular Phone Radiation & Human Brain

Continued from page 30

melatonin levels correlate to quality sleep quality, the researchers suggested that human sleep was degraded by the radio transmitter. Because melatonin is considered to be an important cancer-fighting hormone, the reduced nocturnal melatonin levels also led the researchers to become concerned that the residents of Schwarzenburg could have been at increased risk of cancers. In 1997, transmissions at the Schwarzenburg were ceased, and the tower was closed the following year.

Dr. Burch and team reported (1997) that people who used cellular phones as little as once a day had lower levels of melatonin than people who did not use a cellular phone or used it less than once a week. Those with occupational exposure to cellular phone radiation were also found to have reduced levels of melatonin production during the daytime.

Concluding Remarks

Millions of cellular phone users worldwide are now also exposed daily to radiofrequency and microwave radiation under prolonged and physically close conditions. It is necessary for each of us who uses a cellular phone to become responsible users. We encourage you to become familiar with the body of scientific study on the biological effects of cellular phone radiation, a segment of which has been reviewed in this article. As new data become available, our understanding of the role of these emissions in human health will improve. However, the explosion of utilization of this technology in society creates a unique necessity for ongoing monitoring and interpretation of the scientific data. The sheer numbers of current and future cellular phone users creates great cause for worry. Even if only a small percentage of cellular phone users are adversely affected, that could still equate to a public health issue of epidemic proportions. Adjusting for latency of disease states to the initial triggering exposure, it may be 2020 before a full-scale epidemic hits. Or it might not happen at all.

It thus becomes incumbent upon each cellular phone user to evaluate the extent of his/her exposure to cellular phone radiation and determine whether it places them at increased health risks. If so, adopting techniques to minimize our exposures to cellular phone radiation may be prudent. We have outlined ten simple ways and present them as a Tips Sheet (see pages 36-37).

Finally, we urge that our *Anti-Aging Medical News* readers - many of whom are physicians, health practitioners, and scientists, to whom the public entrusts their health and well-being - share this article with your loved ones, colleagues, and patients/clients. It is our position that consumers should be given the opportunity to know what potential health consequences they may experience as a result of using cellular phones, and by all rights should have the opportunity to make informed judgements as to whether they wish to continue such risk-related use. In the words of public health expert Dr. George Carlo, "We're now in a gray area that we've never been in before with this. When we're in a gray area, the best thing to do is let the public know about the findings so that they can make their own judgment."

Selected Bibliography

Adey WR. "Cell And Molecular Biology Associated With Radiation Fields Of Mobile Telephones." Department of Biochemistry, University of California.

Adey WR. "Cell And Molecular Biology Associated With Radiation Fields Of Mobile Telephones." Dept. of Biochemistry, University of California, Riverside.

Along for the ride: Reducing driver distractions - Final report of the driver focus and technology program. National Conference of State Legislatures, March 2002.

Altpeter ES et al. "Study of Health Effects of Shortwave Transmitter Station at Schwarzenburg." University of Berne, Inst. for Social & Preventive Medicine, August 1995.

Auvinen A, Hietanen M, Luukkonen R, Koskela RS. "Brain tumors and salivary gland cancers among cellular telephone users." Epidemiology. 2002 May;13(3):356-9.

Bass G. "Is your cell phone killing you?" PC Computing Magazine, Nov. 30, 1999.

Borbely AA, Huber R, Graf T, Fuchs B, Gallmann E, Achermann P. "Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram." Neurosci Lett 275(3):207-210, 1999.

Burch JB, Reif JS, Pitrat CA, Keefe TJ, Yost MG. "Cellular telephone use and excretion of a urinary melatonin metabolite." Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, delivery & Use of Electricity, 1997, pp.110.

Burton J. "A Medical Enigma - A Rise in Brain Tumors Sets Off Search For A Reason." Minneapolis Star Tribune, Jan. 4, 1999.

Carlo G and Jenrow R. " Scientific Progress - Wireless Phones and Brain Cancer. Current State of the Science," Medscape, June 31, 2000.

Daniells C, Duce I, Thomas D, Sewell P, Tattersall J, de Pomerai D. "Transgenic nematodes as biomonitors of microwave-induced stress." Mutat Res. 1998 Mar 13. 399(1). P 55-64.

De Pomerai DI, Daniells C, Barker SL, Stout S, Duce IR, Thomas DW, Sewell PD, Tattersall JEH. "Effects of stress-inducing microwave radiation on life-cycle parameters in the nematode Caenorhabditis elegans." Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1999.

Ding G, Xie X, Zhang L et al. "Changes of nitric oxide synthase in hippocampus and cerebellum of the rat following exposure to electromagnetic pulse." Chin J Phys Med 20:81-83, 1998.

Eulitz C, Ullsperger P, Freude G, Elbert T. "Mobile phones modulate response patterns of human brain activity." Neuroreport 9(14):3229-3232, 1998.

Federal Communications Commission. "Radiofrequency FAQs Page." Office of Engineering and Technology. June 1, 1998.

Fist St. "Cell Phones And Cancer." The Australian Newspaper, May 5, 1997.

Foster K and Moulder J. "Are mobile phones safe?," IEEE Spectrum, August 2000.

Freude G, Ullsperger P, Eggert S, Ruppe I. "Effects of microwaves emitted by cellular phones on human slow brain potentials." Bioelectromagnetics 19(6):384-387, 1998.

Freude G, Ullsperger P, Eggert S, Ruppe I. "Microwaves emitted by cellular telephones affect human slow brain potentials." Eur J Appl Physiol 81(1-2):18-27, 2000.

Freude G et al. Bioelectromagnetics, 19, 384-387 (1998)

Frumkin H, Jacobson A, Gansler T, Thun M. Environmental Carcinogens - Cellular Phones and Risk of Brain Tumors. CA Cancer J Clin 2001;51:137-141.

Hardell et al. "Case-Control Study on Radiology Work, Medical X-ray Investigations, and Use of Cellular Telephones as Risk factors for Brain Tumors." Medscape.com, May 4, 2000.

Hardell L, Hallquist A, Hansson-Mild K, Carlberg M, Pahlson A, Lilja A. Cellular and cordless telephones and the risk for brain tumours," Eur J Cancer Prev 2002;11:377-386.

Hardell L, Nasman A, Pahlson A, Hallquist A, Hansson Mild K. "Use of cellular telephones and the risk for brain tumours: A case-control study." Int J Oncol 15(1):113-116, 1999.

Hardell L, Reizenstein J, Johansson B, Gertzen H, Mild KH. "Angiosarcoma of the scalp and use of a cordless (portable) telephone," Epidemiology 10(6):785-786, 1999.

Hogan M, "Will your cell phone kill you?" PCWorld.com, April 2, 2001.

House of Commons, Great Britain. Third Report, The Science and Technology Committee. "Scientific Advisory System: Mobile Phones And Health." Sept. 27, 1999.

Hyland GH. Memorandum (presentation to the European Union); February, 2001.

Independent Expert Group on Mobile Phones. Mobile Phones and Health. National Radiological Protection Board (UK) 2000.

Inskip PD, Linet M, Tarone R et al. Cellular telephone use and brain tumors. N Engl Med, Vol. 344, pp. 79-86, Feb. 2001.

Inskip PD, Tarone RE, Hatch EE, Wilcosky TC, Shapiro WR, Selker RG, Fine HA, Black PM, Loeffler JS, Linet MS. "Cellular-telephone use and brain tumors." N Engl J Med. 2001 Jan 11;344(2):79-86.

International Commission on Non-Ionizing Radiation Protection. Health Issues Related to the use of hand-held Radiotelephones and Base Transmitters. June 1995.

Johansen C, Boice JD, MCLaughlin JK, Olsen JH. Cellular Telephones and Cancer-a Nationwide Cohort Study in Denmark. J Natl Cancer Inst. Vol 93, No.3, pp. 203-207, Feb. 7, 2001.

Jolly C, Mortimer RE. Journal of the National Cancer Institute, Vol. 92, pp. 1564-761, Oct. 2000.

Krause CM, Sillanmaki L, Koivisto M, Haggqvist A, Saarela C, Revonsuo A, Laine M, Hamalainen H. Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task. Neuroreport 2000 Mar 20;11(4):761-4.

Lai H and Singh NP. "Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells." Bioelectromagnetics, Vol.16 pp: 207-210, 1995.

Lai H and Singh NP. "DNA Single- and double-strand DNA breaks in rat brain cells after acute exposure to low-level radiofrequency electromagnetic radiation." Int. J. Radiat. Biol., Vol. 69, pp: 513-521, 1996.

Lai H and Singh NP. "Melatonin and a spin-trap compound blocked radiofrequency radiation-induced DNA strand breaks in rat brain cells." Bioelectromagnetics, Vol. 18, pp: 446-454, 1997.

Lai H and Singh NP. Int. J. Radiation Biol. 69, 13-521 (1996)

Lai H et al. Engineering in Medicine and Biology, 6, 31-36 (1997).

Lai H, Carino MA, and Singh NP. "Naltrexone blocked RFR-induced DNA double strand breaks in rat brain cells." Wireless Networks Journal, Vol. 3, pp: 471-476, 1997.

Lai H, Horita A, Guy AW. "Microwave irradiation affects radial-arm maze performance in the rat." Bioelectromagnetics, 15:95-104, 1994.

Lai, Henry. "Neurological Effects of Radiofrequency Electromagnetic Radiation Relating to Wireless Communication Technology." Bioelectromagnetics Research Laboratory, Department of Engineering, University of Washington, Seattle, Washington. Paper presented at the IBC-UK Conference: Mobile Phones - Is there a Health Risk? Sept. 16-17, 1997 in Brussels, Belgium.

Lebedeva NN, Sulimov AV et al. "Cellular phone electromagnetic field effects on bioelectric activity of human brain." Crit Rev Biomed Eng, Vol. 28, No. 1-2, pp:323-337, 2000.

Leszczynski D, Joenväärä S et al. "Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects." Differentiation 70:120-129, 2002.

Leszczynski D, Joenväärä S et al. "Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects." Differentiation 70:120-129, 2002.

Mann K and Roschke J. Neuropsychobiology, 33, 41-47 (1996).

Mason PA, Escarciga R, Doyle JM, Romano WF, Berger RE, Donnellan JP. "Amino acid concentrations in hypothalamic and caudate nuclei during microwave-induced thermal stress: analysis by microdialysis," Bioelectromagnetics 18(3):277-283, 1997.

McGinity AL. "Yacking Yourself To Death?" zdnet.com, April 10, 2000.

Muscat J. "Cellular telephone use and risk of brain cancer." In: Carlo GL, Editor. Wireless phones and health II: State of the science. Kluwer Academic Publishers, 2000.

Muscat JE, Malkin MG, et al. Handheld cellular telephone use and risk of brain cancer. JAMA, Vol. 284, pp. 3001-3004, 2000.

National Highway Transportation Safety Administration. "An Investigation of the Safety Implications of Wireless Communications in Vehicles," November 1997.

Oakes C. "Cell Study: Hazards Are Real." Wired Magazine, June 21, 1999.

Preece AW et al. "Effect of a 915 MHz simulated mobile phone signal on cognitive function in man." Int J Radiat Biol, Vol. 75, No.4, pp: 447-456, 1999.

Repacholi et al. "Lymphomas in mice exposed to 900MHz pulsed EMFs," Rad. Res. 1997;147(5):631-640 (1997).

Repacholi MH, Basten, A, Gebski V, Noonan D, Finnie JH, Harris AW. Lymphomas in Eu-Pim1 Transgenic Mice Exposed to Pulsed 900 MHz Electromagnetic Fields Radiation Research, Vol.147, pp.631-640, 1997.

Report to Congressional Requesters: Telecommunications - Research and Regulatory Efforts on Mobile Phone Health Issues (Report GAO-01-545), US Government Accounting Office, May 2001.

Ryle S. "Insurers balk at risks of phones." The London Observer, April 11, 1999.

Salford G et al. Microsc. Res. Tech., 27, 535-542 (1994).

Salford G et al. Bioelectrochemistry & Bioenergetics, 30, 293-301 (1993)

Scientific Advisory Group on Cellular Telephone Research. "Potential public health risks from wireless technology: Research agenda for the development of data for science-based decisionmaking." Washington, DC: Scientific Advisory Group on Cellular Telephone Research, 1994.

Szmigielski S, Bortkiewicz A, Gadzicka E, Zmyslony M, Kubacki R. "Alteration of diurnal rhythms of blood pressure and heart rate to workers exposed to radiofrequency electromagnetic fields." Blood Press Monit 3(6):323-330, 1998.

Townsend M and Hanlon M. "New Mobile Phone Danger," London Express, April 4, 2000.

US Federal Drug Administration, Cell Phone Facts: Consumer Information on Wireless Phones, at www.fda.gov/cellphones.

Verschaeve L. "Can non ionizing radiation induce cancer?" The Cancer Journal, Vol. 8, No. 5.

Continued on page 36

EXHIBIT M

Top Ten Tips for Minimi

Produced as a Public Service by The American Academy of Anti-Aging related disease and to promote research into methods to retar aging portal and official website of the A4M. Read the latest life-e cellular phone radiation.

#1. Call Length and Frequency

A number of the scientific studies have shown a correlation between the length of calls and/or frequency of use, with biological changes.

TIP Reserve cellular phone use for short, necessary conversations. Public health expert Dr. Carlo has recommended (2000) that incoming mobile phone calls he kept as brief as possible and returned on a corded phone.

#2. Distance

The concentration of radiation emissions is directly related to the power of the emitting device. The farther you can put yourself from the cellular phone handset, the less emissions you will receive. Radiation from all sources obeys the inverse square law. That is, the further you are from the source the less intense your exposure to the radiation. In fact, it drops off with the square of your distance from the source.

TIP Many cellular phones now have a "speakerphone" option, permitting a substantial distancing between the user and the handset during conversatiurn.

#3. Phone Antenna

The type of antenna that on your cellular phone may contribute to the amount of radiation it emits. Stubby antennae Cannot he extended, and have been shown to be worse because they concentrate energy into the user's brain.

TIP Select a phone with an extendable antenna

#4. Signal Path

The steel construction of vehicles and buildings creates an electrical shielding effect ("Faraday cage"). As a result, using a cellular phone inside an enclosed vehicle or building causes the phone to increase the power output it needs to establish a connection, receive signals, and transmit signals, all of which causes increased radiation emissions. A presentation by the House of Commons (United Kingdom) Science and Technology System reported (1999) that using a cellular phone inside an enclosed vehicle ran cause radiation levels to rise by 10 times

TIP If using the cellular phone inside a vehicle, open the window or door (if not in rnodon). This will improve the poth for the cellular phone signals and possibly reduce the phone's need to increase its power level.

#5. Phone Mode

The highest cellular phone emissions occur when the phone is establishing a connection with a base station. When using the phone in a mobile setting, the phone is constantly re-establishing in base station connection. The emissions in the mobile setting are further compounded by signal path issues (see preceding tip).

TIP When inside a vehicle, avoid keeping the cellula-phone handset turned on unless you are expecting an incoming call, or making a call.

#6. Carrying the Phone

Avoid keeping the cellular phone (when switched-on) adjacent to the body. In particular, do not keep it in on-mode in clothing pockets or clipped to the waist. The soft tissues of the body - namely heart, liver, kidneys, intestines, and reproductive organs - are very vulnerable to penetration by radiation, moreso than the brain (which is protected to a degree by the skull). According to Dr. Hyland's repon to the Economic Union (2000), three sudden deaths occurred from colon cancer amongst members of a secret surveillance unit of the former Royal Ulster Constabulary, all of whom had worn radio or microwave transmitters in the lower pan of their backs for extended periods of time. In 2002, US jeans maker Levi Strauss & Co. debuted to clothing retailers a new line of trousers fitted with a lining which the makers say shields against radiation.

TIP Women: carry your phone in a purse that is carried away from the body. Men: do nor carry the phone in the on-mode in your chest, jacket, or pants pockets, unless you are expecting a call or making a call.

#7. Eyeglass Wearers

The House of Commons (United Kingdom) Science and Technology System repon (1999) also found that cellular phone usen who wear metal-rimmed glasses intensify their exposure to radiation emissions to the eye by 20% and to the head by 6.3%.

TIP Take glasses offwhen making or receiving cellular phone calls, or use the phone when you are wearing contact lenses.

#8. Proximity to Base Stations

The number of "cells" (zones of service) in the geographic area, in addition to the proximity of the cellular

EXHIBIT

ing Your Cellular Phone Radiation Exposure

ng Medicine (A4M), a non-profit medical organization dedicated to the advancement of technology to detect, prevent, and treat and optimize the human aging process. Visit The World Health Network, at www.worldhealth.net, the Internet's leading anti-hancing, life-extending news, sign up for our free bi-weekly e-newsletter, and visit our special information clearinghouse on

phone to a base station, factor into the power necessary for the phone to establish a connection and receive and transmit signals. The few the number of cells, and the farther apart the baste stations, dit greater the power (and radiation emission) necessary to maintain contact with tlie network.

TIP Many cellular phones can display the signal level at which they are operating when turned on. When receiving or making a call, take note of the reponed signal level. If it is weak, keep the call short and continue it later on a corded phone or when you reach an area where the signal level is stronger.

Accessories

Radiation-reducing cellular phone accessories appeal to those consumers who do not wish to give up their frequent and lengthy use of the device.

IMPORTANT: Responsible accessories manufacturers and retailers will openly share independent laboratory studies, validated by third-party testing reviewers, documenting that their devices reduce the amount of radiation delivered horn the cellular phone to the user. This, however, should be the limit of their product claims. Most of these RF protective accessories have only been on the market for less than five years - and many of rhem fur less than a year. To our knowledge, none of these accessory manufacturers have conducted controlled studies of humans to determine if and how their products alter the biological effects of cellular phone radiation. As a result, we consider it to be premature and irresponsible for my accessory manufacturer to state or imply that heir product alters, in any way, the effect that cellular phone radiation has on the human organism.

#9. Hands-Free Kits

Hands-free kits include a headset or earbud/microphone that connects by way of a cable inro a special plug on cellular phones. They offer cellular phone users freedom of movement while using the phone, fur example keeing up the hands for writing or typing. There is conflicting evidence on whether exposure to cellular phone radiation is reduced.

To use hands-free kits, many people tuck the phone handset into a chest or jacket pocket, or attach it to their helr. Positioning the phone at this location has possible risk to the soft tissue of die body (see *Carrying the Phone* above). Additionally, some cellular phones have been shown to require greater power to use hands-free mode, thus placing the soft tissue near the handset at greater risk.

A laboratory evaluation commissioned by Britain's Cancer Associadon reponed (2000) has raised concern over possible magnification of the radiation when using hands-free kits. Two of the most popular brands of hands-free kits were studied. The Cancer Association determined that the hands-free kit cable can create a standing wave that can propel the cellular phone signal wave through the cable and, by way of the earbud, deliver that signal directly into the ear. Additionally, the hands-free kit earbud channeled as much as 3 times the dose of radiation into the era as opposed to using that same phone without die kit. Dr. Carlo has stated that this "coupling effect" can be remedied by using hands-free kits that incorporate ferrite filters in the able. He .suggested that, in selecting a hands-free kit, consumers choose the "filtered" rather than "non-filtered" version.

#10. Shields

Shields are parches made from various types of inaterial that, by self-adhesive, fit atop die earpiece of the phone. The goal of shields is to reduce the amount of radiation delivered to the user's head from the phone. By positioning the shield accessory in between the phone and the user, the purpose of shields is to absorb the emissions. It has heen reported that Motorola has patented technology similar to rhese shields, leading to a frenzy of interest in these accessories.

Manufacturers of shield accessories acknowledge that a significant portion of radiation is emitted by cellular phone antennae. However, shield manufacturers submit that anrenna radiation delivered to phone users is significantly reduced due to its distance from the user, the reach of the antenna emissions following the inverse square law (see *Distance* above). Addidonally, shield manufacrurers submit that antenna emissions are partially obscured by the battery, before they can reach the head. Some makes and models of cellular phones emit notable radiation ***emissions*** from points on die handset - not just the antenna. As a result, when users hold the handset to the head, the earpiece is in direct, dose proximity to the brain.

Many shields are made of mesh consisting of carbon and lead. Shields made of this material from responsible manufacturers provide a fair amount of reduction - ***9090*** or better - in cellular phone radiadon delivered from the phone to the head.

Shields that are constructed kom radar absorbing inaterials are also available. These shields are made of solid state materials and operate as passive circuit analog devices. No external power resource is required. Radar-absorbing material shields from responsible manufacturers are effective at reducing cellular phone emissions delivered from the phone to the user's head to a greater extent than mesh shields.

These tips are excerpted from the new book, *Cellular Phones: Medical Menaces of a Modern-Day Convenience*, by Dr. Robert Goldman, APM Chairman, and Dr. Ronald Klatz, A4M President. Writ The World Health Network, at www.worldhealth.net, for availability details on the release of this must-read book.

EXHIBIT M

SPECIAL ARTICLE

The Sensitivity of Children to Electromagnetic Fields

(Journal of American Academy of Pediatrics)

EXHIBIT M

SPECIAL ARTICLE

The Sensitivity of Children to Electromagnetic Fields

Leeka Kheifets, PhD*; Michael Repacholi, PhD‡; Rick Saunders, PhD‡; and Emilie van Deventer, PhD‡

ABSTRACT. In today's world, technologic developments bring social and economic benefits to large sections of society; however, the health consequences of these developments can be difficult to predict and manage. With rapid advances in electromagnetic field (EMF) technologies and communications, children are increasingly exposed to EMFs at earlier and earlier ages. Consistent epidemiologic evidence of an association between childhood leukemia and exposure to exbemely low frequency (ELF) magnetic fields has led to their classification by the International Agency for Research on Cancer as a "possible human carcinogen." Concerns about the potential vulnerability of children to radio frequency (RF) fields have been raised because of the polentially greater susceptibility of their developing nervous systems; in addition, their brain tissue is more conductive, RF penetration is greater relative to head sue, and they will have a longer lifetime of exposure than adults. To evaluate information relevant to children's sensitivity to both ELF and RF EMFs and to identify research needs, the World Health Organization held an expert workshop in Istanbul, Turkey, in June 2004. This article is based on discussions from the workshop and provides background information on the development of the embryo, fetus, and child, with particular attention to the developing brain; an outline of childhood susceptibility to environmental toxirants and childhood diseases implicated in EMF studies; and a review of childhood exposure to EMFs. It also includes an assessment of the potential susceptibility of children to EMFs and concludes with a recommendation for additional research and the development of precautionary policies in the face of scientific uncertainty. *Pediatrics* 2005;116:e303–e313. URL www.pediatrics.org/cgi/doi/10.1542/peds.2004-2541; children, environmental *risk*, policies, sensitive periods, mobile phones, *electromagnetic fields*, *power* lines.

ABBREVIATIONS. ELF, extremely low frequency; IARC, International Agency for Research on Cancer; RF, radio frequency; EMF, electromagnetic field; WHO, World Health Organization; CNS, central nervous system; ALL, acute lymphoblastic leukemia; AML, acute myeloblastic leukemia; SAR, specific absorption rate.

From the *Department of Epidemiology, University of California School of Public Health, Los Angeles, California; and ‡Radiation and Environmental Health, world Health Organization, Geneva, Switzerland.

Accepted lor publication Feb 2, 2005.
doi:10.1542/peds.2004-2541

The opinions in this paper are the sole responsibility of the authors and do not represent the position of the World Health Organization.

Conflict of interest: Dr Kheifets worked and consulted for Electric Power Research Institute and Utilities (Palo Alto. CA). and Dr Saunders worked for the National Radiation Protection Board (Oxfordshire, United Kingdom).

Address correspondence lo Leeka Kheifets, PhD, Department of Epidemiology, UCLA School of Public Health. 73-284 CHS, 50 Charles E. Young Dr S, Los Angeles, CA 90095-1772. E-mail: kheifets@ucla.edu

Children in both industrialized and developing countries are exposed to a large variety of environmental agents including indoor and outdoor air pollution, water and food contaminants, chemicals (eg, pesticides, lead, mercury), and physical agents such as ultraviolet radiation and excessive noise. Changes in exposure to these agents are being linked to real or perceived increases in the incidence of certain childhood diseases, such a5 asthma, leukemia, and brain cancer, and in some behavioral and learning disabilities. Environmental exposures can be particularly harmful to children because of their special vulnerability during periods of development before and after birth.

Exposure to electric and magnetic fields from 0 to 300 GHz has been increasing greatly as countries increase their capacity to generate and distribute electricity and take advantage of the many new technologies, such as telecommunications, to improve lifestyle and work efficiency (Fig 1). Evidence of an association between childhood leukemia and exposure to extremely low frequency (ELF) magnetic fields has led to their classification by the International Agency for Research on Cancer (IARC) as a "possible human carcinogen"' based on consistent epidemiologic data and lack of support by laboratory studies in animals and cells. The reason why the results of the childhood leukemia studies are consistent is still being investigated, but one possibility is that children may be more sensitive to radiation in some or all parts of the electromagnetic spectrum.

Concerns about the potential vulnerability of children to radio frequency (RF) fields from mobile telephony were first raised by an expert group in the United Kingdom[2] on the grounds that children have a longer lifetime of exposure than adults, and from a physiologic point of view, they have a developing nervous system, their brain tissue is more conductive than that of adults because it has a higher water content and ion concentration, and they have greater absorption of RF energy in the tissues of the head at mobile telephone frequencies. This topic was discussed further at a European Cooperation in the Field of Scientific and Technical Research (COST) 281 workshop: in a report of the Health Council of the Netherlands: and in a recent report from the United Kingdom's National Radiological Protection Board.[5]

To evaluate the available information relevant to children's sensitivity to electromagnetic fields (EMFs) and to identify research needs, the World Health Organization (WHO) held an expert workshop in Istanbul, Turkey, in June 2004. This article is based on discussions and recommendations from the workshop and provides background information on

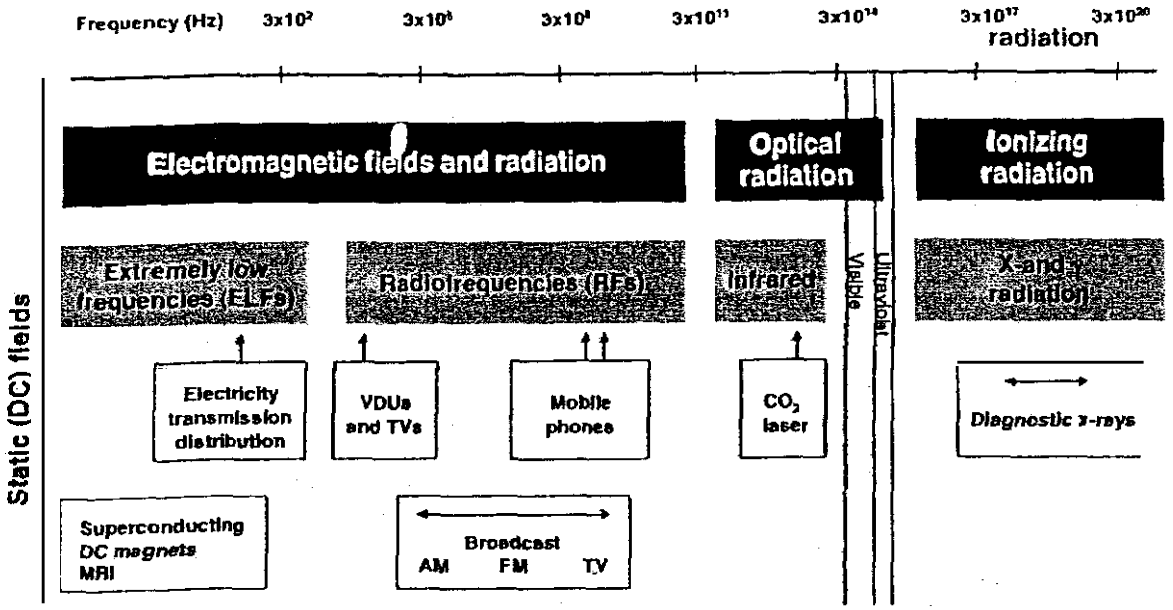


Fig 1. Electromagnetic spectrum. VDUs indicates video display units

the development of the embryo, fetus, and child, with particular attention to the developing brain; an outline of childhood susceptibility to environmental toxicants, childhood diseases implicated in EMF studies, and exposure to ELF and RF fields, with a focus on children. After a brief presentation of the EMF science most pertinent to effects on children and a review of several proposed mechanisms, the potential sensitivity of children to EMFs is discussed. Finally, recommendations are outlined on the protection of children through the development of precautionary approaches in the face of scientific uncertainty.

FROM EMBRYO TO ADOLESCENCE

Embryo, Fetal, and Childhood Development

Development proceeds from conception to adulthood through a number of different stages in which the developmental processes are markedly different, and their susceptibility to environmental teratogens varies. The prenatal period of development is divided roughly into 3 periods: the preimplantation period, extending from fertilization to the settling of the embryo into the uterine wall; a period of organogenesis, characterized by the formation of the main body structures; and the fetal period, during which growth of the structures already formed takes place. Additional developmental changes take place after birth. Postnatal changes are characterized by slower growth and maturation of existing organ systems, notably the central nervous system (CNS), the hemopoietic and immune systems, the endocrine and reproductive systems, and the skeletal system. The completion of sexual development at the end of the second or the beginning of the third decade of human life marks the completion of this period of growth and maturation. Essentially, however, the nature of the toxicant and the timing and magnitude of exposure determine the risk of any adverse effects in terms of both severity and occurrence. Vulnerability can vary quite rapidly during the prenatal period, whereas slower changes occur postnatally.[6]

During the first 2 weeks of embryonic development (known as the "all-or-none period"), the embryo is very sensitive to the lethal effects of toxic agents and much less sensitive to the induction of malformation. Many of the cells are still omnipotential stem cells, and if the embryo survives a toxic exposure it can recuperate without an increased risk of birth defects or growth retardation. During the next 6 to 8 weeks of development, major organogenic events occur and toxic agents with teratogenic potential can cause major malformations of the visceral organs, the CNS, the face, and the limbs. From the 8th to the 15th week, neuron proliferation, differentiation, and migration in the CNS are particularly vulnerable.[7] Genitourinary and other malformations, gonad cell depletion, and neurodevelopmental problems may occur if the thresholds for these effects are exceeded. During the late fetal period, effects on growth of the fetus and susceptible organs such as the CNS diminish, but vulnerability to deleterious effects remains high compared with adults.

Development continues after birth, but now this process largely entails the maturation of existing organ systems, although growth is still occurring. Neurobiologists long believed that neurogenesis in the human ends during the first months of postnatal life, but recent rodent and primate studies demonstrate that there is lifelong neuron production in some parts of the CNS.[8] However, with some particular exceptions, most adult neurons are already produced by birth. The number of connections (synapses) between neurons in the human brain peaks at ~2 years and decreases by 40% to the adult number during adolescence[8] as experience is acquired and "redundant" connections last. This reflects the balance between the formation of new synapses (synaptogenesis) and synapse elimination, a "pruning" back of excess synapses between neurons, which are key

processes in the development of the postnatal "hard-wiring" of the brain. Another important neurologic event that occurs postnatally is myelination, which facilitates the transmission of information within the CNS and occurs most rapidly from birth to 24 months but may also continue into the second decade. Unfortunately, the susceptibility of these processes to environmental agents has not been studied extensively and thus is not well understood. However, because developmental processes are vulnerable to disruption by agents that may not be toxic to mature systems, it is reasonable to expect that the later stages of brain development present special risks.[8]

Other threshold effects that can result from postnatal exposures include interference with fertility and endocrine function, alterations in sexual maturation, and interference with the development of the immune system. Endocrine disrupters, exogenous substances that mimic the action of hormones (particularly steroids), may alter the function of the developing endocrine system and have adverse effects on the reproductive organs, liver, kidney, adrenal glands, CNS, immune system, cardiovascular system, and bones.[9]

Exposure to toxic agents with mutagenic and carcinogenic potential, such as ionizing radiation, cancer chemotherapeutic drugs, and some chemicals, poses theoretical, stochastic risk for the induction or progression of cancer during embryonic and childhood development. However, although many agents have been alleged to be responsible for cancer and genetic disease, such effects will only result from agents that have either mutagenic properties or the ability to produce more subtle effects on carcinogenic processes, such as the stimulation of excessive cell proliferation or an influence on cell-to-cell communication, apoptosis, or DNA repair.

Children's Susceptibility to Environmental Exposures

Several aspects of exposure and susceptibility warrant a focus on children. In some exposure scenarios, children may receive higher doses than adults, resulting from higher intake and accumulation or differences in behavior. Greater susceptibility to some toxicants and physical agents has been demonstrated in children. Because the period from embryonic life to adolescence is characterized by growth and development, deleterious effects can occur at lower levels and be more severe or lead to effects that do not occur in adults; on the other hand, children can be more resilient because of better recuperative capacities.

Toxic exposures in utero have produced effects that are quite surprising, given the period or level of exposure. Cassidy et al[10] reported that exposure to the persistent organochlorine chlordane in utero at quite low levels causes significant long-term alterations in sexual behavior. These effects were evident at levels of exposure very similar to those experienced in homes in the United States when chlordane and heptachlor were universally applied as termiticides. Both of these chemicals produced marked changes in sexually dimorphic functions in rats; females exposed in utero developed masculine behaviors, and males showed exaggerated male mating behaviors. These observations suggest that these chemicals masculinized by mimicking steroid hormones or by changing hormone levels.

Of perhaps more specific interest are toxic exposures that affect the nervous system of the fetus, infant, and child. Because development of the nervous system is very specific in pattern and timing, exposure to various agents at critical periods of development can cause long-lasting or permanent injury. For instance, exposure to ethanol or methylmercury has been shown to affect neuronal proliferation in rodents and in other experimental models. Some agents such as ethanol, lead, methylmercury, and some pesticides seem to affect synaptogenesis. Each of the multiple processes of neural development has been shown to be affected by specific toxic agents, often at low doses but at critical periods of development.

The timing of exposure might be critical as well: for ionizing radiation, excess risk for leukemias and brain and thyroid cancer is higher for exposures that occur in childhood; the risk of breast cancer was highest for Japanese women exposed to ionizing radiation from the atomic bomb during puberty, although the risk also increased in women who were <10 years old (an age at which girls have little or no breast tissue) at the time of the explosion.[11] Similarly, sunburns in childhood seem to be particularly potent in increasing the risk of skin cancer later in life.[12] Exposure in childhood may also increase the risk of disease later in life simply because the duration of exposure can be much longer if it starts early. There is evidence, for instance, that the younger a person is when starting smoking, the higher the risk of lung cancer.[13]

Childhood Diseases Relevant to EMF Exposure

Some diseases are limited to the embryo, child, or adolescent; other diseases that occur in children and adults manifest themselves differently in children. Of particular relevance to EMF exposure are childhood leukemia and brain cancer. There is consistent evidence from epidemiologic studies of a risk of childhood leukemia associated with exposure to environmentally high levels of ELF magnetic fields. There is no explanation for this effect from laboratory studies. An increased risk of brain cancer has been investigated in relation to ELF exposures and has been raised particularly in the context of mobile-phone use and the absorption of RF signals by the brain, although there is no convincing evidence suggesting an increased risk. To put potential EMF effects in perspective and determine how EMFs might be involved in the development of these diseases, we provide a brief overview of rates and risk factors for them.

Childhood Leukemia

Leukemias are the most common cancer to affect children, accounting for 25% to 35% of all childhood malignancies. The biological heterogeneity of childhood leukemia is well documented; the major mor-

phologic types are acute lymphoblastic leukemia (ALL) and acute myeloblastic leukemia (AML).

The rate of leukemia for children <15 years old has been estimated to be ~4 per 100000 per year in the developed world and 2.5 per 100000 per year in the developing world." In developed countries, the incidence of leukemia rises rapidly after birth, peaking at ~3 years of age before declining and then rising steadily again throughout life. Thus, unlike many cancers, it has a short latency and a peak incidence early in life's that has resulted in many etiologic hypotheses, most notably those involving exposure to infections.[16]

Subtypes of AML and ALL are frequently characterized by genetic alterations, including changes in chromosome number (hyperdiploidy or hypodiploidy) and chromosomal translocations that may involve chimeric or fusion genes.[17,18] These genes include *MLL*, *TEL*, and *AML1*, all of which can fuse with many other genes and, in the case of *TEL* and *AML1*, with each other. There is strong evidence that this rearrangement may originate in utero, supported by data obtained from studies of identical twins or children with concordant ALL. Screening of newborn blood samples suggests that ~1% have the *TEL-AML1* gene fusion, 100 times the proportion of children that will develop ALL with a *TEL-AML1* gene fusion before the age of 15 years. This implies that the conversion of the preleukemic clone to overt disease is low and that development of childhood ALL is a multistep process requiring at least 1 prenatal event in combination with additional prenatal and/or postnatal events. Although the "first hit," the initiating in utero event, is believed to be common, the "second hit," possibly occurring postnatally, is rare and therefore acts as the rate-determining step in development of the disease.

As with most other cancers, the mechanism by which leukemia arises is likely to involve gene-environment interactions, the environmental exposures being derived from both endogenous and exogenous sources. Accordingly, it is important to identify exposures that either cause DNA damage and induce chromosome breaks that are repaired inadequately or act as promoters and/or progressers, ultimately leading to the overt expression of the disease. Exposures acting before birth and early in life have long been thought to be important determinants of leukemia; it is unfortunate that the evidence regarding the majority of suggested exposures is limited and often contradictory. Ionizing radiation given at large doses is one of the few known risk factors for leukemia.

Brain Cancer

CNS tumors account for ~20% of all malignancies in children <15 years old[19] but account for <2% of cancers in adults. CNS cancers in children occur in tissues of mesodermal or embryonic origin, but in adults they occur in epithelial tissues. Another difference between childhood and adult tumors is that adult tumors tend to occur in the cerebral hemispheres, whereas the majority of pediatric tumors are brainstem gliomas.

The international incidence rates of childhood CNS tumors (0–14 years) vary between developed and developing nations, with the higher rates observed in most Westernized countries reaching 3 per 100 000 per year compared with 1 to 2 per 100000 in other parts of the world.[19] Over recent decades, steady rises in the incidence of childhood CNS tumors have been observed in several populations of the United Kingdom, the United States, Japan, and Australia. The debate continues over whether these increases are "real" or an artifact of improved diagnostic practice and case finding by cancer registries.

The causes of CNS cancers are largely unknown, although up to 5% may be explained by genetic predisposition, associated with disorders such as neurofibromatosis type 1.[20,21] Having a parent or sibling with a CNS tumor also increases the risk. The identification of environmental risk factors for CNS tumors has generally been inconsistent.[20,21] Again, ionizing radiation given in therapeutic doses is one of the few known risk factors for CNS tumors.

CHILDREN'S EXPOSURE TO RF AND ELF FIELDS

In evaluating the potential role of environmental exposures in the development of childhood diseases, it is important to consider not only the fact that childhood exposures can be different from exposures during adulthood but also the fact that they can be highly age dependent. Exposures of interest during the preconception and gestation periods include residential and parental exposures to ELF and RF fields, including mothers' exposure from use of domestic appliances and mobile phones. Infants and toddlers are exposed mostly at home or at day care facilities. Among preteens, exposure sources expand to include mobile-phone use and sources at school, with an increased use of mobile phones in adolescence. Here we focus on 2 major exposure scenarios: residential ELF and RF exposures and exposure from mobile phones.

Residential Exposure

Everyone is exposed to ELF electric and magnetic fields at home.[22] High-voltage power lines are a major source of exposure for children who live near them; however, only ~1% of children live in close proximity to high-voltage lines. For most children, exposure to low-level fields from primary and secondary distribution wiring is continuous; short-duration and intermittent exposure to higher fields results from proximity to domestic appliances. ELF exposure also occurs at school, during transport, and often during mobile-phone use. Typical average magnetic fields in homes seem to be ~0.05 to 0.1 μT. Generally, magnetic fields in homes vary from country to country; geometric-mean fields are ~35 nT in the United Kingdom and 70 nT in the United States. This difference results from the supply voltage used in the United States (110 V) being approximately half that used in the United Kingdom (220 V), leading to approximately twice the electric current and magnetic field exposure. The fraction of homes with average fields above certain thresholds likewise varies; for example, 1% to 2% of homes in the United Kingdom and 10% in the United States have fields of >0.2

μT. Exposure to appliances has been estimated to be 30% of total exposure. Maximum fields experienced are typically in the tens of microtesla. There is evidence that younger children use appliances less (and spend less time outside the home), so their personal exposure is closer to and correlates better with the fields in the home.

RF fields are produced by radio and television broadcasts, mobile phones and base stations, and other communications infrastructure. Radio and television signals are broadcast to a large area from comparatively few sites. Mobile-phone base stations cover a smaller area and produce much lower emissions but are now much more common than radio and television stations (tens of thousands in many countries). Because of the width and angle of the RF signal beam and perturbation by the earth and building materials, there is little correlation between field strength and distance to the source. Typical power densities outdoors would be 0.01 to 1 $mW \cdot m^{-2}$ but could be orders of magnitude higher (ie, $\geq 100\ mW \cdot m^{-2}$). Depending on where the measurements are taken, base stations can be the largest individual Source of RF fields, but other sources such as radio or television transmitters can result in comparable or greater exposures. Indoor levels are often lower by orders of magnitude, because buildings screen fields. A European median indoor power density of 0.005 $mW \cdot m^{-2}$ has been reported.

Background environmental levels are the primary source of RF exposure for very young children. Potential sources of residential RF exposure to children are wireless in-house communications (eg, wireless monitors used in children's cribs, cordless phones, Wi-Fi) and mobile-phone use by someone in close proximity to a child, creating passive exposure. Because children <5 years of age usually spend most of their time at home, residential exposure can be a sufficient predictor of individual exposure.[22,23] RF exposure may be estimated more easily for children than for adults, because the variety of exposure sources is smaller. When they reach adulthood, today's children will have a much higher cumulative exposure to RF fields than today's adults.

At present, population exposure to RF fields has been much less characterized than ELF fields, partly because of technical challenges (lack of adequate measuring equipment), the rapid evolution of mobile-phone technology (frequency, coding schemes), and new patterns of use (duration of calls, short-message services). However, the main reason ELF fields are better understood than RF fields is that they have been studied more.

Mobile-Phone Use

Modem children will experience a longer period of exposure to RF fields from mobile-phone use than adults, because they started using mobile phones at an early age and are likely to continue using them. Data from a multinational case-control study of potential causes of adult brain cancer show that both the prevalence of regular mobile-phone users and daily use are highest in the younger age groups (eg, 19% of younger subjects made calls for >30 minutes a day, compared with 10% of older subjects).[24,25] Moreover, several recent trends (such as increased popularity, reduced price, and advertising to children) have led to increased mobile-phone use among children.[26] A steep increase in mobile-phone ownership among children has been reported in several public-opinion surveys.[27] For example, in Australia >90% of 6- to 9-year-olds reported sometimes using their parents' mobile phones, and in Germany approximately one third of 9- to 10-year-olds reported owning a mobile phone. Clearly, mobile phones are the dominant source of RF exposure for teens and preteens.

HEALTH-RISK ASSESSMENT

The workshop addressed the potential sensitivity of children at all stages of development from conception through to sexual maturity. The nature of any adverse health effect that ensues from exposure to an environmental toxicant depends not only on the timing and magnitude of the exposure but also on the mechanisms by which the toxicant interacts with the developing tissue or organ. As a consequence, it is not possible to generalize about the possible health effects that might ensue from exposure to an agent posing unknown risks to health by drawing parallels with other toxic agents unless they have very similar mechanisms of interaction. Instead, it is necessary to examine the experimental and epidemiologic evidence by formulating and testing hypotheses on the basis of an examination of the known and possible interaction mechanisms.

Health Risks to Children From ELF Fields

Exposure to ELF EMFs induces electric fields and currents within the body; guidance on exposure is based on avoiding the risks to health that result from the interaction of the induced fields and currents with electrically excitable nerve tissue, particular that of the CNS (see, for example, refs [28] and [29]). Present guidance on occupational exposure is based on a basic restriction on induced current density in the CNS of $10\ mA \cdot m^{-2}$, which approximates an electric field in CNS tissue of $\sim 100\ mV \cdot m^{-1}$. Guidance on public exposure incorporates an additional safety factor, reducing the basic restriction to $2\ mA \cdot m^{-2}$ ($20\ mV \cdot m^{-1}$). The basic restrictions are linked to external field strengths (referencelevels) through dosimetric calculation, which is based on realistic anatomic human models and measurements of the dielectric properties of human tissue. For general public exposure, the corresponding reference levels for power-frequency electric and magnetic fields are of the order of 5 kV/m and 100 μT, respectively.

Dosimetric calculations have not been conducted extensively for children and have not been undertaken for pregnant women and their unborn children. In general, adults exposed to ELF electric or magnetic fields have higher internal electric-field strengths and current densities than children because of size and shape differences. However, the distributions are different, and in children some tissues have higher field strengths and current densities for the same external field. Furthermore, children have sig-

pediatrics.org/cgi/doi/10.1542/peds.2004-2541 e307

nificantly higher internal field strengths and current densities from contact currents than do adults. Dose computations using anatomically correct models of children[30] reveal that modest, imperceptible current into the hand (10 μA) produces $\sim$50 mV . m^{-1} averaged across the lower-arm marrow of a small child and approximately $\geq$130 mV . m^{-1} in 5% of that tissue. During pregnancy, the magnitude and distribution of induced electric fields and currents in the mother will be different because of changes in body shape and will not have been assessed in the embryo or fetus. These factors, along with differences in dielectric properties, need to be taken into account in assessing health risk to children from ELF EMFs.

The guidance cited above was based on a consideration of laboratory evidence, including evidence from volunteer studies of magnetic phosphenes, and more recently on evidence from voltage-gated ion channel and neural-network behavior.[29] Neurobehavioral studies in volunteers and in animals, mostly in adults, have not reported robust responses to ELF exposure[31]; overall, any changes seen have been subtle, transient, and reversible. Workshop participants thought that there is no reason to suppose a greater Sensitivity of CNS neural networks and ion channels to induced electric fields in children or in the embryo or fetus. Reduced myelination seen in childhood and early adolescence was not thought likely to increase sensitivity either. It is not clear what the impart would be of an overabundance of synaptic connections seen in infants and early childhood, but any increased sensitivity was considered to be covered by the more restrictive guidance on public exposure.

The evidence that induced electric fields might affect development of the nervous system and other tissue was discussed at the workshop in some detail. Evidence was presented that endogenous direct current electric fields of 10 to 100 V . m^{-1} played a role in prenatal development. There is little evidence regarding susceptibility to ELF electric fields, although it was thought that there is no reason to suppose greater Sensitivity. It was noted that the direct-current electric fields were several orders of magnitude above present guidance values. However, the possible influence of such fields on synaptogenesis and/or synapse elimination is not known.

Results from several independent research groups suggest that exposure to ELF magnetic fields at microtesla levels may disturb early development of bird embryos. However, replication attempts have been unsuccessful in some laboratories. Results from experiments with other nonmammalian experimental models (fish, sea urchins, and insects) have also suggested subtle effects on developmental stability.[32] In mammals, prenatal exposure to ELF magnetic or electric fields does not result in strong adverse effects on development. Some effects of magnetic (or combined electric and magnetic) fields on postnatal development have been reported, but evaluation of the consistency of the findings is difficult because of the varying methods and approaches used in different studies.

Numerous epidemiologic studies of various pregnancy outcomes in relation to EMFs are available in the scientific literature. They include studies investigating the use of video display terminals, electric blankets, or heated waterbeds, as well as studies of parental occupational exposure. Most studies have found no effects, but these studies have been limited in exposure assessment and lacked the power to examine high exposure levels. Two studies have included personal measurements of ELF exposure and reported effects on spontaneous abortion in relation to maximum measured magnetic fields.[33,34] The possibility of exposure assessment bias in these studies has been discussed, and results need to be confirmed. in additional studies before firm conclusions can be drawn.

The potential cancer risks to children of exposure to ELF EMF, estimated from residential proximity to power sources and from measured fields, have been investigated in relation to in utero and postnatal time periods and to paternal exposure. No consistent associations have been observed for childhood CNS tumors.[35] One recent study[36] found an increased risk of childhood leukemia with high maternal occupational exposure during pregnancy.

An increased risk of childhood leukemia has been found to be consistently associated with exposure to environmental levels of power-frequency magnetic fields at levels very much below present guidance. Initial studies used a surrogate for magnetic fields (known as wire codes) that was based on distance and thickness of power lines near the residence.[37] As instruments became available, the focus shifted to measured or calculated magnetic fields. Results of dozens of increasingly sophisticated studies and the 2 pooled analyses have reported a doubling of risk for children exposed to magnetic fields >0.3 to 0.4 μT compared with children exposed to fields <0.1 μT.[38,39] Although a number of factors, including socioeconomic status, have been evaluated as confounders, substantial confounding has not been identified. However, because of limited knowledge of the etiology of childhood leukemia, it is difficult to exclude the possibility of some yet-tc–be-identified confounder or of confounding by a combination of factors. Nevertheless, substantial confounding of the observed association, it seems to us, is unlikely. Although these results are also not likely to be a result of chance, bias cannot be ruled out.[40] An epidemiologically detectable risk of leukemia for children, but not for adults, might result from either better exposure assessment for children or from greater susceptibility in children.

At present there is no experimental evidence that supports the view that this relationship is causal; however, few animal studies have been conducted using animal models of the predominant form of childhood leukemia, and most carcinogenesis bioassays begin when animals are sexually mature. In addition, there is no biophysical explanation for biologically significant interactions at these low field values, so if the association is causal, then there is currently no scientific explanation. Two hypotheses for such effects were discussed at the workshop.

One hypothesis discussed at the workshop proposed that the association of power-frequency mag-

netic fields with childhood leukemia may result from the flow of electric current through the bone marrow of children after contact with water fixtures or a water stream in which a small voltage difference exists as a result of the grounding of the residential electrical system to the water pipe.[41] Calculation shows that potentially significant electric fields (more than ~100 $mV \cdot m^{-1}$) may be induced in the bone marrow in these circumstances; this lends biological plausibility to the proposed mechanism. The effect of such weak electric fields in inducing effects in hematopoietic tissue that might increase the risk of ALL, possibly by affecting preleukemic clones (see above), has not been investigated.

A second hypothesis suggested that exposure to power-frequency magnetic fields increases the risk of childhood leukemia through disruption of the nocturnal production of melatonin in the pineal gland.[42] Although the International Commission on Non-ionizing Radiation Protection[43] concluded that there is no convincing evidence of an effect, subtle effects on melatonin physiology are not easily excluded, and such studies have not been conducted specifically on children.

Recommendations were made for additional research regarding the association between exposure to power-frequency magnetic fields and childhood leukemia; it is clear that this issue is unresolved. Although such scientific uncertainty remains, the WHO recommends the adoption of precautionary measures for the protection of children (see below).

Health Risk to Children From RF Fields

Exposure to RF radiation induces heating in body tissues and imposes a heat load on the whole body; guidance on exposure is based on avoiding the risks to health that result from localized rises in tissue temperature and from the physiologic stress engendered by excessive whole-body heat loads.[28,29] Present guidance on occupational exposure is based on restricting the RF-induced whole-body specific absorption rate (SAR) to <0.4 $W \cdot kg^{-1}$, a heat load sufficiently small that its contribution to other possible heat loads, generated from hard physical work and/or imposed by high ambient temperatures, can be neglected. Basic restrictions on localized SARs, averaged over any 10 g of contiguous tissue, are 10 $W \cdot kg^{-1}$ in the head and trunk and 20 $W \cdot kg^{-1}$ in the limbs.[28] These are intended to restrict local tissue temperature rises to acceptable levels. Guidance on public exposure incorporates an additional safety factor of 5, reducing the basic restrictions to 0.08 $W \cdot kg^{-1}$ to the whole body and 2 $W \cdot kg^{-1}$ to the head. Temperatures are derived from dosimetric calculation and thermal modeling; SARs are also related to external field values via dosimetric calculation. The corresponding reference levels, which for RF fields are power densities, are frequency dependent and are of the order of 10 $W \cdot m^{-2}$ at 1800 MHz for general public exposure.

Dosimetric calculation has for more than a decade allowed for differences in body size between children and adults, and these differences have been factored into guidance. Despite large differences in the size, shape, and tissue distribution of heads, the SAR values and exposure variations for child models are similar to those for adults, although somewhat higher. In addition, the relative depth of penetration is larger for children, a logical consequence of smaller head diameter. Dielectric studies encompassing several tissue types, including brain, obtained from newborn to fully grown rats, mice, and rabbits exposed to RF EMF in the frequency ranges of 130 MHz to 10 GHz and 300 kHz to 300 MHz report large, age-related variations in the permittivity and conductivity of brain tissue and even larger variations for skin and skull tissue.[44–46] Thus, there is a need for dosimetric modeling of the distribution of SAR and temperature in children and also a requirement for appropriate age-related values for the dielectric properties of tissue.

In addition, the distribution of SAR and temperature should be addressed in pregnancy, taking into account the fact that the circulation of blood in the fetus is separate from maternal blood flow. The heat produced by fetal metabolism is dissipated to the mother mostly at the placenta, but this is less efficient than expected and the temperature of the fetus is usually ~0.5°C above that of the mother.[47]

The differencebetween the ability of children and that of adults to dissipate whole-body heat loads is small During exercise in thermally neutral or warm environments, children thermoregulate as effectively as adults. When ambient temperatures exceed body temperature, however, children are more liable to have a higher rate of heat absorption compared with adults. Also, although neither children nor adults replace fluid loss sufficiently during exercise in the heat, dehydration may have a more detrimental effect on children because of their greater reliance on elevated skin blood flow to dissipate heat.

Hyperthermia during pregnancy can cause embryonic death, abortion, growth retardation, and developmental defects; animal studies indicate that the development of the CNS is especially susceptible.[48] In humans, epidemiologic studies suggest that an elevation of maternal body temperature by 2°C for at least 24 hours during fever can cause a range of developmental defects, although a causal relationship has not been established. In addition, young infants aged 2 to 3 months are even more vulnerable than neonates because of their higher metabolic rate, better tissue insulation, and slightly lower surface area/mass ratio. However, serious health effects are associated only with greatly elevated body temperatures (>40°C), and such temperature rises are well above the maximum allowable for public RF exposure.

Many different nonthermal mechanisms for RF interaction with tissue have been considered in recent studies.[48–50] These are not particular to children, but if any were mnfitmed at levels below current guidance, then questions might also be raised about potential childhood susceptibility. Possible RF electric-field interactions[51] include (1) changes in the conformation of proteins, including ATPases associated with ion channels, resulting in functional changes in the proteins, (2) changes in the binding of

ligands such as Ca^{2+} to cell receptor proteins, also resulting in changed receptor function, (3) absorption of RF energy by the vibrational states of biological components such as microtubules, (4) enhanced attraction between cells (the pearl-chain effect), and (5) demodulation of a modulated RF signal, producing ELF electric fields. Generally, it was considered that such interactions are unlikely to be biologically significant at RF levels below guidance values.

In addition, there is evidence concerning RF interactions with magnetite affecting nearby ion channel function by exerting a torque. Possible RF magnetic field effects include (1) interaction with magnetite particles in biological tissue and (2) radical pair interactions, potentially increasing free-radical concentrations, thereby leading to an increased risk of oxidative damage. Although these interaction mechanisms are also considered unlikely to be of biological significance at RF levels below guidance values, given the l i i between free radicals and disease, RF effects on free-radical concentrations via radical-pair interactions are considered worth exploring.

For infant, childhood, and adolescent exposure, the maturation of the CNS has been raised as potentially susceptible. In this context, the major changes to the CNS during this period comprise a maturation of the hard-wiring (namely, increased myelination), facilitating the transmission of information, which occurs rapidly over the first 2 years but extends into the second decade of life, and remodeling of the synaptic connections between neurons[8] after the first 2 years and into adolescence, mostly by synapse elimination as redundant connections are lost. With regard to synaptogenesis, spontaneous and stimulus-evoked electrical activity in the CNS is believed to play a crucial role in local competition between growing nerve axons and the distribution of their synaptic boutons on target cells.[52] Whether RF fields could affect these processes is not known. Neurobehavioral studies in volunteers and in animals, mostly adults, have not reported robust responses to RF exposure, particularly that associated with mobile phones."

Numerous studies have evaluated developmental effects of RF fields on mammals, birds, and other nonmammalian species.[53,54] These studies have shown clearly that RF fields are teratogenic at exposure levels that are high enough to cause significant increases in temperature. There is no consistent evidence of effects at nonthermal exposure levels, although only a few studies have evaluated possible effects on postnatal development using sensitive end points such as behavioral effects.

Several studies of maternal occupational RF exposure, primarily to physiotherapists, have reported an increased risk of congenital malformations. However, no specific type of malformation has been consistently reported, and there is a potential for recall bias in these studies. Exposure to the fetus from a mobile phone kept in a pocket, handbag, or belt by the hip when a pregnant woman is using hands-free equipment has been mentioned. Thus far, no studies are available on pregnancy outcomes related to mobile telephony.

All the studies have reported negative results for carcinogenicity in normal animals at SARs compatible with mobile telephony,[55] although controversy still exists about the carcinogenic effects of RF radiation in a transgenic mouse model.[56] Two studies in particular reported the lack of an effect of perinatal RF exposure, continuing for 24 months, on spontaneous and chemically induced brain tumors in rats.[57,58]

Several ecological studies[59–66] have examined cancer risk, including risk of childhood leukemia, among populations living in proximity to radio and television broadcast towers. Often driven by a previously identified cluster, these analyses are based simply on distance from the source and often include an extremely small number of cases. Such studies have been uninformative. More rigorous investigations might be feasible with development of new instruments capable of capturing personal RF exposure.

Few relevant epidemiologic or laboratory studies have addressed the possible effects of RF exposure on children. Because of widespread use of mobile phones among children and adolescents and relatively high exposures to the brain, investigation of the potential effects of RF fields on the development of childhood brain tumors is warranted. The importance of longer lifetime exposure has been emphasized by a recent study[67] in which acoustic neuroma occurred only after 10-year use of mobile phones. The type of mobile-phone use among children (eg, text messaging), their potential biological vulnerability, and longer lifetime exposure make extrapolation from adult studies problematic. Such scientific uncertainty can be addressed through both the application of precautionary policies and through additional research.

DEVELOPING POLICY FOR CHILDREN AND PREGNANT WOMEN

In today's world, technologic developments bring both social and economic benefits to large sections of society; however, the health consequences of these developments can be difficult to predict and manage. Nevertheless, even if the effects are small, a widespread exposure can have large public health consequences. When risks are complex, an established cause-effect relationship is absent, or the scientific findings are not robustly quantifiable, the need for timely preventive action makes a precautionary approach an essential part of policy making. Many societies believe that this is particularly hue regarding children (including the unborn child): they represent the future of the society, have the potential for longer exposure than adults, and yet are less able to manage their own risk.

International guidance on occupational and public exposure to EMFs, described above, is based on avoiding risks to health that are well understood and for which there is good scientific evidence. However, with regard to childhood exposure to EMFs (and exposure during pregnancy), several factors argue for the adoption of precautionary measures, including the possibility that EMFs might affect children;

the dread with which some of the diseases raised in this context, such as leukemia and brain cancer, are perceived; the involuntary nature of some of the exposure; its extensiveness; and its likely rapid growth in the future.

The WHO International EMF Project (www.who.int/emf) is finalizing a practical framework for guiding policy options in areas of scientific uncertainty that is based on the application of precaution.[68] In general terms, the draft WHO precautionary framework aims to develop a set of public health policy options that can be applied according to the degree of scientific uncertainty and the anticipated severity of the harm that might ensue from exposure, taking into account the size of the affected population and the cost of exposure reduction. These measures should not be seen as undermining science-based guidance on exposure; rather, they represent additional steps with application that may vary from country to country depending on social and economic considerations.

Precautionary measures may also be adopted at an individual level, depending on the degree of concern felt by the exposed person. In giving advice to their patients, physicians should weigh the strength of scientific evidence for the risk, if any, of an adverse outcome, the benefits of the technology, and the feasibility of reducing exposure, as well as the overall health of the patient, which includes freedom from worry and anxiety.

For ELF (power-frequency) fields, there is some evidence that exposure to environmental magnetic fields that are relatively high but well below guidance levels is associated with an increase in the risk of childhood leukemia, a very rare disease (even if the risk is doubled, it remains small at ~5–8 per 100 000 children per year). Although the evidence is regarded as insufficient to justify more restrictive limits on exposure, the possibility that exposure to ELF magnetic fields increases risk cannot be discounted. For the physician faced with questions from, for example, a couple planning a family and concerned about this issue, or from someone pregnant and occupationally exposed to relatively high ELF magnetic fields, standardized advice is not possible. Instead, physicians could inform their patients of possible risk and advise them to weigh all the advantages and disadvantages of the options available to them (of which EMF reduction is but one consideration). Some simple options include reducing exposure by minimizing the use of certain electrical appliances or changing work practices to increase distance from the source of exposure. People living near overhead power lines should be advised that such proximity is just an indicator of exposure and that homes far away from power lines can have similar or higher fields.

Regarding the long-term health effects of mobile-phone use, the paucity of data, particularly for children, suggests that low-cost precautionary measures are appropriate, especially because some of the exposures are close to guideline limits. Physicians could advise parents that their children's RF exposure can be reduced by restricting the length of calk or by using hands-free devices to keep mobile phones away from the head and body. On the other hand, exposure levels from mobile-phone base stations are extremely low, and therefore precautionary measures do not need to be recommended.

RESEARCH RECOMMENDATIONS

In addition to reviewing the available evidence summarized in this article, workshop participants developed a research agenda that identifies high-priority studies needed to fully assess the potential vulnerability of children to ELF and RF fields and outlines the rationale for these studies (see www.who.int/peh-emf/research/rf03/en for more details). Additional laboratory and epidemiologic studies relating to childhood leukemia and ELF magnetic field exposure were strongly recommended. In addition, because of widespread use of mobile phones and relatively high exposures to the brain among children and adolescents, investigation of the potential effects of RF fields on cognition and the development of childhood brain tumors was considered particularly urgent. Laboratory studies using children are, of course, subject to appropriate ethical design and approval.

APPENDIX: GLOSSARY

Absorption: dissipation of the energy of a radio wave (ie, conversion of its energy into another form, such as heat) into the surrounding medium.

Basic *restriction:* restriction on exposure to time-varying electric, magnetic, and electromagnetic fields that are based directly on established health effects. Depending on the frequency of the field, the physical quantities used to specify these restrictions are current density (J), SAR, and power density (S). Only power density in air, outside the body, can be readily measured in exposed individuals.

Contact current current flowing through a person in contact with 2 surfaces that are at different potentials.

Current density: a vector of which the integral over a given surface is equal to the current flowing through the surface; the mean density in a linear conductor is equal to the current divided by the cross-sectional area of the conductor; expressed in ampere per square meter (A/m^2).

Dosimetry: measurement or determination by calculation of the internal electric-field strength or induced current density, or of the specific absorption (SA) or SAR distribution in humans or animals exposed to EMF.

Electric field or electric-field strength (E): the force (E) on a stationary unit positive charge at a point in an electric field; measured in volts per meter (V/m).

Electric and magnetic fields or electromagnetic fields (EMFs): the combination of time-varying electric and magnetic fields.

Extremely low frequency (ELF) EMFs: EMFs at frequencies of >0 Hz and <300 Hz.

Field strength: the magnitude of the electric or magnetic field, normally the root-mean-square value.

Frequency: the number of sinusoidal cycles completed by electromagnetic waves in 1 second; usually expressed in units of hertz (Hz).

Induced *current:* current induced in a human body exposed to EMF.

Magnetic field or *magnetic* field strength *(H):* an axial vector quantity, H, which, together with magnetic induction, specifies a magnetic field at any point in space; expressed in units of ampere per meter **(A/m²).**

Magnetic flux densify (B): a vector lield quantity, **B,** that results in a force that acts on a moving charge or charges; expressed in tesla (T) or gauss (G).

Nonionizing radiation: includes all radiation and fields of the electromagnetic spectrum that do **not** normally have sufficient energy to produce ionization in matter; characterized by energy per photon less than −12 eV, wavelengths >100 nm, and frequencies <3 x 10^{14} Hz.

Power density: the rate of electromagnetic energy flow crossing a **unit** area normal to the direction of wave propagation; expressed in watts per square meter **($W \cdot m^{-2}$).**

Power frequency: the frequency at which alternating-current electricity **is** generated. For electric utilities, the power frequency is *60 Hz in* North America, Brazil, and parts of Japan. Electric power is 50 Hz in much of the rest of the world. Isolated alternating-current electrical system may have other power frequencies, eg, 440 Hz in commercial airliners and 16⅔ Hz in some railway systems.

Radiation (electromagnetic): the emission or transfer of energy through space in the form of electromagnetic waves.

Radio frequency (RF): any frequency at which electromagnetic radiation is useful for telecommunication. In **this** article, RF refers **to** the frequency range of 10 MHz to *300* GHz.

Reference level: EMF exposure level provided for practical exposure-assessment purposes to determine if basic restrictions are likely to be exceeded. Some reference levels are derived from relevant basic **restrictions** using measurement and/or computational ***techniques,*** and some address perception and adverse indirect effects of exposure to EMF.

Specific absorption: the energy absorbed per unit mass of biological **tissue,** expressed in joules per kilogram (J/kg); specific absorption is the time integral of the **SAR.**

Specific absorption rate (SAR): the rate at which energy is absorbed in body **tissues;** expressed in watts per kilogram (W/kg); SAR is the dosimetric measure **that** has **been** widely adopted at frequencies above −100 kHz.

ACKNOWLEDGMENTS

The workshop was funded by the World Health Organization, Electric Power Research Institute, the European programs EMF-NET and COST281, and Statens Strålskyddsinstitut of Sweden.

We are gratefulto all participants of the expert group (see www.who.int/peh-emf/research/rf03/en for a list of invited experts); Gail Lundell for scientific editing; and Sarah Bullock and Riti Shimkhada for all organizational aspects.

REFERENCES

1. International Agency for Research on Cancer. *Non-ionizing Radiation. Part 1: Static and Extremely Low-Frequency Electric and Magnetic Fields.* IARC Monographs an the Evaluation ofCarcinogenic Risk to Humans. Lyon, France: *International Agency for* Research *on Cancer;* 2002:80
2. Independent Expert Group on Mobile Phone. Report of the group (the Stewart Report). 2000 Available at: www.iegmp.org uk/report/index.htm. Accessed May 8.2005
3. European Cooperation in the field of Scientific and Technical Research 281. European Cooperation in the Field of Scientificand Technical Research workshop *on* mobile communication and children. 2002. Available at: www.cost281.org/documents.php?node=11&dir_session=. Ad—— June 8,2005
4. Health Council of the Netherlands. Mobile phones: an *evaluation of the* health effects. 2002. Available at: www.gr.nl/zoeken.php?zoek=Mobile+telphones%3B+an+evaluation+of+health+effects&Zoeken=Search. Accessed June 8, 2005
5. *National* Radiological Protection Board. *Mobile Phones and Health 2004.* Chilton, United Kingdom: National Radiological Protection Board; 2004
6. Brent RL, Weitzman M, eds. The vulnerability, sensitivity, and resiliency of the developing embryo, infant, child. and adolescent lo the effects of environmental chemicals, drugs, and physical agents as compared to the adult. *Pediatrics.* 2004;113(suppl):931–1172. Theme issue
7. Kimler BF. Prenatal irradiation: a major concern lor the developing brain. *Int J Radiat* Bid. 1998;73:423–434
8. Rodier PM. Environmental causer of central nervous system maldevelopment. *Pediatrics. 2004;113(4 suppl):1076–1083*
9. Greim HA The endocrine and reproductive system: adverse effects of hormonally active substances? *Pediatrics.* 2004;113(4 suppl):1070–1075
10. Cassidy RA, Vorhees CV, Minnema DJ, Hastings L. The effects of *chlordane exposure* during pre- and postnatal periods at environmentally relevant levels *on* sex steroid-mediated behaviors and functions in the rat. *Toxicol Appl Pharmacol.* 1994;126:326–337
11. United Nations Scientific Committee on the Effects of Atomic Radiation. *Sources, Effects and Risks of Ionizing Radiation; UNSCEAR 2000 Report to the* Gourd *Assembly.* New York. N Y United Nations Scientific Committee on the Effects of Atomic Radiation, United Nations; 2000
12. Nole G, Johnson AW. *Am* analysis of cumulative lifetime solar ultraviolet radiation exposure and the benefits of daily sun protection. *Dermatol Ther. 2004;17(suppl 1):57–62*
13. Wiencke JK, Thurston SW, Kelsey KT. et al. Early age at smoking initiation and tobacco carcinogen DNA damage in the lung. *J Natl Cancer Inst.* 1999;91:614–619
14. International Association of Cancer Registries. *Cancer Incidence, Mortality and Prevalence Worldwide.* Lyon, France: Globocan; 2000
15. Linet MS, Devesa SS. Descriptive epidemiology of childhood leukemia. *Br J Cancer.* 1991;63:424–429
16. Mezei G, Kheifets L Clues lo the possible viral etiology of childhood *leukemia. Technology. 2002;9:3–14*
17. Greaves M. Childhood leukemia. *BMJ.* 2002;324:283–287
18. Lightfoot T. Aetiology of childhood leukemia. *Bioelectromagnetics.* 2005; In press
19. Parkin DM, Kramarova E, Draper GJ, et al. *International Incidence of Childhood Cancer.* Lyon, France: International Agency for Research on Cancer; 1998:2. IARC Scientific Publication No. 144
20. Linet MS, Wacholder S, Zahm SH. Interpreting epidemiologic research: lessons from studies of childhood cancer. *Pediatrics.* 2003;112(1 pt 2): *218–232*
21. Little J. *Epidemiology of Childhood Cancer.* Lyon, France: International Agency for Research on Cancer; 1999. IARC Scientific Publication No. 149.
22. Friedman DR, Hatch EE, Tarone R, et al. Childhood exposure to magnetic fields: residential area measurements compared to personal dosimetry. *Epidemiology.* 1996;7:151–155
23. Schuz J, Grigat JP, Stormer B, Rippin G, Brinkmann K, Michaelis J. Extremely low frequency magnetic fields in residences in Germany. Distribution of measurements, comparison of two methods for assessing exposure, and predictors for the occurrence of magnetic fields above background level. *Radiat Environ Biophys.* 2000;39:233–240
24. Cardis E, Kilkenny M. International case-control study of adult brain, *head and neck tumours: results* of the feasibility study. *Radiat Prot Dosimetry.* 1999;83:179–178
25. Christensen HC, Schuz J, Kosteljanetz M, Poulsen HS, Thomsen J, Johansen C. Cellular telephone use and risk of acoustic neuroma. *Am J Epidemiol.* 2004;159:277–283
26. Schuz J. Mobile phone exposures in children. *Bioelectromagnetics.* 2005; In press
27. Böhler E, Schüz J. Cellular telephone use among primary school children in Germany. *Eur J Epidemiol.* 2004;19:1043–1050
28. International Commission *on Non-ionizing Radiation Protection.* Guidelines for limiting exposure to time-varying electric, magnetic, and

electromagnetic fields (up to 300 GHz) [published correction appears in *Health Phys.* 1998;75:442]. *Health Phys.* 1998;74:494–522
29. National Radiological Protection Board. *Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0–300 GHz).* Chilton, United Kingdom: National Radiological Protection Board; 2004
30. Dawson TW, Caputa K, Stuchly MA, Kavet R. Electric fields in the human body resulting from 60-Hz contact currents. *IEEE Trans Biomed Eng.* 2001;48:1020–1026
31. Sienkiewicz Z. Neurobehavioural effects of electromagnetic fields. *Bioelectromagnetics.* 2005; *In press*
32. Juutilainen J. Developmental effects of electromagnetic fields. *Bioelectromagnetics.* 2005; *In press*
33. Lee GM, Neutra RR, Hristova L, Yost M, Hiatt RA. A nested case-control study of residential and personal magnetic field measures and miscarriages [published correction appears in *Epidemiology.* 2003;14:255]. *Epidemiology.* 2002;13:21–31
34. Li DK, Odouli R, Wi S, et al. A population-based prospective cohort study of personal exposure to magnetic fields during pregnancy and the risk of miscarriage. *Epidemiology.* 2002;13:9–20
35. Kheifets L. Electric and magnetic field exposure and brain cancer. *Bioelectromagnetics.* 2001;5:5120–5131
36. Infante-Rivard C, Deadman JE. Maternal occupational exposure to extremely low frequency magnetic fields during pregnancy and childhood leukemia. *Epidemiology.* 2003;14:437–441
37. Kheifets L, Kavet R, Sussman S. Wire codes, magnetic fields, and childhood cancer. *Bioelectromagnetics.* 1997;18:99–110
38. Ahlbom A, Day N, Feychting M, et al. A pooled analysis of magnetic fields and childhood leukemia. *Br J Cancer.* 2000;83:692–698
39. Greenland S, Sheppard A, Kaune W, Poole C, Kelsh M. A pooled analysis of magnetic fields, wire codes, and childhood leukemia. Childhood Leukemia-EMF Study Group. *Epidemiology.* 2000;11:624–634
40. Kheifets L, Shimkhada R. Childhood leukemia and EMF: Review of the epidemiologic evidence. *Bioelectromagnetics.* 2005; *In press*
41. Kavet R. Contact current hypothesis: summary of results to date. *Bioelectromagnetics.* 2005; *In press*
42. Henshaw D, Reiter R. Contact current hypothesis: summary of results to date. *Bioelectromagnetics.* 2005; *In press*
43. International Commission on Non-Ionizing Radiation Protection. *Exposure to Static and Low Frequency Electromagnetic Fields: Biological Effects and Health Consequences (0–100 kHz).* Munich, Germany: ICNIRP; 2003
44. Thurai M, Goodridge VD, Sheppard RJ, Grant EH. Variation with age of the dielectric properties of mouse brain cerebrum. *Phys Med Biol.* 1984; 29:1133–1136
45. Thurai M, Steel MC, Sheppard RJ, Grant EH. Dielectric properties of developing rabbit brain at 37 degrees C. *Bioelectromagnetics.* 1985;6:235–242
46. Peyman A, Rezazadeh AA, Gabriel C. Changes in the dielectric properties of rat tissue as a function of age at microwave frequencies [published correction appears in *Phys Med Biol.* 2002;47:2187–2188]. *Phys Med Biol.* 2001;46:1617–1629
47. Edwards MJ, Saunders RD, Shiota K. Effects of heat on embryos and foetuses. *Int J Hyperthermia.* 2003;19:295–324
48. Adair RK. Biophysical limits on athermal effects of RF and microwave radiation. *Bioelectromagnetics.* 2003;24:39–48
49. Foster KR. Thermal and nonthermal mechanisms of interaction of radiofrequency energy with biological systems. *IEEE Trans Plasma Sci.* 2000; 28:15–23
50. Pickard WF, Moros EG. Energy deposition processes in biological tissue: nonthermal biohazards seem unlikely in the ultra-high frequency range. *Bioelectromagnetics.* 2001;22:97–105
51. Challis L. RF interaction mechanisms. *Bioelectromagnetics.* 2005; In press
52. Advisory Group on Non-ionising Radiation. *Health Effects Related to the Use of Visual Display Units. Report of and Advisory Group on Non-ionising Radiation.* Vol 5. Chilton, United Kingdom: National Radiological Protection Board; 1994
53. Advisory Group on Non-ionising Radiation. *Health Effects From Radiofrequency Electromagnetic Fields. Report of an Independent Advisory Group on Non-ionising Radiation.* Vol 14. Chilton, United Kingdom: National Radiological Protection Board; 2003
54. Heynick LN, Merritt JH. Radiofrequency fields and teratogenesis. *Bioelectromagnetics.* 2003;(suppl 6):S174–S186
55. Anane R, Dulou PE, Taxile M, Geffard M, Crespeau FL, Veyret B. Effects of GSM-900 microwaves on DMBA-induced mammary gland tumors in female Sprague-Dawley rats. *Radiat Res.* 2003;160:492–497
56. Repacholi MH, Basten A, Gebski V, Noonan D, Finnie J, Harris AW. Lymphomas in E mu-Pim1 transgenic mice exposed to pulsed 900 MHZ electromagnetic fields. *Radiat Res.* 1997;147:631–640
57. Adey WR, Byus CV, Cain CD, et al. Spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fischer 344 rats exposed to frequency-modulated microwave fields. *Cancer Res.* 2000;60:1857–1863
58. Adey WR, Byus CV, Cain CD, et al. Spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fischer 344 rats chronically exposed to 836 MHz modulated microwaves. *Radiat Res.* 1999;152:293–302
59. Maskarinec G, Cooper J, Swygert L. Investigation of increased incidence in childhood leukemia near radio towers in Hawaii: preliminary observations. *J Environ Pathol Toxicol Oncol.* 1994;13:33–37
60. Hocking B, Gordon IR, Grain HL, Hatfield GE. Cancer incidence and mortality and proximity to TV towers [published correction appears in *Med J Aust.* 1997;166:80]. *Med J Aust.* 1996;165:601–605
61. Dolk H, Elliott P, Shaddick G, Walls P, Thakrar B. Cancer incidence near radio and television transmitters in Great Britain. II. All high power transmitters. *Am J Epidemiol.* 1997;145:10–17
62. Dolk H, Shaddick G, Walls P, et al. Cancer incidence near radio and television transmitters in Great Britain. I. Sutton Coldfield transmitter. *Am J Epidemiol.* 1997;145:1–9
63. McKenzie DR, Yin Y, Morrell S. Childhood incidence of acute lymphoblastic leukemia and exposure to broadcast radiation in Sydney—a second look. *Aust N Z J Public Health.* 1998;22(3 suppl):360–367
64. Michelozzi P, Capon A, Kirchmayer U, et al. Adult and childhood leukemia near a high-power radio station in Rome, Italy. *Am J Epidemiol.* 2002;155:1096–1103
65. Cooper D, Hemmings K, Saunders P. Re: "Cancer incidence near radio and television transmitters in Great Britain. I. Sutton Coldfield transmitter"; II. All high power transmitters. *Am J Epidemiol.* 2001;153:202–204
66. Sue Kyung Park, Mina Ha, Hyung-Jun Im. Ecological study on residences in the vicinity of AM radio broadcasting towers and cancer death: preliminary observations in Korea. *Int Arch Occup Environ Health.* 2004;77:387–394
67. Lonn S, Ahlbom A, Hall P, Feychting M. Mobile phone use and the risk of acoustic neuroma. *Epidemiology.* 2004;15:653–659
68. Kheifets LJ, Hester GL, Banerjee GL. The precautionary principle and EMF: implementation and evaluation. *J Risk Res.* 2001;4:113–125

EXHIBIT M

World Health Organization

What are electromagnetic fields?

Definitions and sources

Electric fields are created by differences in voltage: the higher the voltage, the stronger will he the resultant field. **Magnetic fields** are created when electric current flows: the greater the current, the stronger the magnetic field. ***An*** electric field will exist even when there is no current flowing. If current does flow, the strength of the magnetic field will vary with power consumption hut the electric field strength will he constant.
(Extract from **Electromagnetic fields** published by the WHO Regional Office for Europe in 1999 (Local authorities, health and environment briefing pamphlet series; **32).**

Natural sources of electromagnetic fields

Electromagnetic fields are present everywhere in our environment hut are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms. The earth's magnetic field causes a compass needle to orient in a North-South direction and is used by birds and fish for navigation.

Human-made sources of electromagnetic fields

Besides natural sources the electromagnetic spectrum also includes fields generated by human-made sources: X-rays are employed to diagnose a broken limb after a sport accident. The electricity that comes out of every power socket has associated low frequency electromagnetic fields. And various kinds of higher frequency radiowaves are used to transmit information – whether via TV antennas, radio stations or mobile phone base stations.

The basics of wavelength and frequency

What makes the various forms of electromagnetic fields so different?
One of the main characteristics which defines an electromagnetic field (EMF) is its frequency or its corresponding wavelength. Fields of different frequencies interact with the body in different ways. One can imagine electromagnetic waves as series of very regular waves that travel at an enormous speed, the speed of light. The frequency simply describes the number of oscillations or cycles per second, while the term wavelength describes the distance between one wave and the next. Hence wavelength and frequency are inseparably intertwined: the higher the frequency the shorter the wavelength.

A simple analogy should help to illustrate the concept: Tie a long rope to a door handle and keep hold of the free end. Moving it up and then down slowly will generate a single big wave; more rapid motion will generate a whole series of small waves. The length of the rope remains constant, therefore, the more waves you generate (higher frequency) the smaller will he the distance between them (shorter wavelength).

What is the difference between non-ionizing electromagnetic fields and ionising radiation?
Wavelength and frequency determine another important characteristic of electromagnetic fields: Electromagnetic waves are canied by particles called quanta. Quanta of higher frequency (shorter wavelength) waves carry more energy than lower frequency (longer wavelength) fields. Some electromagnetic waves carry ***so*** much energy per quantum that they have the ability to break bonds between molecules. In the electromagnetic spectrum, gamma rays given off by radioactive materials, cosmic rays and X-rays carry this property and are called 'ionizing radiation'. Fields whose quanta are insufficient to break molecular bonds are called 'non-ionizing radiation'. Man-made sources of electromagnetic fields that form a major part of industrialized life - electricity, microwaves and radiofrequency fields – are found at **the** relatively **long** wavelength and low frequency end of the electromagnetic spectrum and their quanta are unable to break chemical bonds.

Electromagnetic fields at low frequencies

EXHIBIT M

Electric fields exist whenever a positive or negative electrical charge is present. They exert forces on other charges within the field. The strength of the electric field is measured in volts per metre (V/m). Any electrical wire that is charged will produce an associated electric field. This field exists even when there is no current flowing. The higher the voltage, the stronger the electric field at a given distance from the wire.

Electric fields are strongest close to a charge or charged conductor, and their strength rapidly diminishes with distance from it. Conductors such as metal shield them very effectively. Other materials, such as building materials and trees, provide some shielding capability. Therefore, the electric fields from power lines outside the house are reduced by walls, buildings, and trees. When power lines are buried in the ground, the electric fields at the surface are hardly detectable.

Magnetic fields arise from the motion of electric charges. The strength of the magnetic field is measured in amperes per meter (A/m); more commonly in electromagnetic field research, scientists specify a related quantity, the flux density (in microtesla, μT) instead. In contrast to electric fields, a magnetic field is only produced once a device is switched on and current flows. The higher the current, the greater the strength of the magnetic field.

Like electric fields, magnetic fields are strongest close to their origin and rapidly decrease at greater distances from the source Magnetic fields **are** not blocked by common materials such as the walls of buildings.

Electric fields	Magnetic fields
1. Electric fields **arise** from voltage. 2. Their strength is measured in Volts per metre (V/m) 3. An electric field can be present even when a device is switched off. 4. Field strength decreases with distance from the source. 5. Most building materials shield electric fields to some extent.	1. Magnetic fields arise from current flows. **2.** Their strength is measured in amperes per meter (A/m). Commonly, EMF investigators **use** a related measure, flux density (in microtesla (μT) **or** millitesla (mT) instead. 3. Magnetic fields exist as soon as a device is switched on and current flows. **4.** Field strength decreases with distance from the source. 5. Magnetic fields are not attenuated by most materials.

Electric fields
Plugging a wire into an outlet creates electric fields in the air surrounding the appliance. The higher the voltage the stronger the field produced. Since the voltage can exist even when no current is flowing, the appliance does not have to he turned on for an electric field to exist in the room surrounding it.

Magnetic fields
Magnetic fields are created only when the electric current flows. Magnetic fields and electric fields then exist together in the room environment. The greater the cnrrent the stronger the magnetic field. High voltages are used for the transmission and distribution of electricity whereas relatively low voltages are used in the home. The voltages used by power transmission equipment vary little from day to day, currents through a transmission line vary with power consumption.

Electric fields around the wire to an appliance only cease to exist when the appliance is unplugged or switched off at the wall. They will still exist around the cable behind the wall.

How do **static** fields differ **from time-varying** fields?
A static field does not vary over time. **A** direct current (DC) is an electric current flowing in one direction only. In any battery-powered appliance the current flows from the battery to the appliance and then back to the battery It will create a static magnetic field. The earth's magnetic field is also a static field. So is the magnetic field around a bar magnet which can be visualized by observing the pattern that is formed when iron filings are sprinkled around it.

In contrast, time-varying electromagnetic fields are produced by alternating currents (AC). Alternating currents reverse their direction at regular intervals. In most European countries electricity changes direction with a frequency of 50 cycles **per** second or 50 Hertz. Equally, the associated electromagnetic field changes its orientation SO times every second. North American electricity has a frequency of ***60*** Hertz.

EXHIBIT M

What are the main sources of **low,** intermediate and **high** frequency fields?
The time-varying electromagnetic fields produced by electrical appliances are an example of extremely **low** frequency **(ELF)** fields. ELF fields generally have frequencies up to 300 Hz. Other technologies produce intermediate frequency **(IF)** fields with frequencies from 300 Hz to 10 MHz and radiofrequency (RF) fields with frequencies of 10 MHz to 300 GHz. The effects of electromagnetic fields **on** the human body depend not only on their field level but on their frequency and energy. **Our** electricity power supply and all appliances using electricity are the main sources of ELF fields; computer screens, anti-theft devices and security systems are the main sources of IF fields; and radio, television, radar and cellular telephone antennas, and microwave ovens are the main sources of RF fields. These fields induce currents within the human body, which if sufficient can produce a range of effects such as heating and electrical shock, depending **on** their amplitude and frequency range. (However, to produce such effects, the fields outside the body would have to be very strong, far stronger than present in normal environments.)

Electromagnetic fields at high frequencies

Mobile telephones, television and radio transmitters and radar produce RF fields. These fields are used to transmit information over long distances and form the basis of telecommunications **as** well **as** radio and television broadcasting all over the world. Microwaves are RF fields at high frequencies in the GHz range. In microwaves ovens, we use them to quickly heat food.

At radio frequencies, electric and magnetic fields are closely interrelated and we typically measure their levels as power densities in watts per square metre (W/m^2).

Key points:

1. The electromagnetic spectrum encompasses both natural and human-made sources of electromagnetic fields.
2. Frequency and wavelength characterise an electromagnetic field. In an electromagnetic wave, these two characteristics are directly related to each other: the higher the frequency the shorter the wavelength.
3. Ionizing radiation such as X-ray and gamma-rays consists of photons which carry sufficient energy to break molecular bonds. Photons of electromagnetic waves at power and radio frequencies have much lower energy that do not have this ability.
4. Electric fields exist whenever charge is present and are measured in volts per metre (Vim). Magnetic fields arise from current flow. Their flux densities are measured in microtesla (μT) or millitesla (mT).
5. At radio and microwave frequencies. electric and magnetic fields are considered together as the two components of an electromagnetic wave. Power density, measured in watts per square metre (W/m^2), describes the intensity of these fields.
6. Low frequency and high frequency electromagnetic waves affect the human body in different ways.
7. Electrical power supplies and appliances are the most common sources of low frequency electric and magnetic fields in our living environment. Everyday sources of radiofrequency electromagnetic fields are telecommunications, broadcasting antennas and microwave ovens.

Summary of health effects

What happens when you are exposed to electromagnetic fields?

Exposure to electromagnetic fields is not a new phenomenon. However, during the 20th century, environmental exposure to man-made electromagnetic fields has been steadily increasing as growing electricity demand, ever-advancing technologies and changes in social behaviour have created more and more artificial sources. Everyone is exposed to a complex mix of weak electric and magnetic fields, both at home and at work, fiom the generation and transmission **of** electricity, domestic appliances and industrial equipment, to telecommunications and broadcasting.

Tiny electrical currents exist in the human body due **to** the chemical reactions that occur as part of the normal bodily functions, even in the absence of external electric fields. For example, nerves relay signals by transmitting electric impulses. Most biochemical reactions from digestion to brain activities **go** along with the rearrangement of charged particles. Even the heart is electrically active - an activity that your doctor can trace with the help of an electrocardiogram.

Low-frequency electric fields influence the human body just as they influence any other material made up of charged particles. When electric fields act on conductive materials, they influence the distribution of electric charges at their surface. They cause current to flow through the body to the ground.

Low-frequency magnetic fields induce circulating currents within the human body. The strength of these currents depends on the

EXHIBIT M

intensity of the outside magnetic field. If sufficiently large, these currents could cause stimulation of nerves and muscles or affect other biological processes.

Both electric and magnetic fields induce voltages and currents in the body but even directly beneath a high voltage transmission line, the induced currents are very small compared to thresholds for producing shock and other electrical effects.

Heating is the main biological effect of the electromagnetic fields of radiofrequency fields. In microwave ovens this fact is employed to warm up food. The levels of radiofrequency fields to which people are normally exposed are very much lower than those needed to produce significant heating. The heating effect of radiowaves forms the underlying basis for current guidelines. Scientists are also investigating the possibility that effects below the threshold level for body heating occur as a result of long-term exposure. To date, no adverse health effects from low level, long-term exposure to radiofrequency or power frequency fields have been confirmed, hut scientists are actively continuing to research this area.

Biological effects or health effects? What is a health hazard?

Biological effects are measurable responses to a stimulus or to a change in the environment. These changes are not necessarily harmful to your health. For example, listening to music, reading a book, eating an apple or playing tennis will produce a range of biological effects. Nevertheless, none of these activities is expected to cause health effects. The body has sophisticated mechanisms to adjust to the many and varied influences we encounter in our environment. Ongoing change forms a normal part of our lives. But, of course, the body does not possess adequate compensation mechanisms for all biological effects. Changes that are irreversible and stress the system for long periods of time may constitute a health hazard.

An adverse health effect causes detectable impairment of the health of the exposed individual or of his or her offspring; a biological effect, on the other hand, may or may not result in an adverse health effect.

It is not disputed that electromagnetic fields above certain levels can trigger biological effects. Experiments with healthy volunteers indicate that short-term exposure at the levels present in the environment or in the home do not cause any apparent demmental effects. Exposures to higher levels that might be harmful are restricted by national and international guidelines. The current debate is centred on whether long-term low level exposure can evoke biological responses and influence people's well being.

Widespread concerns for health

A look at the news headlines of recent years allows some insight into the various areas ofpublic concern. Over the course of the past decade, numerous electromagnetic field sources have become the focus of health concerns, including power lines, microwave ovens, computer and **TV** screens, security devices, radars and most recently mobile phones and their base stations.

The International EMF Project

In response to growing public health concerns over possible health effects from exposure to an ever increasing number and diversity of electromagnetic field sources, in 1996 the World Health Organization (WHO) launched a large, multidisciplinary research effort. The International EMF Project brings together current knowledge and available resources of key international and national agencies and scientific institutions.

Conclusions from scientific research

In the area of biological effects and medical applications of uon-ionizing radiation approximately 25,000 articles have been published over the past **30** years. Despite the feeling of some people that more research needs to he done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge ahout biological effects exist and need further research.

Effects on general health

Some members of the public have attributed a diffuse collection of symptoms to low levels of exposure to electromagnetic fields at home. Reported symptoms include headaches, anxiety, suicide and depression, nausea, fatigue and **loss** of libido. To date, scientific evidence does not support a link between these symptoms and exposure to electromagnetic fields. At least some **of** these health problems may be caused by noise or other factors in the environment, or by anxiety related to the presence of new technologies.

Effects on pregnancy outcome

EXHIBIT M

Many different sources and exposures to electromagnetic fields in the living and working environment, including computer screens, water beds and electric blankets, radiofrequency welding machines, diathermy equipment and radar, have been evaluated by the WHO and other organizations. The overall weight of evidence shows that exposure to fields at typical environmental levels does not increase the risk of any adverse outcome such as spontaneous abortions, malformations, low birth weight, and congenital diseases. There have been occasional reports of associations between health problems and presumed exposure to electromagnetic fields, such as reports of prematurity and low birth weight in children of workers in the electronics industry, hut these have not been regarded by the scientific community as being necessarily caused by the field exposures (as opposed to factors such as exposure to solvents).

Cataracts

General eye irritation and cataracts have sometimes been reported in workers exposed to high levels of radiofrequency and microwave radiation, but animal studies do not support the idea that such forms of eye damage can he produced at levels that are not thermally hazardous. There is no evidence that these effects occur at levels experienced by the general public.

Electromagnetic fields and cancer

Despite many studies, the evidence for any effect remains highly controversial. However, it is clear that if electromagnetic fields do have an effect on cancer, then any increase in risk will he extremely small. The results to date contain many inconsistencies, hut no large increases in risk have heen found for any cancer in children or adults.

A number of epidemiological studies suggest small increases in risk of childhood leukemia with exposure to low frequency magnetic fields in the home. However, scientists have not generally concluded that these results indicate a cause-effect relation between exposure to the fields and disease (as opposed to artifacts in the study or effects unrelated to field exposure). In part, this conclusion has been reached because animal and laboratory studies fail to demonstrate any reproducible effects that are consistent with the hypothesis that fields cause or promote cancer. Large-scale studies are currently underway in several countries and may help resolve these issues.

Electromagnetic hypersensitivity and depression

Some individuals report "hypersensitivity" to electric or magnetic fields. They ask whether aches and pains, headaches, depression, lethargy, sleeping disorders, and even convulsions and epileptic seizures could be associated with electromagnetic field exposure.

There is little scientific evidence to support the idea of electromagnetic hypersensitivity, Recent Scandinavian studies found that individuals do not show consistent reactions under properly controlled conditions of electromagnetic field exposure. Nor is there any accepted biological mechanism to explain hypersensitivity. Research on this subject is difficult because many other subjective responses may he involved, apart from direct effects of fields themselves. More studies are continuing on the subject.

The focus of current and future research

Much effort is currently being directed towards the study of electromagnetic fields in relation to cancer. Studies in search for possible carcinogenic (cancer-producing) effects of power frequency fields is continuing, although at a reduced level compared to that of the late 1990's.

The long-term health effects of mobile telephone use is another topic of much current research. No obvious adverse effect of exposure to low level radiofrequency fields has been discovered. However, given public concerns regarding the safety of cellular telephones, further research aims to determine whether any less obvious effects might occur at very low exposure levels.

Key points

1. A wide range of environmental influences causes biological effects. 'Biological effect' does not equal 'health hazard'. Special research is needed to identify and measure health hazards.
2. At low frequencies, external electric and magnetic fields induce small circulating currents within the body. In virtually all ordinary environments, the levels of induced currents inside the body are too small to produce obvious effects.
3. The main effect of radiofrequency electromagnetic fields is heating of body tissues.
4. There is no doubt that short-term exposure to very high levels of electromagnetic fields can be harmful to health. Current public concern focuses on possible long-term health effects caused by exposure to electromagnetic fields at levels below those required to trigger acute biological responses.
5. WHO's International EMF Project was launched to provide scientifically sound and objective answers to public concerns about possible hazards of low level electromagnetic fields.
6. Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health.
7. The focus of international research is the investigation of possible links between cancer and electromagnetic fields, at power lime and radiofrequencies.

EXHIBIT M

Progress in research

If electromagnetic fields constitute a health hazard, there will be consequences in all industrialized countries. The public demands concrete answers to the ever more pressing question, whether everyday electromagnetic fields cause adverse health effects. The media often seem to have definitive answers. However, one should judge these reports with caution and take into account that the primary interest of the media is not education. A journalist may select and report a story driven by a range of non-technical reasons: journalists compete with one another for time and space and different journals and newspapers compete for circulation numbers. Novel sensational headlines that are relevant to as many people as possible aid them in achieving these goals - bad news is not only the big news, it is often the only news we hear. The large number of studies which suggest that electromagnetic fields are harmless receive little if any coverage. Science cannot provide a guarantee of absolute safety yet but the development of research is reassuring overall.

Different types of studies are needed

A mix of studies in different research areas is essential for the evaluation of a potential adverse health effect of electromagnetic fields. Different types of studies investigate distinct aspects of the problem. Laboratory studies on cells aim to elucidate the fundamental underlying mechanisms that link electromagnetic field exposure to biological effects. They try to identify mechanisms based on molecular or cellular changes that are brought about by the electromagnetic field - such a change would provide clues to how a physical force is converted into a biological action within the body. In these studies, single cells or tissues are removed from their normal living environment which may inactivate possible compensation mechanisms.

Another type of study, involving animals, is more closely related to real life situations. These studies provide evidence that is more directly relevant to establishing safe exposure levels in humans and often employ several different field levels to investigate dose-response relationships.

Epidemiological studies or human health studies are another direct source of information on long-term effects of exposure. These studies investigate the cause and distribution of diseases in real life situations, in communities and occupational groups. Researchers try to establish if there is a statistical association between exposure to electromagnetic fields and the incidence of a specific disease or adverse health effect. However, epidemiological studies are costly. More importantly, they involve measurements on very complex human populations and are difficult to control sufficiently well to detect small effects. For these reasons, scientists evaluate all relevant evidence when deciding about potential health hazards, including epidemiology, animal, and cellular studies.

Interpretation of epidemiological studies

Epidemiological studies alone typically cannot establish a clear cause and effect relationship, mainly because they detect only statistical associations between exposure and disease, which may or may not be caused by the exposure. Imagine a hypothetical study showing a link between electromagnetic field exposure in electrical workers of the company "X-Electricity" and an increased risk of cancer. Even if a statistical association is observed, it could also he due to incomplete data on other factors in the workplace. For example, electrical workers may have been exposed to chemical solvents with the potential to cause cancer. Moreover, an observed statistical association may be due only to statistical effects, or the study itself may have suffered from some problem with its design.

Therefore, finding an association between some agent and a specific disease does not necessarily mean that the agent caused the disease. Establishing causality requires that an investigator consider many factors. The case for a cause-and-effect link is strengthened if there is a consistent and strong association between exposure and effect, a clear dose-response relationship, a credible biological explanation, support provided by relevant animal studies, and above all consistency between studies. These factors have generally been absent in studies involving electromagnetic fields and cancer. This is one of the strongest reasons why scientists have generally been reluctant to conclude that weak electromagnetic fields have health effects.

Difficulties in ruling out the possibility of very small risks

"The absence of evidence of detrimental effects does not seem to suffice in modem society. The evidence of their absence is demanded more and more instead". (Bamabas Kunsch, Austrian Research Centre Seibersdorf)

"There is no convincing evidence for an adverse health effect of electromagnetic fields" or "A cause-effect link between electromagnetic fields and cancer has not been confirmed" are typical of the conclusions that have been reached by expert committees that have examined the issue. This sounds as if science wanted to avoid giving an answer. Then why should research continue if scientists have already shown that there is no effect?

EXHIBIT M

The answer is simple: Human health studies are very good at identifying large effects, such as a connection between smoking and cancer. Unfortunately, they are less able to distinguish a small effect from no effect at all. If electromagnetic fields at typical environmental levels were strong carcinogens, then it would have been easy to have shown that by now. By contrast, if low level electromagnetic fields are a weak carcinogen, or even a strong carcinogen to a small group of people in the larger population, that would be far more difficult to demonstrate. In fact, even if a large study shows no association we can never be entirely sure that there is no relationship. The absence of an effect could mean that there really is none. But just as well it could mean that the effect is simply undetectable with our method of measurement. Therefore, negative results are generally less convincing than strong positive ones.

The most difficult situation of all, which unfortunately has developed with epidemiology studies involving electromagnetic fields, is a collection of studies with weak positive results, which however are inconsistent among each other. In that situation, scientists themselves are likely to be divided about the significance of the data. However, for the reasons explained above, most scientists and clinicians agree that any health effects of low level electromagnetic fields, if they exist at all, are likely to be very small compared to other health risks that people face in everyday life.

What's in the future?

The main aim of WHO's International EMF Project is to initiate and co-ordinate research worldwide to produce a well-founded response to public concerns. This evaluation will integrate results from cellular, animal and human health studies to allow as comprehensive a health **risk** assessment as possible. **A** holistic assessment of a variety of relevant and reliable studies will provide the most reliable answer possible about the adverse health effects, if any exist, of long term exposure to weak electromagnetic fields.

One way to illustrate the necessity of evidence from different types of experiments is a crossword. To be able to read the given crossword's solution with absolute **CERTAINTY** nine questions must be answered. Assuming we can only answer three of these, we might be able to guess the solution. However, the three given letters may also be part of a very different word. Every additional answer will increase our own confidence. In fact, science will probably never be able to answer all questions, but the more solid evidence we collect the better will be our guess at the solution.

Key points

1. Laboratory studies on cells aim to determine if there is a mechanism by which electromagnetic field exposure could cause harmful biological effects. Animal studies are essential for establishing effects in higher organisms whose physiology resembles that of humans to a degree. Epidemiological studies look for statistical associations between field exposure and the incidence of specific adverse health outcomes in humans.
2. Finding a statistical association between some agent and a specific disease does not mean that the agent caused the disease.
3. The absence of health effects could mean that there really are none; however, it could also signify that an existing effect is undetectable with present methods.
4. Results of diverse studies (cellular, animal, and epidemiology) must be considered together before drawing conclusions ahout possible health risks of a suspected environmental hazard. Consistent evidence fiom these very different types of studies increases the degree of certainty about a true effect

Typical exposure levels at home and in the environment

Electromagnetic fields at home

Background electromagnetic field **levels** from electricity transmission and distribution facilities
Electricity is transmitted over long distances via high voltage power lines. Transformers reduce these high voltages for local distribution to homes and businesses. Electricity transmission and distribution facilities and residential wiring and appliances account for the background level of power frequency electric and magnetic fields in the home. In homes not located near power **lines** this background field may be up **to** about 0.2 μT. Directly beneath power lines the fields are much stronger. Magnetic ***flux*** densities at ground level can range up to several μT. Electric field levels underneath power lines can be as high as 10 kV/m. However, the fields (both electric and magnetic) drop off with distance from the lines. At 50 m to 100 m distance the fields are normally at levels that are found in areas away from high voltage power lines. In addition, house walls substantially reduce the electric field levels from those found at similar locations outside the house.

Electric appliances in **the** household
The strongest power frequency electric fields that are ordinarily encountered in the environment exist beneath high voltage transmission lines. In contrast, the strongest magnetic fields at power frequency are normally found very close to motors and other

EXHIBIT M

electrical appliances, as well as in specialized equipment such as magnetic resonance scanners used for medical imaging.

Typical electric field strengths measured **near** household appliances
(at a distance **of** 30 **cm)**
From: Federal **Office for** Radiation Safety, Germany 1999)

Electric **appliance**	Electric field strength **(V/m)**
Stereo receiver	180
Iron	120
Refrigerator	120
Mixer	100
Toaster	80
Hair dryer	80
Colour TV	
Coffee machine	60
Vacuum cleaner	***50***
Electric oven	8
Light bulb	5
Guideline limit value	5000

Many people are surprised when they become aware of the variety of magnetic field levels found near various appliances. The field strength does not depend on how large, complex, powerful or noisy the device is. Furthermore, even between apparently similar devices, the strength of the magnetic field may vary a lot. For example, while some hair dryers **are** surrounded by a very strong field, others hardly produce any magnetic field at all. These differences in magnetic field strength are related to product design. The following table shows typical values for a number of electrical devices commonly found in homes and workplaces. The measurements were taken in Germany and all of the appliances operate on electricity at a frequency of 50 Hz. It should be noted that the actual exposure levels vary considerably depending on the model of appliance and distance from it.

Typical magnetic field strength of household appliances at various distances

Electric appliance	3 cm distance (μT)	30 cm distance (μT)	1 m distance (μT)
Hair dryer	**6 – 2000**	0.01 – 7	0.01 – 0.03
Electric shaver	**15 – 1500**	0.08 – 9	0.01 – 0.03
Vacuum cleaner	200 – 800	**2 – 20**	0.13 – 2
Fluorescent	40 – 400	**0.5 – 2**	0.02 – 0.25

EXHIBIT M

light			
Microwave oven	73 – 200	**4 – 8**	*0.25* – 0.6
Portable radio	16 – 56	**1**	< 0.01
Electric oven	1 – 50	**0.15 – 0.5**	0.01 – 0.04
Washing machine	0.8 – 50	**0.15 – 3**	0.01 – 0.15
Iron	8 – 30	**0.12 – 0.3**	0.01 – 0.03
Dishwasher	3.5 – 20	**0.6 – 3**	0.07 – 0.3
Computer	0.5 – 30	**< 0.01**	
Refrigerator	0.5 – 1.7	**0.01 – 0.25**	<0.01
Colour TV	2.5 - 50	0.04 – 2	**0.01 – 0.15**
With most household appliances the magnetic field strength at a distance of 30 cm is well below the guideline limit for the general public of 100 μT.			

(Source: Federal Office for Radiation Safety, Germany 1999) Normal operating distance is given in bold

The table illustrates two main points: First, the magnetic field strength around all appliances rapidly decreases the further you get away from them. Secondly, most household appliances are not operated very close to the body. At a distance of 30 ***cm*** the magnetic fields surrounding most household appliances are more than 100 times lower than the given guideline limit of 100 μT at 50 Hz (83 μT at 60 Hz) for the general public.

Television **sets and** computer **screens**

Computer screens and television sets work on similarprinciples. Both produce static electric fields and alternating electric and magnetic fields at various frequencies. However, screens with liquid crystal displays used in some laptop computers and desktop units do not give rise to significant electric and magnetic fields. Modem computers have conductive screens which reduce the static field from the screen to a level similar to that of **the** normal background in the home or workplace. At the position of operators (30 to 50 cm from the screen), alternating magnetic fields are typically below 0.7 μT in **flux** density (at power frequencies). Alternating electric field strengths at operator positions range from below 1 V/m up to 10 V/m.

Microwave ovens

Domestic microwave ovens operate at very high power levels. However, effective shielding reduces leakage outside the ovens to almost non-detectable levels. Furthermore microwave leakage falls very rapidly with increasing distance from the oven. Many countries have manufacturing standards that specify maximum leakage levels for new ovens; an oven that meets the manufacturing standards will not present any hazard to the consumer.

Portable telephones

Portable telephones operate at much lower intensities than mobile phones. This is because they are employed very close to their home base station, and ***so*** do not need strong fields to transmit over long distances. As a consequence, the radiofrequency fields that surround these devices are negligible.

Electromagnetic fields in the environment

Radar

Radars are used for navigation, weather forecasting, and military applications, **as** well as a variety of other functions. They emit pulsed microwave signals. The peak power in the pulse can be high even though the average power may be low. Many radars rotate or move up and down; this reduces the mean power density to which the public is exposed in the vicinity **of** radars. Even high

power, non-rotating military radars limit exposures to below guideline levels at locations of public access.

Security systems

EXHIBIT

available to date does not suggest that the use of mobile phones has any detrimental effect on human health.

Magnetic fields in everyday life: are they really that high?

In recent years, national authorities in different countries have conducted many measurements to investigate electromagnetic field levels in the living environment. None of these surveys has concluded that field levels could bring about adverse health effects.

The Federal Office for Radiation Safety in Germany recently measured the daily exposure to magnetic fields of about 2000 individuals across a range of occupations and public exposures. All of them were equipped with personal dosimeters for 24 hours. The measured exposure varied widely but gave an average daily exposure of 0.10 μT. This value is a thousand times lower that the standard limit of 100 μT for the public and 200 times lower than the 500 μT exposure limit for workers. Furthermore, the exposure of people living in the centres of cities showed that there are no drastic differences in exposure between life in rural areas and life in the city. Even the exposure of people living in the vicinity **of** high voltage power lines differs very little from the average exposure in the population.

Key points

1. Background electromagnetic field levels in the home are mainly caused by the transmission and distribution facilities for electricity or by electrical appliances.
2. Electrical appliances differ greatly in the strength of fields they generate. Both electric and magnetic field levels decrease rapidly with distance from the appliances. In any event, fields surrounding household appliances usually are far below guideline limits.
3. At operator positions the electric and magnetic fields of television sets and computer screens are hundreds of thousands times below guideline levels.
4. Microwave ovens meeting the standards are not hazardous to health.
5. As long as close public access to radar facilities, broadcasting antennas and mobile phone base stations is restricted, exposure guideline limits for radiofrequency fields will not be exceeded.
6. The user of a mobile phone encounters field levels that are much higher than any levels in the normal living environment. However, even these increased levels do not appear to generate harmful effects.
7. Many surveys have demonstrated that exposure to electromagnetic field levels in the living environment is extremely low.

Current standards

Standards are set to protect our health and are well known for many food additives, for concentrations of chemicals in water or air pollutants. Similarly, field standards exist to limit overexposure to electromagnetic field levels present in our environment.

Who decides *on* guidelines?

Countries set their own national standards for exposure to electromagnetic fields. However, the majority of these national standards draw on the guidelines set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This non-governmental organization, formally recognized by WHO, evaluates scientific results from all over the world. Based on an in-depth review of the literature, ICNIRP produces guidelines recommending limits on exposure. These guidelines are reviewed periodically and updated if necessary.

Electromagnetic field levels vary with frequency in a complex way. Listing every value in every standard and at every frequency would be difficult to understand. The table below is a summary of the exposure guidelines for the three areas that have become the focus of public concern: electricity in the home, mobile phone base stations and microwave ovens. These guidelines were last updated in April 1998.

Summary of the ICNIRF' exposure guidelines

	European power frequency		Mobile phone base station frequency		Microwave oven frequency
Frequency	50 Hz	50 Hz	900	1.8	2.45 GHz

EXHIBIT M

			MHz	GHz	
	Electric field (V/m)	Magnetic field (μT)	Power density (W/m^2)	Power density (W/m^2)	Power density (W/m^2)
Public exposure limits	5 000	100	**4.5**	9	10
Occupational exposure limits	10 000	500	5	45	

ICNIRP, **EMF** guidelines, Health Physics 74, 494-522 **(1998)**

The exposure guidelines may differ by a factor of more than 100 between some former Soviet countries and Western countries. With the globalization of trade and the rapid introduction of telecommunications worldwide there is a need for universal standards. As many countries from the former Soviet Union are now considering new standards, the WHO has recently launched an initiative to harmonize exposure guidelines worldwide. Future standards will be based on the results of the WHO's International Electromagnetic Field Project.

What are guidelines based on?

An important point to make is that a guideline limit is not a precise delineation between safety and hazard. There is no one level above which exposures become hazardous to health; instead, the potential risk to human health gradually increases with higher exposure levels. Guidelines indicate that, below a given threshold, electromagnetic field exposure is safe according to scientific knowledge. However, it does not automatically follow that, above the given limit, exposure is harmful.

Nevertheless, to be able to set limits on exposure, scientific studies need to identify the threshold level at which first health effects become apparent. As humans cannot be used for experiments, guidelines critically rely on animal studies. Subtle behavioural changes in animals at low levels often precede more drastic changes in health at higher levels. Abnormal behaviour is a very sensitive indicator of a biological response and has been selected as the lowest observable adverse health effect. Guidelines recommend the prevention of electromagnetic field exposure levels, at which behavioural changes become noticeable.

This threshold level for hehaviour is not equal to the guideline limit. ICNIRP applies a safety factor of 10 to derive occupational exposure limits, and a factor of 50 to obtain the guideline value for the general public. Therefore, for example, in the radiofrequency and microwave frequency ranges, the maximum levels you might experience in the environment or in your home are at least 50 times lower than the threshold level at which first behavioural changes in animals become apparent.

Why is the safety factor for occupational exposure guidelines lower than for the general public?

The occupationally exposed population consists of adults who generally experience known electromagnetic field conditions. These workers are trained to be aware of potential **risk** and to take appropriate precautions. By contrast, the general public consists of individuals of **all** ages and of varying health status. In many cases, these are unaware of their exposure to EMF. Moreover, individual members **of** the public cannot be expected to take precautions to minimize or avoid exposure. These are the underlying considerations for more stringent exposure restrictions for the general public than for the occupationally exposed population.

As we have seen earlier, low frequency electromagnetic fields induce currents in the human body (see What happens when you are exposed to electromagnetic fields?). But various biochemical reactions within the body itself generate currents as well. The cells or tissues will not be able to detect any induced currents below this background level. Therefore, at low frequencies, exposure guidelines ensure that the level of currents induced by an electromagnetic fields is below that of natural body currents.

The main effect of radiofrequency energy is the heating of tissue. Consequently, exposure guidelines for radiofrequency fields and microwaves are set to prevent health effects caused by localized or whole-body heating (see What happens when you are exposed to electromagnetic fields?). Compliance with the guidelines will ensure that heating effects are sufficiently small not to be harmful.

EXHIBIT M

What guidelines cannot account for...

At present, speculations about potential long-term health effects cannot form the basis for the issuing of guidelines or standards. Addmg up the results of all scientific studies, the overall weight of evidence does not indicate that electromagnetic fields cause long-term health effects such as cancer. National and international bodies set and update standards on the basis of the latest scientific knowledge to protect against known health effects.

Guidelines are set for the average population and cannot directly address the requirements of a minority of potentially more sensitive people. Air pollution guidelines, for example, are not based on the special needs of asthmatics. Similarly, electromagnetic field guidelines are not designed to protect people from interference with implanted medical electronic devices such as heart pacemakers. Instead, advice about exposure situations to be avoided should be sought from the manufacturers and from the clinician implanting the device.

What are typical maximum exposure levels at home and in the environment?

Some practical information will help you to relate to the international guideline values given above. In the following table you will fmd the most common sources of electromagnetic fields. All values are maximum levels of public exposure – your own exposure is likely to be much lower. For a closer look at field levels around individual electrical appliances, please see the section Typical exposure levels at home and in the environment

Source	Typical maximum public exposure	
	Electric field (V/m)	Magnetic flux density (μT)
Natural fields	200	70 (Earth's magnetic field)
Mains power (in homes not close to power lines)	100	0.2
Mains power (beneath large power lines)	10 000	20
Electric trains and trams	300	50
TV and computer screens (at operator position)	10	0.7
	Typical maximum public exposure (W/m^2)	
TV and radio transmitters	0.1	
Mobile phone base stations	0.1	
Radars	0.2	
Microwave ovens	0.5	

EXHIBIT .

Source: WHO Regional Office for Europe

How are guidelines put into practice and who checks on them?

The responsibility to investigate fields around power lines, mobile phone base stations or any other sources accessible to the general public lies with government agencies and local authorities. They must ensure that compliance with guidelines is maintained.

With electronic devices, the manufacturer is responsible for complying with the standard limits. However, as we have seen above, the nature of most devices ensures that the emitted fields are well below the cut-off values. Furthermore, many consumer associations cany out tests on a regular basis. In case of any particular concern or worry, contact the manufacturer directly or enquire with your local public health authority.

Are exposures above the guidelines harmful?

It is perfectly safe to eat a pot of strawberry jam up to the expiration date – hut if you consume the jam any later the manufacturer cannot guarantee good food quality. Nevertheless, even a few weeks or months after the expiration date, it will usually be safe to eat the jam. Similarly, electromagnetic field guidelines ensure that, within the given exposure limit, no known adverse health effects will occur. A large safety factor is applied to the level known to cause a health consequence. Therefore, even if you experienced field strengths several times higher than the given *limit* value, your exposure would still be within this safety margin.

In everyday situations, most people do not experience electromagnetic fields that exceed the guideline limits. Typical exposures are far below these values. However, there are occasions where a person's exposure may, for a short period, approach or even exceed the guidelines. According to ICNIRP, radiofrequency and microwave exposures should be averaged over time to address cumulative effects. The guidelines specify a time-averaging period of six minutes and short-term exposures above the limits are acceptable.

In contrast, exposure to low frequency electric and magnetic fields is not time-averaged in the guidelines. To make things even more complicated, another factor called coupling comes into play. Coupling refers to the interaction between the electric and magnetic fields and the exposed body. This depends on the size and shape of the body, the type of tissue and the orientation of the body relative to the field. Guidelines must be conservative: ICNIRP always assumes maximum coupling of the field to the exposed individual. Thus the guideline limits provide maximum protection. For example, even though the magnetic field values for hairdryers and electric shavers appear to exceed the recommended values, extremely weak coupling between the field and the head prevents the induction of electrical currents that could exceed guideline limits.

Key points

1. ICNIRP issues guidelines on the basis of the current scientific knowledge. Most countries draw on these international guidelines for their own national standards.
2. Standards for low frequency electromagnetic fields ensure that induced electric currents are below the normal level of background currents within the body. Standards for radiofrequency and microwaves prevent health effects caused by localized or whole body heating.
3. Guidelines do not protect against potential interference with electromedical devices.
4. Maximum exposure levels in everyday life are typically far below guideline limits.
5. Due to a large safety factor, exposure above the guideline limits is not necessarily harmful to health. Furthermore time-averaging for high frequency fields and the assumption of maximum coupling for low frequency fields introduce an additional safety margin.

Precautionary approaches

With more and more research data available, it has become increasingly unlikely that exposure to electromagnetic fields constitutes a serious health hazard, nevertheless, some uncertainty remains. The original scientific discussion about the interpretation of controversial results has shifted to become a societal as well as political issue.

The public debate over electromagnetic fields focuses on the potential detriments of electromagnetic fields but often ignores the benefits associated with electromagnetic field technology. Without electricity, society would come to a standstill. Similarly, broadcasting and telecommunications have become a simple fact of modem life. An analysis of the balance between cost and potential hazards is essential.

EXHIBIT M

Protection of public health

International guidelines and national safety standards for electromagnetic fields are developed on the basis of the current scientific knowledge to ensure that the fields humans encounter are not harmful to health. To compensate uncertainties in knowledge (due, for example, to experimental errors, extrapolation from animals to humans, or statistical uncertainty), large safety factors are incorporated into the exposure limits. The guidelines are regularly reviewed and updated if necessary. It has been suggested that taking additional precautions to cope with remaining uncertainties may he a useful policy to adopt while science improves knowledge on health consequences. However, the type and extent of the cautionary policy chosen critically depends on the strength **of** evidence for a health risk and the scale and nature of the potential consequences. The cautionary response should be proportional to the potential risk. For more information, see the WHO Backgrounder on Cautionary Policies.

Several policies promoting caution have been developed to address concerns about public, occupational and environmental health and safety issues connected with chemical and physical agents.

What should be done while research continues?

One of the objectives of the International EMF Project is to help national authorities weigh the benefits of using electromagnetic field technologies against the possibility that a health risk might he discovered. Furthermore, the WHO will issue recommendations on protective measures, if they may be needed. It will take some years **for** the required research to be completed, evaluated and published. In the meantime, the World Health Organization has issued a series of recommendations:

- Strict adherence to existing national or international safety standards: such standards, based on current knowledge, are developed to protect everyone in the population with a large safety factor.
- Simple protective measures: harriers around strong electromagnetic field sources help preclude unauthorized access to areas where exposure limits may be exceeded.
- Consultation with local authorities and the public in siting new power lines or mobile phone base stations: siting decisions are often required to take into account aesthetics and public sensitivities. Open communication during the planning stages can help create public understanding and greater acceptance of a new facility.
- Communication: an effective system of health information and communication among scientists, governments, industry and the public can help raise general awareness of programmes dealing with exposure to electromagnetic fields and reduce any mistrust and fears.

For further information, see the WHO Fact Sheets on Electromagnetic Fields and Public Health

What is EMF - German, Italian & Swedish

German

:: Was sind elektromagnetische Felder? [pdf 63kb]

Italian

:: Cosa sono i campi elettromagnetici? [pdf 711kb]

Swedish

:: Vad ar eleklromaenetiska falt? [pdf 548kb]

EXHIBIT |

To: Parents. Educators, Administrators. Live Oak Residents. Care Providers, & Concerned Citizens

Re: Maintaining the Health of our Community/ Proposed Installation of Cell Tower at west end of Ledyard Properties, near 17th & Felt St , close to El Dorado Ave

We are a coalition of concerned residents, parents, administrators, & care providers who have recently learned about the plan of Metro PCS to lease space from Ledyard Properties for a cell tower to be placed within a few hundred feet of the Shoreline Middle School, Simpkins Swim Center, a massage school, & residents' homes. Because of the potential harmful health effects ("bioeffects") of the "non-ionizing radiation" which is emitted by cell towers, we would like to ask you to consider joining our coalition. While there needs to be more controlled and conclusive research, there is currently much research and anecdotal reports evidencing an association between exposure to non-ionizing radiation and health conditions such as: impaired cognition, cancer, sleep disorders, changes in behavior, increased blood pressure, decrease in efficacy of blood brain barrier, headaches etc. Currently the FCC Telecommunications Act *of* 1996 makes *it* difficult for *any* planning department in the country to rule against placement of a cell tower on the basis of "the environmental effects of radiofrequency emissions."

Therefore we ask that you join with us to communicate to all parties involved, your thoughts and feelings about the matter. There will be a **Zoning Adminstrator's Public Hearing on Friday September 7th at 8:30 am** in the County Gov't Bldg, 5th floor, although an evening meeting time has been requested and that may change. The **Board of Supervisors Meeting on September 18th** at County Gov't Bldg, 5th floor will look at the larger legal issues re: the location of cell towers in Santa Cruz County. Also on **Monday 8/27/07** there will be a showing of a movie about this topic on TV, Channel 27 in Santa Cruz & Channel 73 in Watsonville at 9 pm; this movie is entitled **"Public Exposure, DNA, Democracy & the Wireless Revolution."** Additionally we invite you to contact a member of our coalition to learn more, sign a petition, and be on our mailing list so that you can be apprised of updates.

Thank you for your consideration,

Angela Flynn (anaelaflvnn80@rnsn.com, 469-4399. ***Wireless*** *Radialion Alert Network, "WRAN"*)
David S. Paine, Superintendent of Live Oak School District, Ed.D
Doug Johnson, local resident
Marilyn Garrett (688-4603, *WRAN*)
Rebecca Elder, ***works*** on El Dorado **Aue.,beccaelderf3earthlmk.net.** 477-0258. **WRAN.**
Susan Wallace, **works on El Dorado** Ave

Additional Material
Received 8/30/07
Z..A. Item 0.1
Sept. 7,2007

EXHIBIT M

1. Study of the health of people living **in** the vicinity of mobile phone base stations.
Santini et **al.**
Pathol **Biol** (Paris) [PathologieBiologie **(Paris)]** 2002; *50:* 369 - 73
Found significant health effects on people **living** within 300 metres of mobile phone base stations.
Conclusions include the recommendation:
"... it is advisable that mobile phone base stations not be sited closer than 300meters to populations"

2. Netherlands Organization for **Applied** Scientific Research **(TNO)**
Study for the Netherlands Ministries of Economic Affairs, Housing, Spatial Planning and the Environment,and Health, Welfare and Sport
"Effects of Global Communications System Radio-Frequency Fields On Well Being and Cognitive Function of Human Subjects With and Without Subjective Complaints"
(September 2003)
Found significant effects on wellbeing, according to a number of internationally-recognised criteria (including headaches, muscle fatigue/pain, dizziness etc) from 3G mast emissions well below accepted 'safety' levels (less than 1/25,000th of ICNIRP guidelines). Those who had previously been noted as 'electrosensitive' under a scheme in tbat country were shown to have more pronounced ill-effects, though others were also shown to experience significant effects.

3 THE MICROWAVE **SYNDROME** - FURTHER ASPECTS **OF** A **SPANISH** STUDY

Oberfeld Gerd[1], **Navarro A. Enrique**[3], **Portoles** Manuel[2] ,**Maestu Ceferino**[4], Gomez-Perretta Claudio[2]

1) Public Health Department Salzburg, Austria
2) University Hospital La Fe. Valencia, Spain
3) Department of Applied Physics, University Valencia, Spain
4) Foundation European Bioelectromagnetism (FEB) Madrid, Spain
Presented at an International Conference in Kos (Greece), 2004

This ***study*** found significant ill-health effects in ***those*** **living** in the vicinity of two GSM mobile phone base stations. They observed that:

"The strongest five associations found **are** depressive tendency, fatigue; **sleeping** disorder, difficulty **in** concentration and cardiovascular problems."

As their conclusion the research team wrote:

"Based on the **data** of this study the advice would be to strive ***for*** levels not higher than 0.02 V/m for the sum total, which is **equal** to a power density of 0.0001 μW/cni2 or 1 μW/m^2, which is the indoor exposure value for GSM base stations proposed on empirical evidence by the Public Health Office of the Government of Salzburg in 2002."

EXHIBIT M

4. INCREASED INCIDENCE OF CANCER NEAR A CELL PHONE TRANSMITTER STATION.

Ronni Wolf MD[1], Danny Wolf MD[2]

1. The Dermatology Unit, Kaplan Medical Center, Rechovot, and :be Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, ISRAEL.
2. The Pediatric Outpatient Clinic, Hasharon Region, Kupat Holim, ISRAEL.

Published in:
International Journal of Cancer Prevention Volume 1, No. 2, April 2004

This study, based on medical records of people living within 350 metres of a long-established phone mast, showed a fourfold increased incidence of cancer generally compared with the general population of Israel, and a tenfold increase specifically among women, compared with the surrounding locality further from the mast.

5. Naila Study, Germany (November 2004)

Report by researchers (five medical doctors)

Following the call by Wolfram König, President of the Bundesamt für Strahlenschutz (Federal Agency for radiation protection), to all doctors of medicine to collaborate actively in the assessment of the risk posed by cellular radiation, the aim of our study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumors

Tbe basis of the data used for the survey were PC files of the case histories of patients between the years 1994 and 2004 While adhering to data protection, the personal data of almost 1.000 patients were evaluated for this study. which was completed without any external financial support. It is intended to continue the project in the form of a register.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up lo 400 metres from the cellular transmitter site, which bas been in operabon since 1993, compared to those patients living further away, and that the

In the years 1999-2004, i.e. after five years' operation of the transmitting installation, the relative risk of getting cancer bad trebled for the residents of the area in the proximity of the installation compared lo the inhabitants of Naila outside the area.

NOTE: These are the only studies known of that specifically consider the effects of masts on people. All five of these studies show clear and significant ill-health effects. There are no known studies relating to health effects of masts that do not show such ill-health effects.

In this respect, any statement by industry or official sources that claims (or suggests) that:

(a) There is no evidence of ill-health effects from masts;

or

(b) The overwhelming evidence is that masts do not cause ill-health effects;

is completely and blatantly untrue.

EXHIBIT M

STUDIES THAT POINT TO DANGERS OF CELLULAR ANTENNAS:

1) Dutch TNO *study* **2003;** effects on wellbeing: headaches, muscle fatigue/pain, **dizziness,** etc. from 3G mast
2) Oberfeld **2004 Spain; found** depression, fatigue, sleeping disorder, concentration + cardiovascular problems
3) Wolf **2004 found** fourfold cancer increase within **350m** of a phone **mas1** tenfold among women
4) Naila **study** Germany **2004 found** tripled **risk of** cancer near cellular antenna/masts
5) Austria 2005, **found** illness + **measured** immediate changes of electrical currents in **the brain** *at 80m from mast*
6) Santini 2002; diverse health effects within 300m of base stations (www.starweave.com)

Watch independent documentary on **Community** TV: "Public Exposure: DNA, Democracy" & "The Wireless Revolution"; **Channel 27 (S.C.)& 73 (Wats.);** Monday 8/27/07 @ pm

DR. GERARD HYLAND STUDY

APPEARED IN LANCET MEDICAL JOURNAL NOVEMBER **2000**

Hyland reported research finding that existing ***safety*** guidelines failed to consider the possibility of adverse effects on living organisms. He highlighted a case of an epileptic child living **near** a Mast Base Station. The child's seizures increased from 2 a month **to** an average of **8** a day. He reported a similar paflem with other children **suffering** from headaches and nosebleeds. He also reported reduced growth **in** pine trees, chromosomal and reproductive damage in plants and a six-fold increase in chromosome damage in cows. He concluded that the occurrence of adverse health effects in the case of animals indicates *that* the effects of operating masts are real and not psychosomatic. http://www.powerwatch.org.uk/masts.asp

DR. GERD OBERFELD, MD, STUDIES

PUBLIC **HEALTH OFFICER FOR ENVIRONMENTAL MEDICINE,** SALZBURG. AUSTRIA

Bioeffects that are reported to result bom low-intensity radiofrequency (RF) exposure include changes in cell membrane function, metabolism cellular signal communication, activation of proto-oncogenes and heat-shock protein at 0.1 μW/cm2 and higher. Fatigue, depressive tendency, sleeping disorders, difficulty in concentration and cardiovascular problems were reported **by** Oberfeld (2004) with exposure to **GSM** 900/1800 MHz cell phone frequency at exposures characteristic of low-intensity base station levels (0.0006 – 0.00128 microwatts/cm2). Resulting effects which are reported in the scientific literature include DNA **breaks** and chromosome aberrations, cell death including death of brain cells (neurons), increased free radical production, cell **stress** and premature aging, changes in **brain** function including memory loss, retarded learning, slower promotion in school and slower motor function and other performance impairment in children, headaches and fatigue, sleep disorders, neurodegenerative conditions, reduction *in melatonin* secretion, and cancer. Disruption of sleep **is** reported to occur at levels as low as 0.0001 to 0.1 microwatt/centimeter squared (μW/cm2).
http://www.protectschools.org/Washington%20Post%20Gerd%20Oberfeld%2012-Dez-04%20revised%20final.pdf

PILOT STUDY OF SIX CALIFORNIA FIREFIGHTERS

The study, conducted by **Dr.** Gunnar Heuser of Agoura Hills, **C A** focused on neurological symptoms of six firefighters **who** had been working for **up** to five years in stations with cell towers. Those symptoms included slowed reaction time, lack of focus, lack of impulse control, severe headaches, anesthesia-like sleep, sleep deprivation, depression, and tremors.

Dr. Heuser, along with Dr. J. Michael **Uszler** of Santa Monica, CA, used functional brain scans - SPECT scans - to assess any changes in the **brains** of the ***six*** firefighters as compared to healthy **brains** of men of the same age. Computerized psychological testing known as TOVA was used to study reaction time, impulse control, and attention span.

Disturbingly, the SPECT scans revealed a paflem of abnormal change which was concentrated over a wider area than would normally he seen in brains of individuals exposed to toxic **inhalation, as** might be expected born fighting fires. Dr. Heuser indicated the only plausible explanation at this time would be RF radiation exposure. Additionally, the TOVA testing revealed among the six firefighters delayed reaction time, lack of impulse control, and difficulty in maintaining mental focus.

The International Association of Fire Fighters voted to oppose the use of fire stations as base stations for towers and/or antennas for the conduction of cell phone **transmissions until** a *study* with the highest scientific merit and integrity **on** health effects of exposure to low-intensity RF/MW radiation is conducted and it **is** proven that such sitings are not hazardous to the health of **its** members. http://daily.iaff.org/celltowerfinal.htm

EXHIBIT M

metroPCS

LEDYARD PROPERTIES
SF16711D
1053 17TH AVE.
SANTA CRUZ, CA 95062
026-311-65

T-1	TITLE SHEET
C-1	LEASE AREA DETAIL
	SITE & BOUNDARY PLAN
C-2	OVERALL BOUNDARY PLAN
A-1	SITE PLAN
A-2	EQUIPMENT AND ANTENNA LAYOUT PLANS
A-3	ELEVATIONS
Z-1	TOPOGRAPHIC / AREA MAP
Z-2	PROXIMITY MAP / AERIAL PHOTO

SHEET INDEX (13)

VICINITY MAP (23)

PROJECT INFORMATION (24)

PROJECT TEAM (34)

APPROVALS (44)

CODE COMPLIANCE (14)

REV.	DATE	DESCRIPTION	BY
	11/30/06	100% ZD's	TR

DRAWN BY: RNA | CHK: AMP | APV: TR

CURRENT ISSUE DATE: 11/30/06

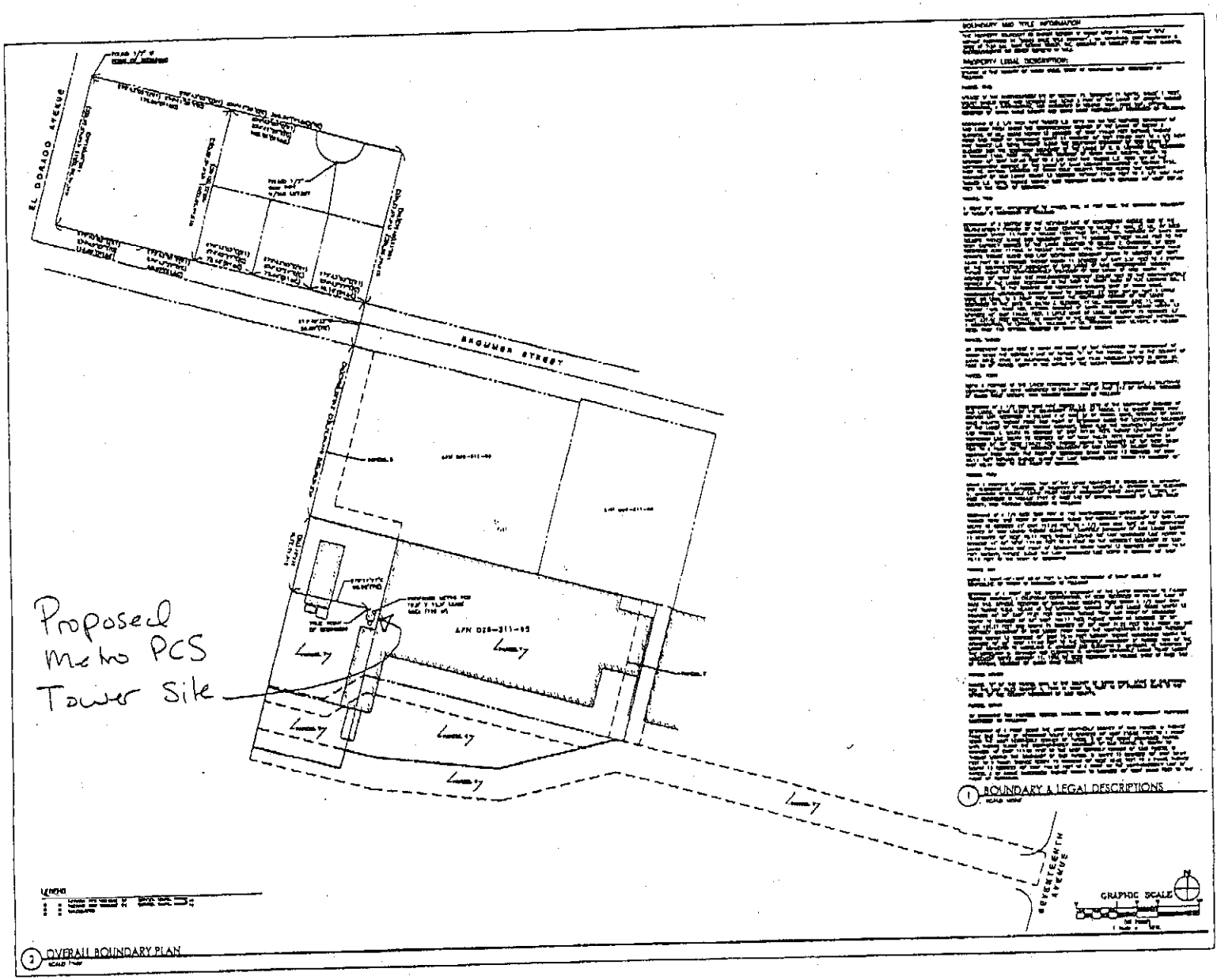
ISSUED FOR: 100% ZD's

PROJECT INFORMATION:
LEDYARD PROPERTIES
SF16711-D
1053 17TH AVE.
SANTA CRUZ, CA 95062
APN NO. 026-311-65
COUNTY OF SANTA CRUZ

SHEET TITLE: TITLE SHEET

SHEET NUMBER: T-1

REVISION:



metroPCS

OMNY

11/30/06

100% ZD's

LEDYARD PROPERTIES
SPI6711-D
1053 17TH AVE.
SANTA CRUZ, CA 95063
APN NO. 026-311-03
COUNTY OF SANTA CRUZ

OVERALL BOUNDARY PLAN

C-2

EXHIBIT M

Location Map

Legend

- APN 026-311-65
- Assessors Parcels
- Streets
- INTERMITTENT STREAM
- PERENNIAL STREAM
- Railroads

N
W E
S

Map Created by
County of Santa Cruz
Planning Department
December *2006*

EXHIBIT M

Telecom Towers Tsunami

By B. Blake Levitt

There ore medical and political ramifications to cell tower siting in our county

Guest editorial published in The New ***Milford (CT) Times, March 3, 2000***

B. Blake Levitt, a former New York Times science writer, is the author of *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves* (Harcourt Brace, 1995) lor which she won an award from the American Medical Writers Association. She lives in Warren, CT

Litchfield County — along with the rest ofthe country — is suffering a telecommunications tower blitzkrieg. The local press has done an excellent job of covering the subject with one exception — the medical implications of tower siting.

At its core, this is a medical and an environmental issue. In emphasizing aesthetics, such as hiding antennas in church steeples, our premier planners are missing a critical opportunity to exercise prudent avoidance and precautionary principles — wise courses of action now recommended by doctors and public health officials all over the world.

Here is a partial list of MD's who are calling lor prudent avoidanre when siting antennas rlose Io the population, particularly near schools: Dr. David Ozonoff, Dept. of Environmental Health, Boston University; Dr. Kathleen Thunnond, Harvard Medical School; Dr. Joseph Brain, Harvard School of Public Health, Slate University of New York at Albany; Dr. Kathleen M. Fagan, Division of Occupational and Environmental Medicine, Cleveland, Ohio; Dr. Cathey Falvo, International and General Public Health, New York Medical College; Dr. Philip I. Landrigan, Department of Community and Preventive Medicine, Children's Health and the Environment, Mt. Sinai School of Medicine and many others.

And from the ever-blunt Helm *Caldicott*, MD, co-founder *of* Physicians for Social Responsibility, this e-mail statement: "Radiofrequencies emitted from mobile telephone towers will have deleterious medical effects to people within the near vicinity according to a large body of scientific literature. Babies and children will be particularly sensitive lo the mutagenic and carcinogenic effects of this radiofrequency radiation. It *is* therefore criminal to place one of there aerials on *or near* a school..."

So what's going on here? Could we *really* have another emerging public health problem? Like lead poisoning? DDT? Asbestos? Tobacco smoke? This time with ambient, low-level, non-ionizing radiation? Many now suspect so.

What we are talking about is the buildout of a new technology in close proximity to the human population for the first *time* in *our evolutionary* history, with no clear understanding of the bioeffects. Despite whit industry says, no safe level of radiofrequency radiation has ever been determined. The standards in place at the Federal Communications Commission (FCC) are considered seriously flawed. Important questions raised over 50 years ago regarding radiofrequency (RF) radiation used in these and myriad other wireless technologies have never *been* resolved.

Outside *of* industry spokesmen, few experts who take an in-depth (vs. a cursory) look at the science feel comfortable with this today. The FCC standards are based on models for acute, thermal exposures only, with downward extrapolations built in for presumptions of safety. But adverse *non-thermal* effects, far below the standards, have been noted time and again in the research. In other words, the standards ran guarantee we won't cook — like in a microwave oven which uses frequencies very close to digital PCS cell-phone technology — hut they cannot guarantee anything else.

The studies used lo reach these conclusions about safety are also suspect. Scientists, from the physics and engineering disciplines (the non-living sciences), have traditionally used test designs of high-power, short-term exposures then extrapolated to presumptions about long-term, low-level exposures such as those who live near RF installations experience. But are these comparable? Again, many think not.

Scientists from the biology disciplines (the living sciences) point out that living systems are far mote complex than inanimate physics models. They ray that inappropriate research has consistently been used to reach inappropriate conclusions and it's been generated by the wrong professions.

There is a federal RF Interagency Work Group comprised of division directors from the FCC, FDA, OSHA, EPA and NIOSH trying to address some of these problems.

EXHIBIT M

In June 1999 the group issued an RF guidelines paper outlining the tasks at hand. In it they recognize that the current standards are based on acute exposures that are engineering *dosimetry* models, not on biological principles. They acknowledge that extrapolation of acute effects data to chronic exposure conditions is uncertain.

The zoning preemptions for RF contained in the Telecommunications Act of 1996 were not an accident. The telecom industry knew they could never develop a ground-based system (vs. a more expensive satellite system) without such preemptions because whenever the subject of RF health effects gets a serious airing at the local level, the industry loses. Individuals may want their cell phones, which are **voluntary RF exposures, but no one wants a 24-hour involuntary** exposure **near** an antenna array:

Behind the scenes, this industry plays hardball. In 1994, they asked the FCC to preempt all local zoning. In 1997, they asked the FCC to forbid the discussion of RF health effects at local zoning. (Don't they know we have a First Amendment here?) Also in 1997, they asked the FCC to declare it illegal for communities to make them prove they are in compliance with the standards. (The FCC hasn't granted any of these requests.)

The industry has repeatedly tried for interstate commerce status, which would override local zoning. John McCain heads the commerce committee. He is a pro-industry advocate. He has refused to allow citizens to testify at committee hearings; only industry reps are allowed. During the first six months of 1999 alone, telecommunications companies spent over $3,000,000 on lobbying legislators. Few vote against them.

But *most ominously* for our churches and towns, this industry has consistently tried to shift all liability onto the site owners and away from themselves as providers of the service. Using third-party tower builders--vertical real estate companies like SBA currently trolling Litchfield County – is another way of shifting liability. The service providers get an extra layer in between themselves and the community. And the tower companies understand the RF risks only too well. They are set up as holding companies with their assets tied up in subsidiary companies, meaning most of their assets are untouchable in lawsuits. High-risk companies always do this.

The Telecom Act only preempted *for service providers*, not for tower speculators. Tower companies hope local governments won't quite figure that one out.

This entire industry has carefully crafted insulation around itself, but the question remains, against what?

Here's a sampling of the non-thermal "contraband" science they don't want us to talk about at public hearings:

- In the 80's and 90's, Dr. William Ross Adey, a neurosc*ientist, and Dr. Carl Blackman*, a biophysicist at the U.S. EPA, *found* in several studie 'that **the human** anatomy **has critical "windows" in which we respond to some frequencies, but not to others.** At set intervals in the non-ionizing bands they observed a dramatic cellular effect called *calcium ion* dumping. The cells use *calcium for a host* of important functions. This work could indicate any number of adverse cellular effecu.

- In 1994, Drs. Henry Lai and N.P. Singh, at the University of Washington, Seattle, **found both double and single-strand DNA breaks in test animals exposed to cellular and PCS-frequency pulsed microwaves.** Double-strand DNA breaks are thought not to repair themselves and can lead to mutations. Dr. Lai recently published a study that found learning defects in test animals exposed to low-level pulsed microwaves.

- In 1996, Dr. Michael Repacholi found **a significant increase in B-cell lymphomas in test mice exposed to long-term,** low-level pulsed microwave frequencies in the cellular and PCS range. Changes in B-cells in the immune system are implicated in roughly 85 percent of all cancers.

- The work of Dr. Stanislaw Szmigielski in Poland on microwave and radar personnel has iound sharp increases in cancers--including lymphomas, *melanomas*, leukemias and brain tumors--**as well as high blood pressure, headaches, memory** lost, and brain damage. **Also** noted were **immune system abnormalities.** About 10 other studies have found immune-system suppression.

- In 1984, Dr. William Arthur Guy, at the University of Washington, Seattle, found an increase in **malignant** endocrine gland tumors and in benign adrenal gland *tumors in test* animals.

EXHIBIT M

- In 1975, researcher **Alan** Frey reported for the first time increaser in the permeability of the blood-brain harrier in **test** animals exposed to pulsed microwaves similar to what is used today in digital PCS systems. The blood-brain barrier protects the brain from access by viruses, bacteria and toxins.

- In 1975, Dr. William Bise, using 10 human test subjects, found severe alterations in human electroencephalograms at microwave and RF power levels that are now common in most urban areas due to ambient RF. The yearlong study documented a kind of entrainment phenomenon ofthe test subjects' brain waves with the external exposures, and radical changes in mood and behavior.

- In 1992, Dr. loseph Kirchvink, a geobiologist, discovered magnetite in human brain tissue in the blood-brain harrier and in the meninges which covers the brain. Magnetite interacts a million times more strongly with external magnetic **fields** than with any other biological material. Many species--bees, birds. butterflies, fish—manufacture magnetite and use it as a navigational tool. Any standards for RF exposure presume humans do **not manufacture** magnetite.

- There **are** indiratianr that some **frequencies** may be **unsafe at** any **intensity.** This **is** a crucial point when telecommunications reps talk about how low-power their installations are, likening them to 25- and 100-watt lightbulbs. (What they **leave** out **is** that it is 100 watts of effective radiated power per channel. There can be dozens of channels an one antenna, and dozens of antennas on One installation.)

- The pulsing factor oi RF alone – such **as** that used in the newer digital PCS and Bigh Definition Television (HDTV) technologies—has been found **to** be ***a significant*** variable in adverse effects. Dr. Jerry Phillips has found in several studies that RF pulsing of tumorogenic cell cultures accelerated their already abnormal growth rates by 3000 percent. And recent research from China found that important portals on the cell's surface are fantastically sensitive to low-intensity pulsed RF signals. The presence of **such** signals alone **was** found to completely alter the iniormation reaching the interior oithe cell. This is critical information with implications for everything from **cancer,** to genetic mutations, to immune system dysfunction, among many other things.

There is federal legislation to remedy this. Senator Patrick Leahy (DVT) introduced Senate Bill 1538 that would restore ail **local** siting control for RF. Representative Bernie Sanders (I-VT) has introduced similar legislation at the U.S. House of Representatives (HR 2834 and 2835). There are $10 million research appropriations attached to **these** hills, with funds directed to the National Instituter of Health. ***[Reader, please note as of 10/02 the above bills were updated as separate bills: S.3102, S.3103 and HR.5631, HR.5632. Sponsors were Senators Leahy(VT), Jeffords(VT), Murray(WA), and Dodd(CT), and Congressmen Sanders(VT), Tancredo(CO), Davis(IL), and Shays(CT). These bills will be reintroduced in the new session.]*** There is currently **no** federal research **effort** into RF. Industry, with **its inherent** bias and with decades **of well-leveled** accusations **of research** tampering, controls the show. Four independent bioelectromagnetic research labs have folded within the last five years due to absence of funding. It's imperative, in the face of this buildout, that an unbiased research program without industry influence he initialed. It's a *no-brainer*, actually...

Is there contradictory science that would indicate we don't have reason for concern? Ofcourse. **Are** there people of **good faith** on both sides *of this* issue? Of course.

But as laymen, it is still our obligation lo e n on the side of caution, especially where our children are concerned

Hide antennas in church steeples? Near schools? Near homes? Our planners might want to rethink that recommendation They can be held personally liable, too.

EXHIBIT M

The Largest Biological Experiment Ever

http://www.eldoradosun.com/Firstenberg.htm 1/2006

by Arthur Firstenberg

In 2002, Gro Harlem Brundtland, then head of the World Health Organization, told a Norwegian journalist that cell phones were banned from her office in Geneva because she personally becomes ill if a cell phone is brought within about four meters (13 feet) of her. Mrs. Brundtland is a medical doctor and former Prime Minister of Norway. This sensational news, published March 9,2002 in Dagbladet, was ignored by every other newspaper in the world. The following week Michael Repacholi, her subordinate in charge of the International EMF (electromagnetic field) Project, responded with a public statement belittling his boss's concerns. Five months later, for reasons that many suspect were related to these circumstances, Mrs. Brundtland announced she would step down from her leadership post at the WHO after just one term.

Nothing could better illustrate our collective schizophrenia when it comes to thinking about electromagnetic radiation. We respond to those who are worried about its dangers — hence the International EMF Project — but we ignore and marginalize hose, like Mrs. Brundtland, who have already succumbed to its effects.

As a consultant on the health effects of wireless technology, I receive calls that can be broadly divided into two main groups: those from people who are merely worried, whom I will call A, and those from people who are already sick, whom I will call B. I sometimes wish I could arrange a large conference call and have the two groups talk to each other — there needs to be more mutual understanding so that we are all trying to solve the same problems. Caller A, worried, commonly asks what kind of shield to buy for his cell phone or what kind of headset to wear with it. Sometimes he wants to know what is a safe distance to live from a cell tower. Caller B, sick, wants to know what kind of shielding to put on her house, what kind of medical treatment to get, or, increasingly often, what part of the country she could move to to escape the radiation to save her life.

The following is designed as a sort of a primer: first, to help everybody get more or less on the same page, and second, to clear up some of the confusions so that we can make rational decisions toward a healthier world.

FUNDAMENTALS

The most basic fact about cell phones and cell towers is that they emit microwave radiation; so do Wi-Fi (wireless Internet) antennas, wireless computers, cordless (portable) phones and their base units, and all other wireless devices. If it's a communication device and it's not attached to the wall by a wire, it's emitting radiation. Most Wi-Fi systems and some cordless phones operate at the exact same frequency as a microwave oven, while other devices use a different frequency. Wi-Fi is always on and always radiating. The base units of most cordless phones are always radiating, even when no one is using the phone. A cell phone that is on but not in use is also radiating. And, needless to say, cell towers are always radiating.

Why is this a problem, you might ask? Scientists usually divide the electromagnetic spectrum into "ionizing" and "non-ionizing." Ionizing radiation, which includes x-rays and atomic radiation, causes cancer. Non-ionizing radiation, which includes microwave radiation, is supposed to be safe. This distinction always reminded me of the propaganda in George Orwell's Animal Farm: "Four legs good, two legs bad." 'Won-ionizing good, ionizing bad" is as little to be trusted.

An engineer once quipped that if Neil Armstrong had taken a cell phone to the Moon in 1969, it would have appeared to be the third most powerful source of microwave radiation in the universe, next only to the Sun and the Milky Way. He was right. Life evolved with negligible levels of microwave radiation. An increasing number of scientists speculate that our own cells, in fact, use the microwave spectrum to communicate with one

EXHIBIT M

another, like children whispering in the dark, and that cell phones, like jackhammers, interfere with their signaling. In any case, it is a fact that we are all being bombarded, day in and day out, whether we use a cell phone or not, by an amount of microwave radiation that is some ten million times as strong as the average natural background. And it is also a fact that most of this radiation is due to technology that bas been developed since the *1910s.*

As far as cell phones themselves are concerned, if you put one up to your head you are damaging your brain in a number of different ways. First, think of a microwave oven. ***A*** cell phone, like a microwave oven and unlike a hot shower, heats you fiom the inside out, not from the outside in. And there are no sensory nerve endings in the brain to warn you of a rise in temperature because we did not evolve with microwave radiation, and this never happens in nature. Worse, the structure of the head and brain is so complex and non-uniform that "hot spots" are produced, where heating can be tens or hundreds of times what it is nearby. Hot spots can occur both close to the surface of the skull and deep within the brain, and also on a molecular level.

Cell phones are regulated by the Federal Communications Commission, and you can find, in the packaging of most new phones, **a** number called the Specific Absorption Rate, or SAR, which is supposed to indicate the rate at which energy is absorbed by the brain from tbat particular model. One problem, however, is the arbitrary assumption, **upon** which the FCC's regulations are base4 tbat the brain can safely dissipate added heat at a rate of **up** to 1 degree C per how. Compounding this is the scandalous procedure used to demonstrate compliance with these limits and give each cell phone its *SAR* rating. The standard way to measure SAR is on a "phantom" consisting, incredibly, of a homogenous fluid encased in Plexiglas in the shape of a bead. Presto, no hot spots! But in reality, people who use cell phones for hours per day are chronically heating places in their brain. The FCC's safety standard, by the way, was developed hy electrical engineers, not doctors.

THE **BLOOD·BRATN** BARRIER

The second effect that I want lo focus on, which has been proven in the laboratory, should by itself have been enough to shut down this industry and should be enough to scare away anyone from ever using a cell phone again. I call it the "smoking gun" of cell phone experiments. Like most biological effects of microwave radiation, this has nothing to do with heating.

The brain is protected by tight junctions between adjacent cells of capillary walls, **the** so-called blood-brain barrier, which, like a border patrol, lets nutrients pass **through** from the blood to the brain, hut keeps toxic substances out. Since **1988,** researchers in the laboratory of a Swedish neurosurgeon, Leif Salford, have been running variations on this simple experiment: they expose young laboratory rats to either a cell phone or other source of microwave radiation, and later **they** sacrifice the animals and look for albumin in their brain tissue. Albumin is a protein that is a normal component of blood but that does not normally cross the blood-brain barrier. The presence of albumin in brain tissue is always a sign that blood vessels have been damaged and that the brain has lost some of its protection.

Here is what these researchers have found, consistently for 18 years: Microwave radiation, at doses equal to a cell phone's emissions, causes albumin *to* **be** found in brain tissue. ***A*** one-time exposure to an ordinary cell phone for just two minutes causes albumin to leak into the brain. In one set of experiments, reducing the exposure level by a factor of 1,000 actually increased the damage lo the blood-brain barrier, showing that this is not a dose-response effect and that-reducing the power will not make wireless technology safer. And finally, in research published in June ***2003,*** a single two-hour exposure to a cell phone, **just once** during its lifetime, permanently damaged the blood-brain barrier **and,** on autopsy 50 days later,. was found to have damaged **or** destroyed up lo **2** percent **of** an animal's brain cells, including cells in areas of the brain concerned with learning, memory and movement.1 Reducing the exposure level by a factor of 10 or 100, thereby duplicating the effect of wearing a headsef moving **a** cell pbone further from your body, or standing next to-Somebody else's phone, did not appreciably change the results! Even at the lowest exposure, half the animals had a moderate to high number of damaged neurons.

EXHIBIT M

The implications for us? Two minutes on a cell phone disrupts the blood-brain barrier, two hours on a cell phone causes permanent brain damage, and secondhand radiation may be almost as bad. The blood-brain barrier is the same in a rat and a human being.

These results caused enough of a commotion in Europe that in November 2003 a conference was held, sponsored by the European Union, titled "The Blood-Brain Barrier — Can It Be Influenced by RF [radio frequency]-Field Interactions?" as if to reassure the public: "See, we are doing something about this." But, predictably, nothing was done about it, as nothing bas been done about it for 30 years.

America's Allan Frey, during the 1970s, was the first of many to demonstrate that low-level microwave radiation damages the blood-brain barrier.2 Similar mechanisms protect the eye (the blood-vitreous barrier) and the fetus (the placental barrier), and the work of Frey and others indicates that microwave radiation damages those barriers also. The implication: No pregnant woman should ever be using a cell phone.

Dr. Salford is quite outspoken about his work. He has caned the use of handheld cell phones "the largest human biological experiment ever." And he has publicly warned thal a whole generation of cell-phone-using teenagers may suffer fiom mental deficits or Alzheimer's disease by the time they reach middle age.

RADIO-WAVE SICKNESS

Unfortunately, cell phone users are not the only ones being injured, nor should we be womed only about the brain. The following brief summary is distilled from a vast scientific literature on the effects of radio waves (a larger spectrum which includes microwaves), together with the experiences of scientists and doctors all over the world with whom I am in contact.

Organs that have been shown to be especially susceptible to radio waves include the lungs, nervous system, heart, eyes, testes and thyroid gland. Diseases that have increased remarkably in the last couple of decades, and that there is good reason to connect with the massive increase in radiation in our environment include asthma, sleep disorders, anxiety disorders, attention deficit disorder, autism, multiple sclerosis, ALS, Alzheimer's disease, epilepsy, fibromyalgia, chronic fatigue syndrome, cataracts, hypothyroidism, diabetes, malignant melanoma, testicular cancer, and heart attacks and strokes in young people. Radiation from microwave towers has also been associated with forest die-off, reproductive failure and population decline in many species of buds, and ill health and birth deformities in farm animals. Tbe literature showing biological effects of microwave radiation is truly enormous, running to tens of thousands of documents, and I am amazed that industry spokespersons are getting away with saying that wireless technology has been proved safe or — just as ridiculous — that there is no evidence of harm.

I have omitted one disease from the above list: tbe illness that Caller B has, and that I have. A short history is in order here. In the 1950s and 1960s workers who built, tested and repaired radar equipment came down with this disease in large numbers. So did operators of industrial microwave heaters and sealers. The Soviets named it, appropriately, radio wave sickness, and studied it extensively. In the West its existence was denied totally, but workers came down with it anyway. Witness congressional hearings held in 1981, chaired by then Representative Al Gore, on the health effects of radio-frequency heaters and sealers, another episode in "See, we are doing something about this," while nothing is done.

Today, with the mass proliferation of radio towers and personal transmitters, the disease has spread like a plague into the general population. Estimates of its prevalence range up to one-third of the population, but it is rarely recognized for what it is until it has so disabled a person that he or she can no longer participate in society. You may recognize some of its common symptoms: insomnia dizziness, nausea, headaches, fatigue, memory loss, inability to concentrate, depression, chest discomfort, ringing in the ears. Patients may also develop medical problems such as chronic respiratory infections, heart arrhythmias, sudden fluctuations in blood pressure, uncontrolled blood sugar, dehydration, and even seizures and internal bleeding.

EXHIBIT M

What makes this disease so difficult to accepf and even more difficult to cope with, is that no treatment is likely to succeed unless one can also avoid exposure to its cause — and its cause is now everywhere. A 1998 survey by the California Department of Health Services indicated that at that time 120,000 Californians — and by implication 1 million Americans — were unable to work due to electromagnetic pollution.4 The ranks of these so-called electrically sensitive are swelling in almost every country in tbe world, marginalized, stigmatized and ignored. With the level of radiation everywhere today, they almost never recover and sometimes take their own lives.

"They are acting as a warning for all of **us,"** says Dr. Olle Johansson of people with this illness. "It could he a major mistake to subject the entire world's population to whole-body irradiation, **24** hours a day." A neuroscientist at the famous Karolinska Institute in Stockholm, Dr. Johansson heads a research team that is documenting a significant and permanent worsening of the public health tbat began precisely when the second-generation, 1800 MHz cell phones were introduced into Sweden in late 1997.5,6 After a decade-long decline, the number of Swedish workers on sick leave began to rise in late 1997 and more than doubled during the next five years. During the same period of time, sales of antidepressant drugs also doubled. The number of traffic accidents, after declining for years, began to climb again in 1997. The number of deaths from Alzheimer's disease, after declining for several years, rose sharply in 1999 and had nearly doubled by 2001. This two-year delay is understandable when one considers that Alzheimer's disease requires some time to develop.

UNCONTROLLED PROLIFERATION

If cell phones and cell towers are really deadly, have the radio and TV towers that we have been living with for a century been safe? In ***2002*** Ojan Hallberg and Olle Johansson coaulhored a paper titled "Cancer Trends During the 20th Century," which examined one aspect of that question.7 They found, in the United States, Sweden and dozens of other countries, that mortality rates for skin melanoma and for bladder, prostate, colon, breast and lung cancers closely paralleled the degree of public exposure to radio waves during the past hundred years. When radio broadcasting increased in a given location, so did those forms of cancer; when it decreased, so did those forms of cancer. And, a sensational finding: country by country — and county by county in Sweden — they found, statistically, that exposure to radio waves appears **to** be as big **a** factor in causing lung cancer **as** cigarette smoking!

Which brings me to address a widespread misconception. The biggest difference between the cell towers of today and the radio towers of the past is not their safety, hut their numbers. The number of ordinary radio stations in the United States today is still **less** than 14,000. But cell towers and Wi-Fi towers number in the hundreds of thousands, and cell phones, wireless computers, cordless telephones and two-way radios number in the hundreds of millions. Radar facilities and emergency communication networks are also proliferating out of control. Since 1978, when the Environmental Protection Agency **last** surveyed the radio frequency environment in the United Slates, the average urban dweller's exposure to radio waves has increased 1,000-fold, most of this increase occumng in **just** the last nine years.8 lo the same period of time, radio pollution has spread from the cities to rest like a ubiquitous fog over the entire planet.

The vast human consequences of all this are being ignored. Since the late 1990s a whole new class of environmental refugees has been created right here in the United States. We have more and more people, sick, dying, seeking relief from our suffering, leaving our homes and our livelihoods, living in cars, trailers and tents in remote places. Unlike victims of hurricanes and earthquakes, we are not the subject of any relief efforts. No one is donating money to help us, to buy **us** a protected refuge; no one is volunteering to forego their cell phones, their wireless computers and their cordless phones so that we can once more be their neighbors and live among them.

The womed and the **sick** have not yet opened their hearts to each other, but they are asking questions. To answer caller **A:** No shield or headset will protect you from your cell or portable phone. There is no safe distance from a cell tower. If your cell phone or your wireless computer works where yon live, you are being irradiated 24 hours a day.

To caller B: To effectively shield a house is difficult and rarely successful. There are only a few doctors in the United States attempting to treat radio wave sickness, and their success rate is poor — because there are few places left on Earth where one can go to escape this radiation and recover.

Yes, radiation comes down from satellites, too; they are part of the problem, not the solution. There is simply no way to make wireless technology safe.

Ow society has become hotb socially and economically dependent, in just one short decade, upon a technology that is doing tremendous damage to the fabric of our world. The more entrenched we let ourselves become in it, the more difficult it will become to change our course. The time lo extricate ourselves, both individually and collectively — difficult though it is already is — is now.

NOTES

1. Leif G. Salford et al., "Nerve Cell Damage in Mammalian Brain After Exposure to Microwaves from GSM Mobile Phones," Environmental Health Perspectives 111, no. 7 (2003): 881–883.

2. Allan H. Frey, Sondra R. Feld and Barbara Frey, "Neural Function and Behavior," Annals of tbe New York Academy of Sciences 247 (1975): 433–439.

3. Allan H. Frey, "Evolution and Results of Biological Research with Low-Intensity Nonionizing Radiation," in Modem Bioelectricity, ed. Andrew A. Marino (New York: Dekker, 1988), 785–837, at 809–810.

4. California EMF Program, The Risk Evaluation: An Evaluation of the Possible Risks From Electric and Magnetic Fields (EMFs) From Power Lines, Internal Wiring, Electrical Occupations and Appliances (2002), app. 3.

5. Örjan Hallberg and Olle Johansson, "1997 — A Curious Year in Sweden," European Journal of Cancer Prevention 13, no. 6 (2004): 535–538.

6. Örjan Hallberg and Olle Johansson, "Does GSM 1800 MHz Affect the Public Health in Sweden?" in Proceedings of the 3rd International Workshop "Biological Effects of EMFs," Kos, Greece, October 4-8, 2004, 361–364.

7. Örjan Hallberg and Olle Johansson, "Cancer Trends During the 20th Century," Journal of Australian College of Nutritional and Environmental Medicine 21, no. I (2002): 3–8.

8. David E. Janes Ir., 'Radiofrequency Environments in the United States," in 15th IEEE Conference on Communication, Boston, MA, lune 10–14, 1979, vol. 2, 31.4.1–31.4.5.

Arthur Firstenberg is an author and consultant on the health and environmental effects of electromagnetic energy. He is a founder and president of the Cellular Phone Task Force, a nonprofit organization. He is the author of Microwaving Our Planet: The Environmental Impact of the Wireless Revolution (1997), and be edited and published the journal No Place To Hide from 1997 to 2002. He can be contacted at (505) 471-0129 or (707) 937-3990. His feature, "The Largest Biological Experiment Ever," begins on page 34.

EXHIBIT M

6,000 doctors worldwide.

Interdisziplinäre Gesellschaft für Umweltmedizin e. V.

IGUMED, Bergseestr. 57. 79773 Bad Säckingen
Tel. 07761 913490, FAX 913491, mail: igumed@gmx.de

IGUMED

9. Oktober 2002

FREIBURGER APPEAL

Out of great concern for the health *of* our fellow human beings do we - as established physicians of all fields, especially that *of* environmental medicine - turn to the medical establishment and those in public health and political domains, as well as to the public.

We have observed, in recent years, a dramatic rise in severe and chronic diseases among our patients, especially:

- Learning. concentration, and behavioural disorders (e.g. attention deficit disorder, ADD)
- Extreme fluctuations in blood pressure, ever harder io influence with medications
- Heart rhythm disorders
- Heart attacks and strokes among an increasingly younger population
- Brain-degenerative diseases (e.g. Alzheimer's) and epilepsy
- Cancerous afflictions: leukemia. brain tumors

Moreover, **we** have observed an ever-increasing occurrence of various disorders, often misdiagnosed in patients as psychosomatic:

- Headaches, migraines
- Chronic exhaustion
- Inner agitation
- Sleeplessness, daytime sleepiness
- Tinnitus
- Susceptibility to infection
- Nervous and connective tissue pains, for which the usual causes do not explain even the most conspicuous symptoms

Since the living environment and lifestyles of our patients are familiar to us. we can see – especially afler carefully-directed inquiry – a clear temporal and spatial correla-

EXHIBIT M

tion between the appearance of disease and exposure to pulsed high-frequency microwave radiation (HFMR), such as:

- Installation of a mobile telephone sending station in the near vicinity
- Intensive mobile telephone use
- Installation of a digital cordless (DECT) telephone at home or in the neighbourhood

We can no longer believe this to be purely coincidence. for:

- Too often do we observe a marked concentration of particular illnesses in correspondingly HFMR-polluted areas or apartments;
- Too often does a long-term disease or affliction improve or disappear in a relatively short time afler reduction or elimination of HFMR pollution in the patient's environment;
- Too often are our observations confirmed by on-site measurements of HFMR of unusual intensity.

On the basis of our daily experiences, we hold the current mobile communications technology (introduced in 1992 and since then globally extensive) and cordless digital telephones (DECT standard) to be among the fundamental triggers for this fatal development. One can no longer evade these pulsed microwaves. They heighten the risk of already-present chemical/physical influences, stress the body's immune system, and can bring the body's still-functioning regulatory mechanisms to a halt. Pregnant women, children, adolescents, elderly and sick people are especially at risk.

Our therapeutic efforts to restore health are becoming increasingly less effective: the unimpeded and continuous penetration of radiation *into* living and working areas – particularly bedrooms, an essential place for relaxation, regeneration and healing – causes uninterrupted stress and prevents the patient's thorough recovery.

In the face of this disquieting development, we feel obliged to inform the public of our observations – especially since hearing that the German courts regard any danger from mobile telephone radiation as "purely hypothetical" (see the decisions of the constitutional court in Karlsruhe and the administrative court in Mannheim, Spring 2002).

What we experience in the daily reality of our medical practice is anything but hypothetical! We see the rising number of chronically sick patients also as the result of an irresponsible "safety limits" policy, which fails to take the protection of the public from the short- and long-term effects of mobile telephone radiation as its criterium for action. Instead, it submits to the dictates of a technology already long recognized as dangerous. For us, this is the beginning of a very serious development through which the health of many people is being threatened.

We will no longer be made to wait upon further unreal research results -which in our experience are often influenced by the communications industry – while evidential studies go on being ignored. We find it to be of urgent necessity that we act now!

EXHIBIT M

Above all, we are, as doctors, the advocates for our patients. In the interest of all those concerned, whose basic right to life and freedom from bodily harm is currently being put at stake, we appeal to those in the spheres of politics and public health. Please support the following demands with your influence:

- New health-friendly communications techniques, given independent risk assessments before their introduction

and, as *immediate* measures and transitional steps:

- Stricter safety limits and major reduction of sender output and HFMR pollution on a justifiable scale, especially in areas of sleep and convalescence
- A say on the part of local citizens and communities regarding the placing of antennae (which in a democracy should be taken for granted)
- Education of the public, especially of mobile telephone users, regarding the health risks of electromagnetic fields
- Ban on mobile telephone use by small children, and restrictions on use by adolescents
- Ban on mobile telephone use and digital cordless (DECT) telephones in preschools, schools, hospitals, nursing homes, events halls, public buildings and vehicles (as with the ban on smoking)
- Mobile telephone and HFMR-free zones (as with auto-free areas)
- Revision of DECT standards for cordless telephones with the goal of reducing radiation intensity and limiting actual use time, as well as avoiding the biologically critical HFMR pulsation
- Industry-independent research, finally with the inclusion of amply available critical research results and our medical observations

EXHIBIT M

Dr. med. Thomas Allgaier, General medicine, Environmental medicine, Heitersheim
Dr. med. Christine Aschermann, Neural physician, Psychotherapy, Leutkirch
Dr. med. Waltraud Bär, General medicine, Natural healing, Environmental medicine, Wiesloch
Dr. med. Wolf Bergmann, Genaeral medicine, Homeopathy, Freiburg
Dr. med. H. Bernhardt, Pediatry, Schauenburg
Dr. Karl Braun von Gladiß, General medicine, Holistic medicine, Teufen
Hans Brüggen, Internal medicine, Respiratory medicine, Environmental medicine, Allergenics, Deggendorf
Dr. med. Christa-Johanna Bub-Jachens, General medicine, Natural healing, Stiefenhofen
Dr. med. Arndt Dohmen, Internal medicine, Bad Säckingen
Barbara Dohmen, General medicine, Environmental medicine, Bad Säckingen
Verena Ebert, Doctor, Kötzting
Dr. med. Joachim Engels, Internal medicine, Homeopathy, Freiburg
Karl-Rainer Fadig, Practiced doctor
Dr. med. Gerhilde Gabriel, Doctor, München
Dr. med. Karl Geck, Psychotherapy, Murg
Dr. med. Jan Gerhard, Pediatrics, Child/adolescent psychiatry, Ahrensburg
Dr. med. Peter Germann, Doctor, Environmental medicine, Homeopathy, Worms
Dr. med. Gertrud Grünenthal, General medicine, Environmental medicine, Bann
Dr. med. Michael Güllich, Doctor, Schopfheim
Julia Günter, Psychotherapy, Korbach
Dr. med. Wolfgang Haas, Internal medicine, Dreieich
Dr. med. Karl Haberstig, General medicine, Psychotherapy, Psychosomatics, Inner-Urberg
Prof. Dr. med. Karl Hecht, Specialist in stress-, sleep-, chrono- und space travel medicine, Berlin
Dr. med. Bettina Hövels, General medicine, Lörrach
Walter Hofmann, Psychotherapy, Singen
Dr. med. Rolf Jänzen, Pediatrics, Waldshut-Tiengen
Dr. med. Peter Jaenecke, Dentist, Ulm
Michaela Kammerer, Doctor, Murg
Dr. med. Michael Lefknecht, General medicine, Environmental medicine, Duisburg
Dr. med. Volker zur Linden, Internal medicine, Bajamar
Dr. med. Dagmar Marten, Doctor, Ochsenfurt
Dr. med. Rüdolf Mraz, Psychotherapy, Natural healing, Stiefenhofen
Dr. med. Otto Pusch, Nuclear medicine, Bad Wildungen
Dr. med. Josef Rabenbauer, Psychotherapy, Freiburg
Elisabeth Radloff-Geck, Doctor, Psychotherapy, Homeopathy, Murg
Dr. med. Anton Radlspeck, Practical doctor, Natural healing, Ahohming
Barbara Rautenberg, General medicine, Environmental medicine, Kötzting
Dr. med. Hans-Dieter Reimus, Dentist, Oldenburg
Dr. med. Ursula Reinhardt, General medicine, Bruchköbel
Dr. med. Dietrich Reinhardt, Internal medicine, Bruchköbel
Dr. med. Andreas Roche, General medicine, Kaiserslautern
Dr. med. Bernd Salfner, Pediatrics, Allergenics, Waldshut-Tiengen
Dr. med. Claus Scheingraber, Dentist, München
Dr. med. Bernd Maria Schlamann, Dentist, Non-medical practitioner, Ahaus-Wessum
Dr. med. Hildegard Schuster, Psychotherapy, Lörrach
Norbert Walter, General medicine, Natural healing, Bad Säckingen
Dr. med. Rosemarie Wedig, Doctor, Psychotherapy, Homeopathy, Düsseldorf
Dr. med. Günter Theiss, General medicine, Frankfurt
Prof. Dr. med. Otmar Wassermann, Toxicology, Schönkirchen

Prof. Dr. med. H.-J. Wilhelm, Ear, nose and throat doctor, Phoniater, Frankfurt
Dr. med. Barbara Würschnitzer-Hünig, Dermatology, Allergenics, Environmental medicine, Kempten
Dr. med. Ingo Frithjof Zörn, General medicine, Phlebology, Natural healing, Environmental medicine, Nordrach

List of supporters for the *FREIBURGER APPEAL:*

Dr. med. Wolfgang Baur, General medicine, Psychotherapy, Environmental medicine, Vienenburg
Prof. Dr. Klaus Buchner, Physicist, München
Volker Hartenstein, Member of Parliament (Bavaria), Ochsenfurt
Maria und Bruno Hennek, Self-help group for chemical- and wood preservative-damaged, Würzburg
Dr. Lebrecht von Klitzing, Medicinal physicist, Stokelsdorf
Wolfgang Maes, Baubiology and Environmental analysis, Neuß
Helmut Merkel, 1st Chairman of Biobiology Organization, Bonn
Peter Neubold, Non-medicinal practitioner, Berlin
Prof. Dr. Anton Schneidrr. Scientific leader of Institute for Baubiology and Ecology, Neubeuern
Dr. Birgit Stöcker, Chairwoman of Self-Help Organization for Electrosensitives, München
Prof. Dr. Alfred G. Swierk, Mainz
Dr. Ulrich Warnke, Biophysics, Biopsychology

...e, Saarbrücken

EXHIBIT M

The EMR Policy Institute
A Non-Profit Corporation www.EMRPolicy.org

Advancing Sound Public Policy
on the Use of Electromagnetic Radiation (EMR)
P. O. Box 117 Marshfield VT 05658 E-mail: info@emrpolicy.org
Tel: 802-426-3035 FAX: 802-426-3030

FOR IMMEDIATE RELEASE

Contact:
Susan Foster Ambrose, M.S.W., Medical Writer
P.O. Box 3605
Rancho Santa Fe. CA 92067
858.756.3532
sfambrose@cox.net

INTERNATIONAL ASSOCIATION OF FIREFIGHTERS (IAFF) VOTES TO STUDY HEALTH EFFECTS OF CELL TOWERS ON FIRE STATIONS

Call for Moratorium on New Cell Towers on Fire Stations Until Health Effects Can Be Studied

Boston. MA – August 24, 2004 – Firefighters returned lo their home stations throughout the United States and Canada following last week's IAFF convention afler passing a resolution lo study the health effects of cell towers placed on the fire stalions where they work and live

Added to the resolution was an amendment calling for the IAFF to support a moratorium on the placement of new tell towers on fire stations until the completion of the study.

In many parts of the U.S. and Canada, the wireless industry has sought to place cell towers on fire stations because of their strategic localions. Fire stations lend to be located in densely populated areas, many of them near main highways, making them attractive locations for cell towers to maximize coverage. The wireless industry is not alone in the benefits of placing cell towers on these stations. Municipalities receive revenue from the wireless companies in exchange for locating the antennas on fire station property.

Lt. Ron Cronin of the Brookline, MA Fire Department and Acting Lt. Joe Foster of the Vancouver Fire Department and Vice President of Vancouver, B.C. Local #18 spearheaded the passage of the resolution.

'Some firefighters with cell lowers currently located on their stalions are experiencing symptoms that put our first responders at risk, It is important to be sure we understand whal effects these towers may have on the firefighters living in these stations." Cronin explained. "If the jakes in the fire house are suffering from headaches, can't respond quickly and their ability to make decisions is clouded by a sort of brain fog, then entire communities they are protecting will clearly be at risk. No one wants the guys responding to their family emergency to be functioning at anylhing less than 100 percent capacity. "

A recent pilot study of six California firefighters. first publicly revealed at the IAFF convention by medical writer and sludy organizer Susan Foster Ambrose of San Diego, CA, raises concern about the safety of fire fighters working and sleeping in stations with lowers.

EXHIBIT M

The study. conducted by Dr. Gunnar Heuser of Agoura Hills, CA. focused on neurological symptoms of six firefighters who had been working for up to five years in stations with cell towers. Those symptoms included slowed reaction time, lack of focus, lack of impulse control. severe headaches. anesthesia-like sleep, sleep deprivation. depression, and tremors.

Dr. Heuser, along wilh Dr. J. Michael Uszler of Santa Monica, CA, used functional brain scans - SPECT scans - to assess any changes in the brains of the six firefighters as compared lo healthy brains of men *of* the same age. Computerized psychological testing known as TOVA was used lo study reaction time, impulse control. and attention span.

Disturbingly, the SPECT scans revealed a pattern **of** abnormal change which was concentrated over a wider area than would normally be seen in brains of individuals exposed to toxic inhalation, as might be expected from fighting fires. Dr. Heuser indicated the only plausible explanation at this time would be RF radiation exposure. Additionally, the TOVA testing revealed among the six firefighters delayed reaction time. lack of impulse control. and difficulty in maintaining mental focus.

Because of increasing complaints among firefighters with cellular antennas on their stations coupled with the California study showing damage among the ***six*** firefighters tested, a group of five individuals spread across **two** provinces and three states worked with Southern California firefighters lo draft the resolution put before the IAFF membership last week. Lt. Ron Cronin and Acting Lt. Joe Foster werejoined by Dr. Magda Havas of Trent University in Peterborough, Ontario, Vermont-based Janet Newton - president ***of*** the EMR Policy Institute, and Susan Foster Ambrose.

"It is imperative to understandthat in spite of the build out of an extensive wireless infrastructure in the U.S. and Canada," explained Ambrose. "we have no safety standards for cell towers. There are only regulatory standards, not proven safety standards. The Heuser Study in California calls into question *whether or* not we are sacrificing the health and well being of our countries' first responders for the convenience of a technology we've come lo rely upon."

Considering approximately 80 percent of the firefighters attending last week's convention voted in favor of a medical study with the spirit of a cell lower moratorium attached. it appears firefighters throughout the U.S. and Canada share that concern.

This study has far-reaching public health implications in view of the fact that the wireless industry pays local governments **to** place cell towers, not only on fire stations. but also on top of schools and municipal buildings.

For more information contact:
Susan Foster Ambrose: 858.756.3532; sfambrose@cox.net
Lt. Ron Cronin: 617.212.5670; ron.cronin@verizon.net
Acting Lt. Joe Foster: 604.250.5727; joe@iaff18.org
Magda Havas, Ph.D.: 705.748.1011 x 1232; mhavas@trentu.ca
Janet Newton: 802.426.3035; JNewton@emrpolicy.org
Gunnar Heuser. M.D., Ph.D., F.A.C.P.: 818.865.1858; www.toxqun.com
J. Michael Uszler, M.D.: 310.264.0080; www.santarnonicaimaqina.com

###

EXHIBIT M

THE EMR NETWORK
A NON-PROFIT CORPORATION www.EMRNetwork.org
CITIZENS AND PROFESSIONALS FOR THE RESPONSIBLE USE OF ELECTROMAGNETIC RADIATION (EMR)
P. O. Box 221, MARSHFIELD, VT 05658 TEL: (802) 426-3035 FAX: (802)426-3030

SERIOUS FLAWS WITH THE FCC RF/MW SAFETY STANDARDS

Adapted from B. Blake Levitt

The Federal Communications Commission (FCC) is a licensing and engineering agency that relies on other agencies to recommend and set safety standards for communications technology.

The ***FCC*** has traditionally adopted safety recommendations from the American National Standards Institute (ANSI). ANSI is an industry-based and controlled organization comprised of numerous industries. automobile manufacturers. and many others. ANSI looks to a subcommittee of the Institute of Electrical and Electronics Engineers (IEEE) which is responsible for making recommendations for exposure standards to radio frequency radiation (RFR) Subcommittee C95.1 The standards are referred to as ANSI-IEEE C95.1 -1992. representing the last year in which revisions were made to the original standard put out in 1966.

The National Council of Radiation Protection and Measurement (NCRP) also sets standards for diverse radiation-producing products. including RF-emitting devices. The NCRP is the only agency mandated by **Congress** to set radiation standards. In 1986. it set a standard for RF/Microwave **(MW)** exposure levels for the general public that was five times more stringent than the then-current **ANSI** standard.

The U.S. Environmental Protection Agency is the agency that has final authority to determine which standards will be **used.** In 1996. Congress – while preempting states rights for environmental control over RF health concerns– mandated that the FCC get its regulatory house in order. The FCC was widely expected to adopt the IEEE/ANSI standard again. Both industry and the U.S. military favored it and lobbied hard. But the EPA urged that the NCRP standard be adopted instead. What the FCC adopted was the two-tiered NCRP levels for human exposure. adding the IEEEIANSI description for the two tiers.

This is a step in the right direction. <u>But the standards are still seriously flawed</u>,

1. The model used for both standards is an adult male of average height and weight. It does not take women, pregnant women, or children into consideration – all of whom absorb radiation differently than this "average" model. Nor does it consider the elderly or the infirm who are more susceptible to adverse exposures.

2. The model. and all of the research it is drawn from, is based solely on the thermal effects these frequencies can create. It has been known for decades that microwaves, at sufficient power-output. can create heating. That's what occurs in a microwave oven. This model presumes that nothing other than heating occurs. Therefore. if heating does not occur. nothing else does either. But a range of adverse non-thermal effects have been noted lor decades as well – at significantly lower levels than this current standard. It has been at the heart of this debate since the 1950's.

EXHIBIT M

3. The FCC standards do not take into account:

- Numerous research reports finding non-thermal **effects.**
- long-term. low-level, continuous exposures such as would be found in homes near RF/MW emitting installations.
- The potential of RF radiation to create "standing wave hot-spots" near metal objects (water towers. other antenna towers, metal roofs, metal girders used in some architectural designs. elevator shafts. etc.)
- The distinction between digital (pulsed-wave) technology and the older analog (continuous-wave) tethnology. Pulsed RF has been found in several experiments to increase abnormal cell growth in tumorogenic cell cultures by up to 3000%.

4. The FCC requires very little RFR monitoring from its licensees and does little of its own. As a result the aggregate of many collocated installations, and resulting RFR accumulation. is poorly documented and rarely monitored.

5. The IEEE is mainly comprised of engineers and physicists who deal with the non-living sciences. They have traditionally been charged with making these technologies work, not with understanding the health effects that are within the purview of the "living" sciences of biology and medicine. etc. Yet appropriate funds for RF research in the living sciences have never heen forthcoming. The RF standards in place today are based on a faulty thermal model. designed by professionals from an inadequate range of scientific disciplines. and are drawn from research of an inappropriate kind (short-term. high-power designs models.)

6. For many of the new personal wireless services, the FCC does not monitor any communications installations for *RF* compliance. They issue licenses for whole regions and do not have a complete inventory list of actual installations and no idea where many are located. RF emission levels are usually based solely on computer models done by the industry when applying for licenses, not on actual on site measurements.

(Source: Electromagnetic Fields: A Consumers Guide and How to Protect Ourselves, by B. Blake Levitt. Harcourt Brace. 1995.)

EXHIBIT M

Judge thinks radiation of 3G-mast could possibly he harmful
Monday June 06th 2005, 9:16 am
Filed under: Cell Phone Towers, Court actions

Press release, to be forwarded and printed
Information: Frans van Velden, ++31 70 3820525, fransp@dds.nl

Judge thinks radiation of 3G-mast could possibly be harmful

lune 5, 2005 - **A** judge of the court of Almelo (The Netherlands) has rejected the demands of Vodafone Libertel, **a** provider of mobile telephone services. The judge said it is not beyond doubt that the radiation of a planned 3G-mast does not affect the well-being and health of people living and working in the vicinity. **A** standard procedure should give the answer.

The municipality of Haaksbergen gave a permit on Nov. 2,2004 to Vodafone Libertel to build a 37,5 metre mast for mobile telephone antennas. But people living and working in the area raised strong objections. The local council decided, no masts were allowed in the vicinity of homes, until the uncertainty about tbe health effects is taken away. Therefore, on April ***26,*** 2005 the municipality has withdrawn the permit. On May **9** Vodafone asked the judge to suspend this withdrawal. The judge decided on May **24.**

The consideration of the municipality was, that the well-being and health interests of the people living and working in the vicinity is more important than the wish of Vodafone to cover the **area** by 3G-technology Their legal adviser Paul Baakman (www.bawa.nl) called upon the precautionary principle, given by article 174 of the European Treaty, This principle has been agreed at the conference of Rio in **1992,** concerning the environment. "Electrosmog is a problem of health and environment", **said** Baakman. Vodafone however stated, that 3G-antennas do not have noticeable negative effects on the health of these people, according lo jurisprudence. The provider says the withdrawal of the permit is insufficiently motivated.

The judge said the suspension of the withdrawal could not be the same as the revival of the permit. To revive the permit would be a bridge too far, since it is not certain **and** beyond doubt that the withdrawal will not stand in a standard procedure. Moreover the consequences could be irreversible. The withdrawal can be questioned, but a standard procedure should give the answer.

There is no appeal to this verdict. Vodafone has to wait **for** the standard procedure. In tbe meantume the people living and working in the vicinity of the planned 3G-mast, the local council and the municipality of Haakshergen have to develop convincing proof of the harmfulness of the radiation to their well-being, health and environment.

Sources in Dutch:
http://www.stopumts.nl/doc.php/Artikelen/381
http://www.stopumts.nl/doc.php/Artikelen/382
http://www.ictubantia.nl/regioportal/TC/1,1478,1654-zoeken-Zoeken!!__2727983_,00.html?ArchiefID=2727983

This site is powered by WordPress 1.5

EXHIBIT M 9:18 2006 7

When Bees Disappear, Will People Soon Follow?

by Jean-Claude Gerard Koven

LAST WEEK I received an email from a friend reporting a sudden, devastating collapse in America's bee population. The message triggered an immediate unpleasant shiver through my body as I recalled the ominous quote attributed to Albert Einstein: "If the bee disappeared off the surface of the globe, then man would only have four years of life left. No more bees, no more pollination, no more plants, no more animals, no more man."

Being a bit skeptical, I assumed this was just another piece of alarmist misinformation finding its way onto Internet distribution lists. A few minutes' research not only confirmed the story, but made me realize that the problem is far from local. In official circles, the condition is called either Fall-Dwindle Disease or, more commonly, Colony Collapse Disorder (CCD).

The communication I received stated: "Honeybees are flying off in search of pollen and nectar and simply never returning to their colonies. During the final three months of 2006, a distressing number of honeybee colonies began to diminish from the United States, and beekeepers all over the country have reported unprecedented losses. According to scientists, the domesticated honeybee population has declined by about 50 percent in the last 50 years. Reports of similar losses to the honeybee population have been documented before in beekeeping literature, but are widely believed to have occurred at this scale previously only at a regional level. With outbreaks recorded as far back as 1896, this is regarded as the first national honeybee epidemic in U.S. history."

The topics grabbing headlines these days leave little room in the news for the plight of an insect. What we fail to appreciate is that without an abundance of bees to pollinate crops, the United States could lose as much as 30 percent of its food supply. According to Zac Browning, vice president of the American Beekeeping Federation, "Every third bite we consume in our diet is dependent on a honeybee to pollinate that food."

There is no doubt about what is happening — or its consequences if the situation is not rectified. What remains murky is the cause. According to Walter Haefeker, director of the German Beekeepers Association, CCD has four possible causes: the varroa mite, introduced from Asia; the widespread practice of spraying wildflowers with herbicides; the practice of monoculture (a single crop covering a large area); and the controversial yet growing use of genetic engineering in agriculture (so many GMO crops which even invade the organic grown farms) [**Editor's Note:** *By the way there have been many more incidences of severe allergies that people are reporting which may be related to the GMO crops as well as 'chem trails' AND the 'chem trails' may also be affecting the bees. Bottom line, all of the above affects us all in adverse ways*].

However, it is the thinking of one of the cell phone industry's former scientific hired guns that caught my attention. When George Carlo, M.D., the celebrated author of "Cell Phones: Invisible Hazards in the Wireless Age" and current chairman of the nonprofit Science and Public Policy Institute in Washington, D.C., weighs in with an opinion, we'd all be fools not to listen carefully.

On a recent conference call, Dr. Carlo laid the blame for the sudden demise (often within 72 hours) of entire bee colonies on the recent proliferation of electromagnetic waves (EMF). He cited the startling statistic that, at present, there are some 2.5 billion cell phone users around the world. While this (plus the explosive growth of cell phone towers) used to be the major concern, the problem has been significantly exacerbated by the recent introduction of satellite radio. Imagine being closeted in a confined environment filled with chain smokers; it would be impossible for you to get a breath of clean air. It is becoming equally difficult for you to avoid the now-measurable damage from EMF exposure.

Dr. Carlo commented that the constant electromagnetic background noise seems to disrupt intercellular communication within individual bees, such that many of them cannot find their way back to the hive. His conclusions are confirmed by a recent study conducted by three departments of Panjab University (India), which has found that cell phone towers — the dominant source of electromagnetic radiation in the city of Chandigarh — could well be the cause behind the mysterious disappearance of butterflies, some insects (like bees), and birds.

Andrew Weil, M.D., author of "Spontaneous Healing and 8 Weeks to Optimum Health," fully agrees: "Electromagnetic pollution may be the most significant form of pollution human activity has produced in this century, all the more dangerous because it is invisible and insensible." In some countries, up to 10 percent of the population suffers from a serious EMF-induced condition that Dr. Carlo and others call membrane sensitivity syndrome. In a recent address to the Health, Social Services and Housing Sub-Panel in the United Kingdom, Carlo explained, "Originally, this type of condition was the result of high chemical exposures; we used to call it chemical sensitivity. Now, we have identified the same type of condition in patients who are exposed to various types of electromagnetic radiation. It is a medical problem. People who have membrane sensitivity syndrome have internal bleeding. They can be in a room where somebody puts on a cell phone, and they will end up having an immediate reaction; they will go home and they will bleed and in their stool they will have blood. This condition is very debilitating. It prevents these people from being able to work; they cannot earn a living, they have difficult relationships with their children, their spouses give up on them. ... It is a very, very serious medical problem."

The bees are the modern-day counterpart of the canaries that miners used to carry with them as they descended into the mine shafts. If the birds died, it was an early warning of a buildup of toxic gases in the mine. When canaries die or bees disappear, we are being cautioned that we too are in immediate danger. It is time to listen to the message nature is telling us. Denial — the favorite ploy of those whose profits are being threatened — is no longer an option. As Arthur Schopenhauer said, "All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident."

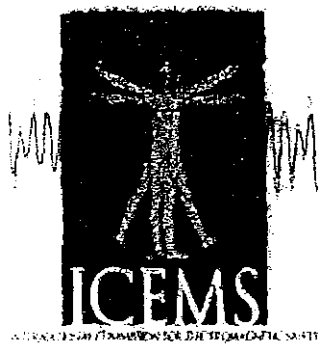
I shudder to think of what will become of humankind if we linger too long in stage two: "no more bees, no more pollination, no more plants, no more animals, no more people."

Jean-Claude Gerard Koven is a writer and speaker based in Rancho Mirage, Calif. He is a featured weekly columnist for UPI's (United Press International) ReligionAndSpirituality.com and the author of "Going Deeper: How to Make Sense of Your Life When Your Life Makes No Sense," recipient of both the Allbooks Reviews editor's choice award and the USABookNews.com award for the best metaphysical book of the year. For more information, please visit: www.goingdeeper.org. Printed with permission.

The Connection Magaz
www.theConnect.com
May 2007

EXHIBIT M

Sito Web ufficiale del
Comune di
BENEVENTO
Via Annunziata Palazzo Mosti
Telefono 0824 772111 Fax 0824 47774



IMMEDIATE RELEASE – September 19.2006
Elizabeth Kelley, ICEMS Management Secretarial
info@icems.eu

Scientists Urge Greater Precaution and Independent Research, lo Protecl Health from Exposure lo Electromagnelic Fields

A group of scientists are urging people to lake sensible precautions against potential health **risks** relaled lo exposure lo electromagnetic fields (EMF). They also call for a full and independent review of the scientific evidence that points to hazards lrom current EMF exposure conditions world-wide, and lor an independent. publicly managed research program to investigate critical issues of health and salety. **At** a meeting held in Benevento. Italy in last February, 2006, these scienlists reviewed current scientific evidence on potential health effects related to EMF exposure in the extremely-low frequency **(ELF)** and radiofrequency (RF) band *of* the electromagnetic spectrum (0-300GHz). Energies of lhese frequencies. called nonionizing. are used in electrical transmission, distribution and electrical use by *the* public. by radio and *television* broadcasls, cellular transmissions. wireless internet access and more. These scientists believe that exposure Io even the weak fields emitted by these technologies can affect biological systems.

After several months of debate. thirty-one scientists, just signed a consensus statement, called the 'Benevento. Resolution. to advise the public and the scientific community of their strong belief that there are adverse health effects from current EMF exposure conditions. They urge more prudent use of all EMF-emitting products and services. They specifically advise children and young leenagers be guided to limit use of cellular and cordless phones and that marketing campaigns 'lo them should be banned

Dr. Sandro D'Allessandro, a physician and Mayor of Benevento from **2001-2006.** at the time Ihe City of Benevento sponsored the February 2006 meeting. states. 'Public opposition to two high power transmission lines that went through a nearby village, Contrada San Vitale. **led** to their removal. As a physician, and as Ihe mayor of Benevento, I share public concern about electromagnetic safety. We sponsored this workshop in response lo public interest in knowing more about the science on bioelectromagnetics."

The 3-day workshop. entitled, "Precautionary **EMF** Approach: Rationale. Legislation and Implementation". began on February 22. 2006. The organizer was the International Commission for Electromagnetic Safety (ICEMS), who invited participants horn 12 *different* countries – Brazil. Canada, China, Israel, Italy. Poland. **Russia,** Sweden. Taiwan, Turkey. **United** Kingdom and the United States. The Benevento Resolution of *2006* affirms the Catania Resolution. adopted in 2002, Ihat conveyed a similar scientific position. These resolutions apply the Precautionary Principle[1] to encourage more protective safety measures be employed in the design. manufacture, and standard-setting process for all **EMF** emitting technologies, calling for health assessments of current EMF exposure conditions lor the general public and for wcikeis.

Prof. Livio Guiliani, ICEMS Spokesman, who directs research programs for the "Instituto Superiore per la Prevenzione e la Sicurezza del Lavoro" (ISPESL). the Italian Health Ministry's worker salety and protection program, slated. 'why is it laking *so* long to gel these concerns addressed? Scientific controversy about **EMF** and this meeting provide new reasons to reach an agreement on increased public health and worker safety protection. The criticisms of some scientists who ignore the epidemiological findings are effectively challenged as new experimental results were presented that indicate mechanisms of electromagnetic field non-thermal bio-interaction.'
The International Commission on Electromagnetic Safety, is a not-for- profit group of concerned scientists.
The Benevento Resolution may be viewed online at www.icems.eu

[1] The Precautionary Principle states " when there is uncertainty concerning possible adverse effects from an exposure, the risks from inaction may be much greater than the risks of action to control these exposures, and the burden of proof is shifted from those suspecting the risk to those who deny it."

EXHIBIT M

Enter your email ac GO

#541: Court dehvers blow against mobile masts
Thursday August 24th 2006, 2 25 pm
Filed under: Cell Phone Towers

The weblog version of this message is at:
http://www.emfacts.com/weblog/index.php?p=541

From http://www.mast-victims.org:

Court delivers blow against mobile masts
Ruling cites public health risk
Original article: http://www.ekathimerini.com/4dcgi/_w_articles_politics_100010
18/07/2006_72201

Ten mobile telephone antennas, eight of which are in Athens, must be removed as they pose a threat to public health, the Athens Appeals Court ruled yesterday.

The ruling rebuffs an appeal by an unidentified mobile operator for the suspension of a decision by the National Telecommunications and Post Commission (EETT) to remove the poles. In justifying its ruling, the court cited "urgent concerns regarding the protection of public health."

All 10 antennas in question had been hidden in chimneys, electric boilers and other appliances to thwart residents and authorities. Eight of the 10 antennas are located on top of apartment blocks in districts of Aihens including Halandri, Vyronas, Ilioupolis and Kallithea. The other two are located at the airports of Iraklion, in Crete, and Kos. Only one of the antennas, in Kallithea, had been operating with a license but it will also be taken down.

"It is not only one (mobile phone) company that is to blame here," EETT Vice President Nikos Koulouris told Kathimerini. "The unlicensed erection of antennas is common practice. EETT has also decided to take down antennas put there by other companies," he said, adding that the commission usually finds out about illegal antennas through residents' complaints.

"We refuse to become the guinea pigs of (mobile) firms," Nikos Krassakis, a member of the Sepolia committee lobbying for the removal of antennas told Kathimerini. "Our main concern is not whether the antennas are legal or not but how much of a threat they are to our health." Krassakis said his group's protests had led to the removal of two antennas and the decision to stop the erection of a third.

"(The ruling) is a very positive decision, a blow against the unaccountability of (mobile) firms, but is not enough. We need a more collective approach," Loukas Margaritis, a professor at Athens University, told Kathimerini. "Scientifically, there is no doubt that radioactivity is a health risk, even within the limits imposed by legislation," he said. He added that a solution would be to relocate the antennas to the outskirts of towns, and set them at much higher levels to lessen the impact of emissions.

EXHIBIT M 9/18/2006

THE INDEPENDENT

Are mobile phones wiping out our bees?

Scientists claim radiation from handsets are to blame for mysterious 'colony collapse' of bees

By Geoffrey Lean and Harriet Shawcross

Published: 15 April 2007

It seems like the plot of a particularly far-fetched horror film. But some scienlists suggest that our love of the mobile phone could cause massive food shortages, as the world's harvests fail.

They are putting forward the theory thal radiation given ofl by mobile phones and olher hi-tech gadgets is a possible answer to one of the more bizarre mysteries ever lo happen in the natural world - the abrupt disappearance of the bees that pollinate crops. Late last week, some bee-keepers claimed that the phenomenon - which started in the US, then spread to continental Europe - was beginning lo hit Britain as well.

The theory is thal radiation from mobile phones interfereswith bees' navigation systems. preventing the famously homeloving spedes from finding their way back to heir hives. Improbable as it may seem. Ihere is now evidence lo back this up.

Colony Collapse Disorder (CCD) occurs when a hive's inhabilanls suddenly disappear, leaving only queens, eggs and a few immature workers. like so many apian Mary Celestes. The vanished bees are never found, but thought lo die singly far from home. The parasites. wildlife and other bees that normally raid the honey and pollen left behind when a colony dies, refuse to go anywhere near the abandoned hives.

The alarm was first sounded lasl autumn, but has now hit half of all American slates. The West Coast is thought to have lost 60 per cent of its commercial bee population, with 70 per cent missing on the East Coast.

CCD has since spread io Germany, Switzerland. Spain, Portugal, Italy and Greece. And lasl week John Chapple. one of London's biggest beekeepers. announced that 23 of his 40 hives have been abruptly abandoned.

Olher apiarists have recorded losses in Scotland, Wales and north-west England, but the Department of the Environment. Food and Rural Affairs insisted: "There is absolutely no evidence d CCD in the UK."

The implications of the spread are alarming. Most of the worlds crops depend on pollination by bees. Albert Einstein once said that if the bees disappeared. "man would have only four years of life left".

No one knows why it is happening. Theories involving miles, pesticides. global warming and GM crops have been proposed. but all have drawbacks.

EXHIBIT M

German research has long shown that bees' behaviour changes near power lines.

Now a limited study at Landau University has found that bees refuse to return to their hives when mobile phones are placed nearby. Dr Jochen Kuhn, who carried it out, said this could provide a "hint" to a possible cause.

Dr George Carlo, who headed a massive study by the US government and mobile phone industry of hazards from mobiles in the Nineties, said: "I am convinced the possibility is real."

The case against handsets

Evidence of dangers to people from mobile phones is increasing. But proof is still lacking, largely because many of the biggest perils, such as cancer, take decades to show up.

Most research on cancer has so far proved inconclusive. But an official Finnish study found that people who used the phones for more than 10 years were 40 per cent more likely to get a brain tumour on the same side as they held the handset.

Equally alarming, blue-chip Swedish research revealed that radiation from mobile phones killed off brain cells, suggesting that today's teenagers could go senile in the prime of their lives.

Studies in India and the US have raised the possibility that men who use mobile phones heavily have reduced sperm counts. And, more prosaically, doctors have identified the condition of "text thumb", a form of RSI from constant texting.

Professor Sir William Stewart, who has headed two official inquiries, warned that children under eight should not use mobiles and made a series of safety recommendations, largely ignored by ministers.

EXHIBIT M

YAHOO! MAIL

From: [redacted]

To: [redacted]

Subject: Cellphone Radiation & Bee Population

Date: Mon, 16 Apr 2007 18:35:48 -0700

B. Blake Levitt edited Cell Towers: Wireless Convenience or Environmental Hazard?

you may have read recently about a catastrophic event taking place among the world's bee population. As the cause of this problem is unknown. variously theories are under consideration. The following article from the UK's Independent discusses the possible relationship to cellular phone radiation.
I've included afterward a discussion by Blake Levitt, long-time NY Times science writer and an expert on the health and environmental effects of RF radiation.

http://news.independent.co.uk/environment/wildlife/article2449968

From slake Levitt:

The dialogue on colony collapse, RF and bees is pretty new although the *fact* that EMF/RF can impact bees certainly is not. I wrote about that in my first book in 1995. It isn't being discussed at zoning meetings yet for all the reasons that this subject doesn't get much traction there -- people .think they cannot take RF into *consideration.* There is a test case now in the CT. Supreme court that is trying to establish that the federal preemption for RF and siting does not apply to wildlife, only humans. If that argument prevails, then the whole landscape changes.

The short course on this is that bees' bellies are loaded with a magnetic material called magnetite that they use as a navigational tool. Dr. Karl Von Frisch won the Nobel Prize in 1975 for the discovery of the honey bee dance in which bees literally dance out complex information for the hive using the vector of the sun in relationship to where the flowers are producing the most pollen. Quite extraordinary. Magnetite is thought to play a key role in how they gather that information. So anything that interferes with that -- including abnormal, external electromagnetic fields such as from ambient radiofrequency radiation and powerlines, could in theory do exactly what is being observed... screwing up bees' ability to find their way back to the hive. But more work needs to be done to establish anything like that. There are also some pesticides that can apparently screw up their directional abilities.

EXHIBIT M

I'd be curious to know if anything new & interesting has gone online from satellite transmissions within the last year. That makes more sense to me than just cell towers. Colony Collapse is now being observed worldwide. That indicates a more pervasive environmental exposure and sats would do that.
Plus, the military is always fooling around with missile defense stuff now in the ionosphere/atmosphere. And it doesn't help that the FCC has recently licensed all of that new broadband technology that's literally pumping tons of RF into the environment just within the last year. And then there's broadband-over-powerlines... on & on. We are zapping the planet and everything is reacting -- all for our ability to call home for the grocery list on a wireless device *or* log onto the Internet while on vacation in a remote area. Probably plays a role in global warming too. RF heats atmospheric hydrogen molecules just like in a microwave oven. The accelerated weather changes we have seen in the past 20 years probably isn't just from green house gases. Unfortunately, most of that information is classified.

Blake

EXHIBIT M

Electromagnetic Biology and Medicine (formerly Electro- and Magnetobiology)
Publisher: Taylor & Francis
Issue: Volume 24, Number 2 / 2005
Pages: 109 - 119
URL: Linking Options
DOI: 10.1080/15368370500205472

Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (*Ciconia* ciconia)

Alfonso Balmori[A1]

[A1] Consejeria de Medio Ambiente. Junta de Castilla y León, Valladolid, Spain

Abstract:

Monitoring of a white stork population in Valladolid (Spain) in the vicinity of Cellular Phone Base Stations was carried out, with the objective of detecting possible effects. The total productivity, in the nests located within 200 meters of antennae. was 0.86 ± 0.16. For those located further than 300 m, the result was practically doubled. with an average of 1.6 ± 0.14. Very significant differences among the total productivity were found (U = 240; p = 0.001, Mann-Whitney test). In partial productivity, an average of 1.44 ± 0.16 was obtained for the first group (within 200 m of antennae) and of 1.65 ± 0.13 for the second (further than 300 m of antennae), respectively. The dilference between bolh groups of nests in this case were not statistically significant (U = 216; P = 0.26, Mann-Whilney Test U). Twelve nests (40%) located within than 200 m of antennae never had chicks, while only one (3.3%) located further than 300 m had no chicks. m e electric field intensity was higher on nests within 200 m (2.36 ± 0.82 V/m) than on nests further than 300 m (0.53 ± 0.82 V/m). Interesting behavioral observalions of the white stork nesting sites located within 100 m of one or several cellsite anlennae were carried out. These results are compatible with the possibility that microwaves are Interfering with the reproduction of white storks and would conoborale the results of laboratcry research by olher authors.

Keywords:

Cellsites, Cellular phone masts. *Ciconia ciconia*, Elecirornagnelic fields. Microwaves, Nonthermal effects, Reproduclion. White stork

EXHIBIT M

Final report on the REFLEX
http:[/itis.ethz.ch/downloads/REFLEX Final%20Report 171104.pdf
(.pdf, 12 MB!)

and project summary now available
http:'itis.ethz.ch/downloads/REFLEX ProgressSummary.pdf

REFLEX (Risk Evaluation of Potential Environmental Hazards from Low Energy Electromagnetic Fiel Exposure Using Sensitive in vitro Methods) **was** a 3-year joint research project within the 5th EU Fr Program. Among the 12 participating research groups, the ITIS Foundation/ETH **was** responsible fc providing the exposures (signal definitions, exposure setups and technical quality assurance) of all subprojects. Direct comparison of the results **was** possible between the participants by maintaining strictly controlled exposure conditions. REFLEX reported several genotoxic effects as well as effects expression.

?he ITIS Foundation is committed to conducting replications and extensions with the utmost scient scrutiny in the shortest possible time. Experiments are currently being conducted at the BioCenter the Department of Human Biology and Genetics in Kaiserslautern and the Finnish Radiation and **Nu** Safety Authority.

EXHIBIT M

KILLER ON **THE** ROOF: Cancer fears over phone **masts**
Source: *"NEWS OF THE WORLD"* **INVESTIGATES**
By Guy Basnett
December *3,* 2006 http://www.newsoftheworld.co.uk/story_pages/news/news5.shtml

SIX neighbours **from the same** floor of a block of flats have **all** been hit by cancer afler **two** phone **masts** were installed on the building now dubbed The **Tower of** Doom.

Two people died after the disease struck in six out of just eight homes on the top storey. Tenant Mike Cole, 70, said: "It's **like** living on Death **Row.** You're constantly worrying who's going to be next."

And campaigners say the shock statistic, uncovered by the News of the World, flies in the face of government guideline: which maintain no link has yet been **proved** between mobile masts and sickness. Our investigation has also revealed local authorities around the country are raking in cash from mobile networks by allowing **them** to site masts on tower blocks, and council buildings.

The cancer rate on the fifth floor **of** Berkeley **House** in Bristol is TEN TIMES that of the rest of the UK.Cancer Research say two **per** cent of people sufferfrom the disease. **Yet** on **that** floor alone it affects nearly, ***20*** PER CENT. **All** the cases have occurred since the Vodafone and Orange masts were put up 10 years ago...and two women neighbours have already fallen victim to the killer on the **roof.**

Barbara Wood, who lived at No 42, died two years ago, in her 70s, from **breast** cancer that spread to her stomach. Two years previously a Mrs Davies, of No 47. died of the same disease. Two **more** residents-Bernice Mitchell. 68, and 62-year-old Hazel Frape- have both had breast cancer: An 89-year-old woman moved out after she contracted the same disease. And 63-yea -old John Llewellin, **from** No 48, is battling bowel cancer..

Other residents, such as "Doreen Sheppard, 73, from No 45, have'complained of headaches and other health problems. Doreen told 'the News of **the** World: "I get terrible headaches, and I've started suffering Meniere's disease. where I lose my balance. "I blame it on the masts. They're right on top of our homes."

South Gloucestershire Council has been trying lo get the masts taken down afler its agreement with the phone companies'ended in 2004. But the firmsare fighting **the** move and the masts still loom over residents while legal wrangles continue.

SCHOOLS

Other residents are worried about the effect on children. There are three schools within 250 yards of the flats - Christchurch Downend Infants School, Christchurch Downend Primary and Staple Hill Primary. Last year **the** Government's chief advisor on mobile phone **safety** Sir William Stewart, the head **of** the National Radiological Protection Board, called for a ban on erecting masts near schools. Sir William - who bans hls own grandchildren from using mobile phones unless it's an emergency - said: "I don't think we can put our hands on our hearts and say mobiles are safe. If there **are** risks, and **we** think there may be; ***the*** people who will be most affectedare children. The younger the child, the greater ***the*** danger." The World Health Organisation says evidence "so far" shows no adverse short or long-term effects from mobile phone base stations. But in August the International Journal of Cancer Prevention published a report claiming people's risk of contracting cancer was FOUR TIMES greater if they live near a mast. The Bristol cancer cluster is not the only one being blamed on phone masts. Families in three streets surrounding an Orange mast in Shooters Hi Stoke-on-Trent, claim the radiation has led to seven deaths. Four died from brain haemorrhages within three years. Three others succumbed to cancer. However an Orange spokeswoman said: "We're satisfied our base stations, operating within international guidelines, are safe and do not present a health risk."

Omega read "Base Stations, operating within strict national and international Guidelines, do not present a Health Risk?' under: http://omega.twoday.net/stories/771911/

NURSERY LINK TO TINY TOT VICTIMS

THREE children taught at a nursery school next to a **mast** developed leukaemia. And a further three living nearby also suffered the disease. Nurse Tracy Rimmer, 36, says her daughter Penny was diagnosed with leukaemia afler attending *the Kinderworld* Montessori *nursery, in Southport, Lancs. Penny,* who attended *the school for two years, was sent for* treatment at Liverpool's Aider Hey Children's Hospital: "There we bumped into the parents of two other children from th nursery, both with leukaemia," said mum Tracy. "It was a staggering coincidence." Penny, now eight. beat the-disease. But campaigners claim children-with their' thinner skulls and developing brains are most at risk from phone mast radiation. And Health'Protection Agency chairman Sir William Stewart, has called for a ban on masts near schools "as a precautionary measure".

EXHIBIT M

County of Santa Cruz
Planning Department

Planning Commission
Meeting Date: 01/09/08
Agenda Item: # 11
Time: After 9:00 a.m.

Additions to the Staff Report for the Planning Commission

Item 11: 06-0701

Late Correspondence

12/31/07

To: Members Santa Cruz County Planning Commission /Jan.9, 2008 agenda)
Re: Item 11 Ledyard Co./Metro PCS radiation-emitting cell tower near Shoreline Middle School (1005 17th Ave./APN:026-311-65)

Dear Planning Commission members,

Why are radiation-emitting sites proliferating like vast endless wildfires throughout the county(and beyond) frequently with near unanimous opposition of the community? Who benefits? Who suffers? Is our democracy consume8 in the flames?

We believe you will find these submitted materials offer rare historical and contextual clarity. The presenters, who volunteer their time and expertize, demonstrate integrity and dedication to the truth. Especially when evidence exists of negative impacts on children, everyone of us must make responsible, informed, courageous, and wise decisions to guarantee a safe healthy learning and working environment. Can there be any higher priority?

It is in this spirit that we provide for your studied consideration prior to the evening 1/9/08 Planning Comm. meeting:

(1)DVD of 5/10/07 Washington D.C. Congressional Staff Briefing "Wireless and Broadcast Radiation Pollution, a U.S. Regulatory Health Issue " by EMRPolicy Institute (emrpolicy.org), and (2) Copy of the accompanying Briefing Book distributed to the Congressional staff.

We trust you will find this data both helpful and enlightening. We appreciate everyone's busy schedules. Therefore, though we recommend the entire viewing, we suggest you begin this 90 minute DVD with the last two presenters (Seymore Whitney and B.Blake Levitt - approx. ½ hour) as their discussion on zoning, wireless technology, schools, and children is critical for your evaluation and informing your decisions.

As stated in the briefing book, "Exposure to Mobile Phone, WiFi and FM Antenna RF/MW Radiation,"

> Despite the preemption of state and local authority to regulate exposure to low-level RF radiation enacted in the Telecommunications Act of 1996, municipal governments have a responsibility to protect the health and safety of their citizens.

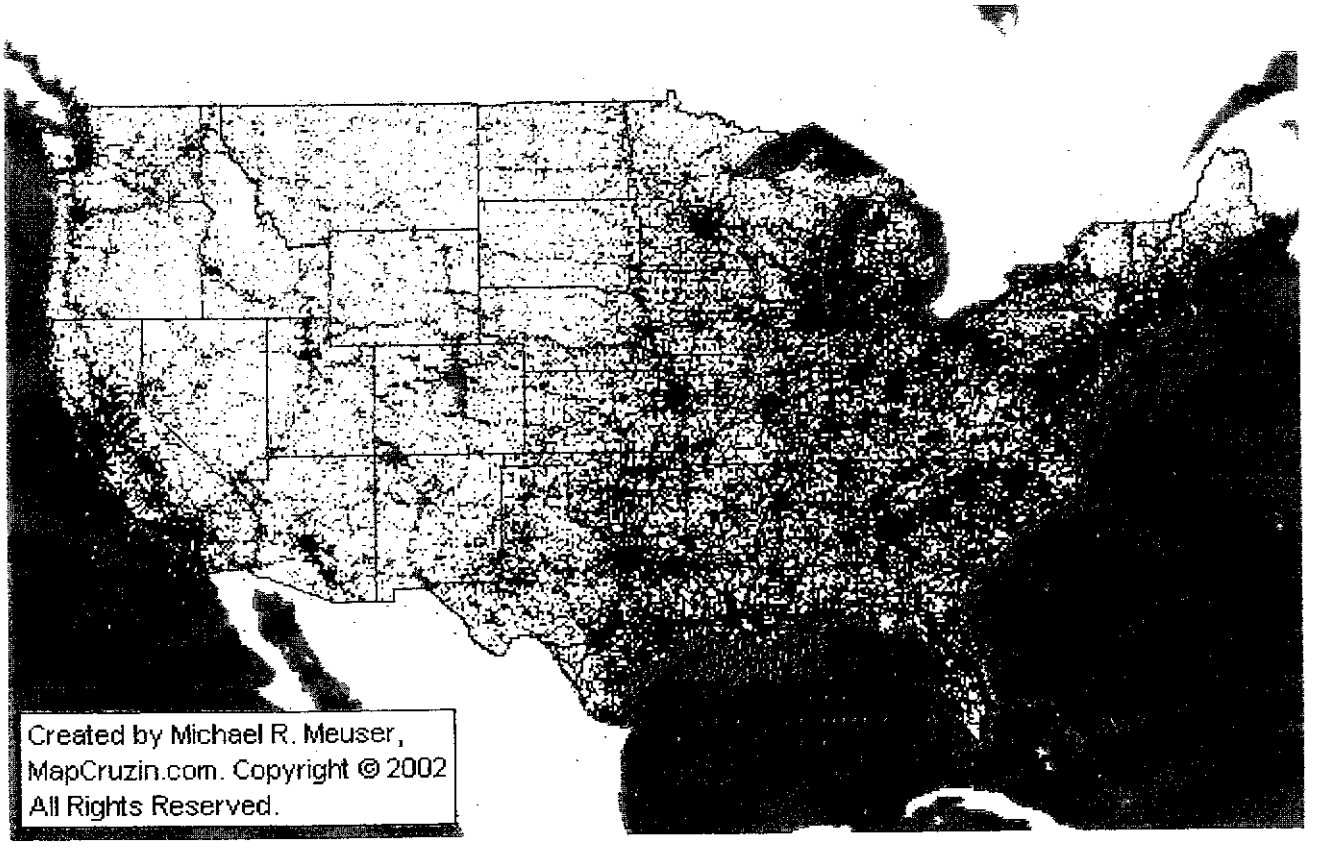
We look to you to protect our children and our community.

Sincerely,

Angela Flynn 469-4399
Marilyn Garrett 688-4603
With WRAN
Wireless Radiation Alert Network

P.S. If you or your Supervisor does not wish to keep the DVD, in the interests of conservation, kindlyreturn to Patsy, Laura, or Terry at the counter, and one of us will pick it up. Sup. Beauts has thoughtfully returned such items in the past. Thank you.

Radiofrequency Antennas and Towers Across the U.S.



Wireless and Broadcast Radiation Pollution

A U.S. Regulatory Health Issue and What To **Do** About It

Congressional Staff Briefing
Presented by
The EMR Policy Institute

www.emrpolicy.org

May 10, 2007

The EMR Policy Institute
A Non-Profit Corporation www.EMRPolicy.org

Advancing Sound Public Policy
on the Use of Electromagnetic Radiation (EMR)
P. O. Box 117 Marshfield VT 05658
Tel. and FAX : 802-426-3035 E-mail: info@emrpolicy.org

Documents Challenging Radiofrequency Radiation Safety Policy

in the United States and Internationally

[Links are provided for the lengthier documents rather than hard copies.)

1. "Serious Flaws with the FCC RF/MW Safety Guidelines." Adapted from: *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves* (Harcourt Brace, 1995), by B. Blake Levin. Updated January, 2007. Used with permission of the author.

> ***Despite the preemption of state ond local authority to regulate exposure to low-level RF radiation enacted in the Telecommunications Act of 1996, municipal governments hove o responsibility to protect the heolth and safety of their citizens. This document gives background on the scientific debate about RF/MW health effects as it relates to current US radiofrequency rodtarion safety policy.***

2. Letter of June 17,1999. from the U.S. federal Radiofrequency Interagency Work Group to Richard Tell, Chairman of IEEE's SCC28 Subcommittee 4 Risk Assessment Work Group, outlining *14* issues with the RF guidelines, "that we believe need to be addressed to provide a strong and credible rationale to support RF exposure guidelines." www.emrpolicy.org/litigation/case_law/docs/exhibit_a.pdf

3. EPA Budget for Radiofrequency Radiation Research for Fiscal Years 1990-2000. Since 1998 there has been no Congressionally-funded research at EPA, the agency to which Congress assigned the "lead role" *in* 1970, into the biological effects of RF/MW radiation. The EPA supplied the following summary in response to a request *from* Senator loseph Lieberman of Connecticut in the summer of 2000.

4. "The dangers of electropollution," by Joy Carlson, *Napa Valley Register,* February *6,2007.* This is a concise explanation of how radiofrequency radiation and electromagnetic fields interact with living organisms, even at very low power intensities. It was published recently in a local California newspaper. Joy Carlson is a consultant on children's environmental health issues.

5. The 2006 Benevento Resolution and the 2002 Catania Resolution signed by more than 31 international scientists promoting EMF research and the development of strategies to protect public health through the wise application of the Precautionary Principle.

6. Statement on the science of biological effects relating to WiFi antennas from Magda Havas, PhD, Professor of Environmental and Resources Studies at Trent University, Peterborough, Ontario, Canada, to the mayor and city aldermen of Milwaukee, Wisconsin. Professor Navas's *curriculum vitae* is available upon request.

> ***WiFi simply hasn't been around long enough for us to know how these particular frequencies and intensities are likely to affect people who are exposed to them on a daily basis for years at a time . . . Local governing bodies must be provided with scientific information on the biological effects of antennas so they can make intelligent decisions regarding siting of these antennas.***

7. Press Release of Library Director at a college in Santa Fe, NM who left her position due to wireless internet (WiFi) in the library. Rehekah Zablud Azen, MLIS, resigned from her position at Quimby Memorial Library, Southwestern College, on December 16, 2006, after administrators refused to discuss the issue.

8. Memo to Editors - Connecticut Cell Tower Plan Defies State Law Protecting the Environmeut and 3:06cv01416 (JBA) *Bornemann v. Tait* - Complaint filed in United Slates District Court District of Connecticut (New Haven).

In **2005,** the Connecticut Siting Council granted permission to Nextel Telecommunications to erect an 85 I Megahertz cell phone transmission mast on top of **a** power line pylon **on** Beebe Hill, above Falls Village in Litchfield County, Connecticut. The village is on the banks of the Housatonic River and next to Robbins Swamp, the slate's largest inland wetland, home of multiple endangered species, and a major flyway for migratory **buds.** The property owner has challenged the Connecticut Siting Council's actions. Memo, brief and supporting documents rue found at: www.emrpolicy.org/litigation/case_law/index.htm

9. 06-175 In *Re Marla Gonzalez* Petition for Writ of Mandamus in the Supreme Court of the United Stales. This Press Release gives links **to** the complete brief **as** well **as to** the amicus brief filed in support by The Healthy Schools Network: www.emrpolicy.org/litigation/case_law/index.htm

> *Question 1. **Is** the FCC required by Federal law to prepare an Environmental Impact Statement prior* **to** *any nationwide licensing of a whole **new** spectrum of ultra-high radiofrequencies for Advanced Wireless Services?*

From the *Amicus Curiae* Brief filed by The Healthy Schools Network (www.healthyschools.org) in Support of Supreme Court Petition 06-175.

> *If the FCC does **not** conduct an EIS evaluating the risks of the **new** RF radiation **it is** about* **to** *unleash, **it** can reasonably be expected that **no** other agency or local school odminisnator or parent will step **in** to produce or to finance **on** EIS that would generateprotecrion. Hence the significance of a Court-mandated EIS **in** this case.*

10. *Amicus Curiae* brief of the State of Connecticut in support of Supreme Court Petition for Writ of Certiorari 04-1515 *EMR **Network v.** Federal **Communications Commission** and **United** States of America.* www.emrpolicy.org/litigation/case_law/docs/blumenthal_amicus.pdf

> *The Court should grant certiorari to review the arbitrary and capricious action of the Federal Communicarions Commission **in** refusing* **to** ***grant** the **EMR's** request **for** inquiry under the FCC rules **on** the biological health and environmental effects of radiofrequency radiation.*

11. *Amicus Curiae* brief *of* the International Association of Firefighters in support of Supreme Court Petition for Writ of Certiorari 04-1515 *EMR Network **v.** Federal Communications Commission **and** United States* of America. www.emrpolicy.org/litigation/case_law/docs/iaff_amicus_brief.pdf

> *. . . the IAFF strongly believes that **its** members should **nof** be required* **to** *live with doubts* **as** *to whether their exposure to low-intensify RF/MW radiation **is** subjecting them to risks beyond those related to their already risky professions*

12. IAFF Press Release announcing the "Position on the Health Effects from Radio Frequency/Microwave **(RF/MW)** Radiation in Fire Department Facilities from Base Stations for Antennas and Towers for the Conduction of Cell Phone Transmissions," issued by The International Association of Firelighters on April 7,2005. www.emrpolicy.org/news/headlines/iaff_announcement.PDF

The complete IAFF Position Paper is found at: www.emrpolicy.org/news/headlines/iaff_position.PDF

> *The International Association of Fire Fighters' position **on** locating cell towers commercial wireless infrastructure on fire departmentfacilities,* **as** *adopted by **its** membership in August 2004, **is** that the IAFF opposes the use of fire stations **as** base **stations** for towers and/or antennasfor the conduction of cellphone transmissions **until** a study with the highest scientific merit **and** integrity **on** health effects of exposure* **to** *low-intensify RF/MW radiation* **is** *conducted and it **is** proven that such sitings are not hazardous to the health **of** **our** members.*

***Addendum – Biolnitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF). Released August 31, 2007. Synopsis provided. Complete Report is found at: www.bioinitiative.org

The EMR Policy Institute
A Non-Profit Corporation www.EMRPolicy.org

Advancing Sound Public Policy
on the Used Electromagnetic Radiation (EMR)
P. O. Box 117 Marshfield VT 05658
E-mail: info@emrpolicy.org
Tel. and FAX: 802-426-3035

Exposure to Mobile Phone, WiFi and FM Antenna RF/MW Radiation

lore and more teachers, students and neighbors are finding themselves exposed throughout the day and ight to **radiofrequencylmicrowave**(RFIMW) radiation from mobile phone, WiFi. and low-power FM ntennas that are being sited at school and university facilities and in residential neighborhoods. luestions about health effects from long-term, chronic exposure to this radiation remain unanswered. In ne United States, there has been no funding for research on this new and ever-increasing environmental xposure since the mid 1990s.

iince its August 2004 biennial convention. the International Association of Fire Fighters (IAFF), the eading advocate for fire tighter health and safety in North America, has become proactive in addressing imílar exposures to its 267,000 members in their workplaces. In June 2005, IAFF fled a strongly-rorded amicus brief in support of a Supreme Court case that would have required the federal jovernment lhrough the Federal Communications Commission (FCC) to fully investigate this important ccupational and public health question. The IAFF brief stated:

. . *the* IAFF strongly believes that its members should *not* be required lo live with doubts as lo whelher heir exposure to *low-intensity RF/MW* radiation *is* subjecting them to ***risks*** beyond those relaled to their *lready risky* professions. See brief at: http //www.emrpolicy.org/litigation/case_law/index htm

Despite the preemption of state and local authority to regulate exposure to low-level RF radiation enacted n the Telecommunications Act of 1996. municipal governments have a responsibility to protect the health and safety of their citizens. Below is background on the scientific debate about RFIMW health effects as t relates to current US radiofrequency radiation safety policy.

SERIOUS FLAWS WITH THE FCC RFIMW **SAFETY GUIDELINES**

Adapted from: ***Electromagnetic*** Fields, A Consumer's Guide ***to the Issues*** and ***How*** **lo** ***Protect Ourselves*** **(Harcourt** Brace, 1995)
by **B.** Blake Levitt

Updated **January** 2007. **Used *with permission*** of **the** author.

The Federal Communications Commission (FCC) is a licensing and engineering agency that relies on other agencies to recommend and set safety standards for communications technology. It is not a health agency itself.

The FCC has traditionally adopted safety recommendations from the American National Standards Institute (ANSI). ANSI is an industry-based organization comprised of numerous committees representing diverse business interests. such as automobile manufacturers. chemicallpharmaceutical companies, the electrical industries, and many others. To create standards for radiofrequencylmicrowave radiation (RFIMW) used in telecommunications and other RF/MW-related activities, ANSI looks to a subcommittee of the Institute of Electrical and Electronics Engineers (IEEE) called C95.1 that is responsible for making recommendations for RF/MW exposures. The standards are referred to as ANSI-IEEE C95.1-1992; the date refers to the last year in which revisions were made to the original standard, which was put out in 1966. There is currently a subcommittee within C-95.1. called SC-4, that is circulating a draft to relax the U.S. standards even further — at a time when the FCC is issuing more licenses for wireless technologies, This is a step in the wrong direction. The U.S. is already among the most lenient of the industrialized countries re: RFIMW exposures.

The National Council on Radiation Protection and Measurements (NCRP) also sets standards for diverse radiation-producing products. including RFIMW-emitting devices, The NCRP is the only agency mandated by Congress to set radiation standards. In 1986, it set a standard for RFIMW exposure levels for the general public that was five times more stringent than the ANSI/IEEE standard. Unfortunately, due to funding problems, the NCRP committee has not been able to review and update its current recommendation for RFIMW biological effects and it is doing no further standards work a this time.

(over:

The V.S. Environmental Protection Agency (EPA) is required by statute to provide guidance in the formulation of all radiation standards to federal agencies regarding all matters directly or indirectly affecting health. In the **1996** Telecommunications Act, Congress – while preempting states' rights for environmental control over RFIMW health **concerns** – mandated that the FCC get its regulatory house in ordw. The FCC was widely expected to adopt the IEEE/ANSI standard again. Both industry and the U.S. military favored it and lobbied hard for that adoption. But lor the first time. the EPA urged that the NCRP standard be adopted instead. What the FCC adopted was a two-tiered amalgamation of the two standards. Civilian exposures (called 'uncontrolled environments") follow the NCRP standard while prolessional exposures (called "controlled environments'? follow the ANSI-IEEE standard. The rationale lor the higher professional limits is that prolessionals understand the risks.

While inclusion of the NCRP recommendation **lor** civilian exposures was a step in the right direction, the standards are still seriously flawed.

The model used for both the IEEE and the NCRP standards is an adult male of average height and weight. Though safety margins are factored in. the standards do not take women. pregnant women, or children into consideration – all of whom absorb radiation differently than this 'average' model. Nor does it consider the elderly or the infirm who are more susceptible to adverse exposures.

1. The model. and all of the research it is drawn from, is based solely on the thermal effects these frequencies can create. It has been known for decades that microwaves, at sufficient power output, can create heating. That's what occurs in a microwave oven. The current FCC model presumes that nothing adverse other than heating occurs. Therefore. if heating does not occur. **no** other adverse biological effect does either. But a range of adverse non-thermal effects have been noted for decades as well – at levels significantly lower than the current FCC Standard. This has been at the heart of the debate since the **1950's**.

2. The FCC standards do not take into account:

- Numerous research **reports** finding non-thermal effects.
- Long-term, low-level, continuous exposures such as would be found in schools, workplaces, and homes near RF/MW-emitting installations.
- The potential lor **RFlMW** radiation to create standing RF/MW "hot-spots" near metal objects (water lowers, other antenna towers. metal roofs, metal girders used in some architectural designs, elevator shafts. metal fences, metal in furniture. etc.)
- The distinction between digital (pulsed-wave) technology and the older analog (continuous-wave) technology. Pulsed RF has been found in several experiments to inaease abnormal cell growth in tumorogenic cell cultures by up to 3000%. Digital technology exposures — such as the PCS frequencies used most widely today for mobile phones/towers — is the area where more lenient recommendations are expected to be made, despite research calling this into question.

3. The NCRP tier of the standards took no studies past 1985 into consideration; the ANSI-IEEE tier took no studies past 1986 into consideration. Therefore, although the FCC claims lo keep track of the subject. the standards currently in place at the FCC are outdated by two decades of new research.

4. The FCC requires very little RF radiation monitoring from its licensees and **does** little of its own. As a result the aggregate of many co-located installations, and resulting RF accumulation, is poorly documented and remains unmonitored unless a community complains to the FCC about interference with other devices.

5. The IEEE is mainly comprised of engineers and physicists who deal with the non-living sciences. They have traditionally been charged with making these technologies work. not with understanding the health effects that are within Me purview of the 'living' sciences of biology and medicine. Yet appropriate funds for RF research in the living sciences have never been forthcoming. The FCC RF standards in place today are based on a faulty thermal model, designed by professionals from an inadequate range of scientific disciplines. and are drawn from research of an inappropriate kind (short-term. high-power designs models,) For many of the new personal wireless services, the FCC does not monitor any communications installations lor RF compliance. They issue licenses for whole regions and do not have a complete inventory list of actual installations and no idea where many are located. RF emissions levels are usually based solely on computer models done by the industry when applying for licenses. not on actual on-site measurements.

6. Meanwhile, the EPA has only been provided $25,000 in the last **5** years for RFIMW radiation research. While the FCC sets the RFIMW radiation limits for wireless technologies. the FCC states officially that it is not a health agency and is not knowledgeable about human health.

Exhibit C – FY 1990-2000 EPA Budget Summary

There is no Congressionally funded research at EPA, the agency to which Congress assigned the 'lead role" in 1970, into the biological effects of RF/MW radiabon.m e EPA supplied the following summary in response to a request from Senator Joseph Lieberman of Connecticut in the summer of 2000:

Summary of EPA Budget and Staffing for RF Radiation Activities from FY 1990-2000

FY	90	91	92	93	94	95	96	97	98	99	00
Full-time Employees	2.3	2.2	2.1	2.1	2	2	0.5	0.5	0.5	0.5	0.5
$ (K)	$ 0	$40	$25	$543a	$73b	$140c	$ 0	$ 0	$25d	$ 0	$ 0

a Includes gram funds ($510,000) under EPA/NIEHS Interagency Agreement DW75935939.

b Includes funds ($50,000) f a Cooperative Agreement (CX823714) with the National Council on Radiation Protection and Measurements (NCRP).

c Includes funds ($50,000) for Cooperative Agreement (CX823714) with NCRP.

d $25K completes total funding ($125,000) for Cooperative Agreement (CX823714) with NCRP.

Below is a concise explanation of how radiofrequency radiation and electromagnetic fields interact with living organisms, even at very low power intensities. It was published recently in a local California newspaper. Joy Carlson is a consultant on children's environmental health issues.

Napa Valley Register

The Dangers of Electropollution
By JOY CARLSON
Tuesday, February 6,2007

It is an invisible danger that has no sound or smell but is creating chaos with all of our cells. In less than two decades. one third of the global village has embraced this new technology, spawning the multi-million dollar wireless communications industry. From cell phones to hot spots to entire wireless cities, rarely has a technology so rapidly and so profoundly transformed the world. The explosion of wireless technology has brought with it a totally new form of dangerous radiation called electropollution.

Humanity is now exposed to more than 100 million times more radiation than just two decades ago.

The 100 trillion cells of the body communicate with each other by subtle low-intensity eledromagnetic signals as well as through chemical reactions.

Continuous exposure to electromagnetic radiation can drastically distort and disrupt these cellular communications pathways, resulting in abnormal cellular metabolism and eventually disease. Electropollution profoundly compromises the normal intercellular communication of the body. Cell fundion deteriorates, cell membranes harden, causing a shutdown of the cells. Now nutrients cannot get in and toxins cannoi get out. Over time this leads to toxin and free radical buildup, genetic mutation. premature aging, illness and disease.

So picture this... it's a typical morning in a Starbucks equipped with wireless Internet. You see three people involved in cell phone conversations, one sending a text message from a PDA and two surfing the Internet on laptops. Each device is transmitting to the antenna installed in the back of the store, which in turn is transmitting out. At each point the signal gets an electronic push from the device to get it going. This push, like a boat being accelerated through water, creates a wake called a near-field plume. This plume is sending out lots of radiation.

Homes, wireless offices, schools, hospitals and most every workplace are now filled with cell phones, laptops. wireless networks, game stations, iPods. With the increasing world of wireless technology our world is now being blanketed with a dense fog of plumes and beams. As we work, learn, sleep and play in these environments and whether we personally use these gadgets or not. our cells are being bombarded and our cellular fundion is being compromised.

The most vulnerable are the children. Their cells are still growing and are filled with more fluid, thus the radiation can penetrate much faster into their cells. Disney got in the game big time recently with offers of family plans and a kid starter plans targeted to 8-to-12 year-olds. An 8-year-old child who gets a cell phone will by age 28 have used a cell phone for longer than anyone to date.

Consider this: In 1970, one out of 10,000 children were diagnosed with autism. Last year, one in 166 children were diagnosed with autism. Many scientists and some doctors are now trying to get the word out that we are now starting to see genetic damage that is weakening our children's cells. thus causing many more health challenges such as autism.

Benevento Resolution

The International Commission for Electromagnetic Safety (ICEMS) held an international conference entitled "The Precautionary EMF Approach: Rationale, Legislation and *Implementation*", hosted by the City of Benevento, Italy, on February 22, 23 & 24, 2006. The meeting was dedicated to W. Ross Adey, M.D. (1922-2004). The scientists at the conference endorsed and extended the 2002 Catania Resolution and resolved that:

1. More evidence has accumulated suggesting that there are adverse health effects from occupational and public exposures to electric, magnetic and electromagnetic fields, or EMF[1], at current exposure levels. What is needed, but not yet realized, is a comprehensive, independent and transparent examination of the evidence pointing to this emerging, potential public health issue.
2. Resources for such an assessment are grossly inadequate despite the explosive growth of technologies for wireless communications as well as the huge ongoing investment in power transmission.
3. There is evidence that present sources of funding bias the analysis and interpretation of research findings towards rejection of evidence of possible public health risks.
4. Arguments that weak (low intensity) EMF cannot affect biological systems do not represent the current spectrum of scientific opinion.
5. Based on our review of the science, biological effects can occur from exposures to both extremely low frequency fields (ELF EMF) and radiation frequency fields (RF EMF). Epidemiological and in vivo as well as in *vitro* experimental evidence demonstrates that exposure to some ELF EMF can increase cancer risk in children and induce other health problems in both children and adults. Further, there is accumulating epidemiological evidence indicating an increased brain tumor risk from long term use of mobile phones, the first RF EMF that has started to be comprehensively studied. Epidemiological and laboratory studies that show increased risks for cancers and other diseases from occupational exposures to EMF cannot be ignored. Laboratory studies on cancers and other diseases have reported that hypersensitivity to EMF may be due in part to a genetic predisposition.
6. We encourage governments to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle' -- as some nations have already done. Precautionary strategies should be based on design and performance standards and may not necessarily define numerical thresholds because such thresholds may erroneously be interpreted as levels below which no adverse effect can occur. These strategies should include:
   - 6.1. Promote alternatives to wireless communication systems, e.g., use of fiber optics and coaxial cables; design cellular phones that meet safer performance specifications, including radiating away from the head; preserve existing land line phone networks; place power lines underground in the vicinity of populated areas, only siting them in residential neighborhoods as a last resort;
   - 6.2. Inform the population of the potential risks of cell phone and cordless phone use. Advise consumers to limit wireless calls and use a land line for long conversations.
   - 6.3. Limit cell phone and cordless phone use by young children and teenagers to the lowest possible level and urgently ban telecom companies from marketing to them.
   - 6.4. Require manufacturers to supply hands-free kits (via speaker phones or ear phones), with each cell phone and cordless phone.
   - 6.5. Protect workers from EMF generating equipment, through access restrictions and EMF shielding of both individuals and physical structures.

---

[1] EMF, in this resolution, refers to zero to 300 GHz

[2] The Precautionary Principle states when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary Principle shifts the burden of proof from those suspecting a risk to those who discount it

6.6. Plan communications antenna and tower locations to minimize human exposure. Register mobile phone base stations with local planning agencies and use computer mapping technology to inform the public on possible exposures. Proposals for city-wide wireless access systems (e.g. Wi-Fi, WIMAX, broadband over cable or power-line or equivalent technologies) should require public review of potential EMF exposure and, if Installed, munlcipalitles should ensure this information is available to all and updated on a timely basis.

6.7. Designate wireless-free zones In cities, in public buildings (schools, hospitals, residential areas) and, on public transit, to permit access by persons who are hypersensitive to EMF.

7. ICEMS' is willing to assist authorities in the development of an EMF research agenda. ICEMS encourages the development of clinical and epidemiological protocols for investigations of geographical clusters of persons with reported allergic reactions and other diseases or sensitivitles to EMF, and document the effectiveness of preventive interventions. JCEMS encourages scientific collaboration and reviews of research findings.

We, the undersigned scientists, agree to assist in the promotion of EMF research and the development of strategies to protect public health through the wise application of the precautionary principle.

Signed:

Fiorella Belpoggi, European Foundation for Oncology & Envlronmental Sciences, B.Ramazzini, Bologna, Italy
Carl F. Blackman, President, Bioelectromagnetics Society (1990-91). Raleigh, NC, USA
Martin Blank, Department of Physiology, Columbia University, New York, USA
Natalia Bobkova, Institute of Cell Biophysics, Pushchino. Moscow Region
Francesco Boelb, National Inst. Prevention & Worker Safety, Venice, Italy
Zhaojin Cao, National Institute Envlronmental Health, Chinese Center for Disease Control, China
Sandro D'Allessandro, Physician, Mayor of Benevento, Italy, (2001-2006)
Enrico D'Emilia, National Institute for Prevention and Worker Safety, Monteporzio, Italy
Emilio Del Giuduice, National Institute for Nuclear Physics, Milan, Italy
Antonella De Ninno, Italian Natlonal Agency For Energy, Environment &Technology, Frascati, Italy
Alvaro A. De Salles, Universidade Federal do Rio Grande do Sul, Porto Aiegre, Brazil
Livio Giullanl, East Veneto&South Triol, National Inst. Prevention & Worker Safety, Camerino University
Yury Grigoryev, Institute of Biophysics; Chairman, Russian National Committee NIERP
Settimo Grlmaldl, Inst. Neurobiology & Molecular Mediclne, National Research, Rome, Italy
Lennart Hardell, Department of Oncology, University Hospital, Orebro, Sweden
Magda Havas, Envlronmental & Resource Studies, Trent University, Ontario, Canada
Gerard Hyland, Warwick University, UK; International Inst. Biophysics, Germany; EM Radiation Trust, UK
Olle Johansson, Experimental Dermatology Unit, Neurosctence Department. Karolinska Institute, Sweden
Michael Kundi, Head, Institute Environmental Health, Medical University of Vienna, Austria
Henry C. Lai, Department of Bioengineering, University of Washington, Seattle, USA
Mario Ledda, Inst. Neurobiology a Molecular Medicine, Natlonal Council for Research, Rome, Italy
Yi-Ping Lin, Center of Health Risk Assessment & Polky, National Taiwan University, Taiwan
Antonelb Lisi, Inst. Neurobiology & Molecular Medicine, National Research Council, Rome, Italy
Fiorenzo Marinelil, Institute of Immunocytology, National Research Council, Bologna, Italy
Elihu Richter, Head, Occupational & Environmental Medkine, Hebrew University-Hadassah, Israel
Emanuela Rosola, Inst. Neurobiology & Molecular Medicine, National Research Council, Rome, Italy
Leif Salford, Chairman, Department of Neurosurgery, Lund University, Sweden
Nesrin Seyhan, Head. Department of Biophysics; Director, Gazi NIRP Center, Ankara, Turkey
Morando Soffrittl, Scientific Director, European Foundation for Oncology & Environmental Sciences, B. Ramazzini, Bologna, Italy
Stanislaw Szmigielski, Military Institute of Hygiene and Epidemiology, Warsaw. Poland
Mikhail Zhadin, Institute of Cell Biophysics, Pushchino, Moscow Region.

Date of Release: September 19, 2006. For more information, contact Elizabeth Kelley, Managing Secretariat, International Commission For Electromagnetic Safety (ICEMS), Montepulciano, Italy. Email: info@icems.eu Website: www.icems.eu

[3] International Commission For Electromagnetic Safety. For information, link to www.icems.eu.

Additional signers to the Benevento Resolution after September 19, 2006:

Igor Y. Belyaev, Dept. Genetics, Microbiology and Toxicology, Arrhenius Laboratories for Natural Sciences, Stockholm University, Stockholm, Sweden
Mauro Cristaldi, Dip, B.A.U. Universita degli Studi "La Sapienza', Roma, Italia
Suleymsn Dasdag, Biophysics Department of Medical School, Dicle University, Diyarbakir, Turkey
Sandy Doull, Consultant, Noel Arnold & Associates, Box Hili VIC, Australia
Reba Goodman, Prof. Emeritus, Clinical Pathology, Columbia University, New York, New York, USA
Luisa Anna Ieradi, Istituto per lo Studio degli Ecosistemi C.N.R., Roma, Italia
Lukas H. Hargaritis, Professor of Cell Biology and Radiobiology, Athens University, Athens, Greece
Vera Markovic, Faculty of Electrical Engineering, University of Nis, Serbia
Gerd Oberfeld, Federal Salzburg Government. National Medical Management, Public Health Hygiene and Environmental Health, Salzburg, Austria
Zamir Shalita, Consultant on Electromagnetic Hazards, Ramat Gan, Israel
Ion Udroiu, Dip. B.A.U., Universita degli Studi 'La Sapienra', Roma. Italia

For submission guidelines, see: http://www.icems.eu/resolution.htm

---

CATANIA RESOLUTION
September 2002

The Scientists at the International Conference
"State of the Research on Electromagnetic Fields - Scientific and Legal Issues",
organized by ISPESL*, the University of Vienna and the City of Catania,
held in Catania (Italy) on September 13th - 14th, 2002, agree to the following:

1. **Epidemiological and i vivo and** in vitro **experimental evidence demonstrates the exist f electro tic fie) i di I ff ct r of which can** be adverse tc health.
2. **/t** take **exception** to arguments ti **that w** (low intensity) EMF cannot **it /ith ti**
3. There are **sible nistic ations** for **EMF which** occur below **it I** and IEEE guidelines **d o** EU.
4. The **of** calls for preventive **it based** on the **caut p cip** At the **principle** may involve prudent and **prudent use.**
5. **We are that there a p** in **e** on biological and physical **ff** and **health ris lat EMF, h eq d d** research.
6. **Th ed tists ag** to establish an **ter** scientific **m sic** to **p e** research for the **protection** of public **alt** from and to **develop scientific** basis for assessment, **prevention, ma t and** of based on the **pr cipl**

Fiorella Belpog F n Bologna, Italy
Carl F. Blackman, F of the **(1990-1991)** Raleigh, USA
Martin Blank. D of Physiology, **U , Ne** York,
Del Giudice, **Istituto Nazionale di** Fisica **Nucleare, Milano, Italy**
Cam - ISPESL*,
aldi, biol Italy
Lennart **ell), D** of Oncology, **sit pital,** **Sweden**
el Kun of **ers of ia**
H ry Lai, p of **University of Washington** USA
Al ah R. **iboff,** Department of **hysics, Oakland U it USA**

Wolfgang Löscher, Department of Pharmacology, Toxicology and Pharmacy, School of Veterinary Mediclne, Hannover, Germany
Kjell Hansson Mild, President of the Bioelectromagnetics Society (1996-1997), National Institute of Working Life, Umea, Sweden
Wilhelm Mosgöller, Institute for cancer Research, University of Vienna, Austria
Elihu D. Richter, Head, Unit of Occupational and Environmental Medicine, School Of Public Health, Hebrew University-Hadassah, Jerusalem, Israel.
Umberto Scapagnini, Neuropharmacology, University of Catania, Italy, Member of the Research Comm. of the European Parliament
Stanislaw Szmigielski, Military Institute of Hygiene and Epidemiology, Warsaw, Poland

* = Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro, Italy
(National Institute for Prevention and Work Safety, Italy)

Magda Havas, B.Sc., Ph.D.
Environmental & Resource Studies
TRENT UNIVERSITY, PETERBOROUGH, ONTARIO, CANADA, K9J 7B8
Phone: (705) 748-1011 ext. 1232, FAX: (705) 748-1569, e-mail mhavas@trentu.ca

Date: January 17, 2006
To: Mayor Tom Barren and City Aldermen
Regarding: upcoming vote on WiFi for the City of Milwaukee

First let me introduce myself. I am an Associate Professor at Trent University and I have been doing research on electromagnetic pollution for the past 12 years. I understand that you are considering converting the City of Milwaukee into a wireless zone for the convenience of its residents and visitors.

Whatever decision you make should be based on the available scientific evidence. I expect that you have been told that this form of technology is safe as long as it remains below existing federal guidelines. Adverse biological effects have been documented below existing federal guidelines (based on thermal effects) and you should be aware that there are no federal guidelines for non-thermal effects.

WiFi simply hasn't been around long enough for us to know how these particular frequencies and intensities are likely to affect people who are exposed to them on a daily basis for years at a time. Milwaukee is on the forefront of a large population study with some unwilling participants.

Below I present some laboratory and epidemiological studies documenting the adverse effects of radio frequency radiation. Please make your decision wisely with the health of the population in mind and not just the convenience of this technology.

SUMMARY

The success and widespread use of cellular phones has led to the rapid proliferation of cell phone antennas worldwide. These antennas are erected in residential areas, near schools, on churches, on high rise office buildings, on hill-tops facing cities with little regard for their combined radiation patterns and exposure of the surrounding population. There is no international consensus on exposure guidelines, which range orders of magnitude in different countries.

Guidelines for radio frequency radiation (RFR) are based on thermal effects, yet biological effects with non-thermal exposure occur below these guidelines. The United States does not have non-thermal guidelines for RFR and the existing thermal guidelines do not protect the public. The Public Health Office of the government of Salzburg recommended that levels for the sum total of all antennas at a particular site not exceed a power density of 1 microwatt/m^2 (0.1 milliwatts/cm^2). These are much lower than the guidelines provided by the FCC in the US.

Municipal authorities approve antenna sites but once the antennas are erected government Ministries (Health, Environment, Occupational Health & Safely, Telecommunication) do not monitor the sites for compliance.

Biological effects have been documented and range from cancers to cognitive disorders and sleeping dysfunction among humans and abnormal behavior, reduced milk yield, miscarriages and premature death among farm animals. People who live near cell phone antennas have a higher risk of developing leukemia An increasing number of individuals are also becoming sensitive to this form of radiation and exhibit signs of *electrical hypersensitivity* (EHS), which has been recognized as a disability in Sweden. This illness appears to be increasing and may already affect between 2% and 35% of the population.

Local governing bodies must be provided with scientific information on the biological effects of antennas so they can make intelligent decisions regarding siting of these antennas. It is critical that antennas not be placed near residential areas and near schools since children seem to be particularly vulnerable to this form of energy. Avoiding these areas would not be possible with WiFi technology.

CELL PHONE ANTENNAS

Several studies have now documented the response of residents who live near mobile phone antennas in various countries. According lo Dr. Grahame Blackwell, as of Feb *2005* all five epidemiological studies of people who live near such installations show ill health effects from the masts. These include studies in Spain, Netherlands, Israel and Germany. Two of those studies are presented below:

Example #I: Symptom experienced by people in the vicinity of cellular phone bare station. [Santini 2001, La Presse Medicale]

In this study the people who lived closest to the cellular antennas had the highest incidences of the following disorders: fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness (See Figure 1).

Adverse health effects were reported at distances up to 300 meters. In this case, health is defined according to the World Health Organization definition as ***"the state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity"***. Note that these symptoms are commonly referred to as electrical hypersensitivity (EHS).

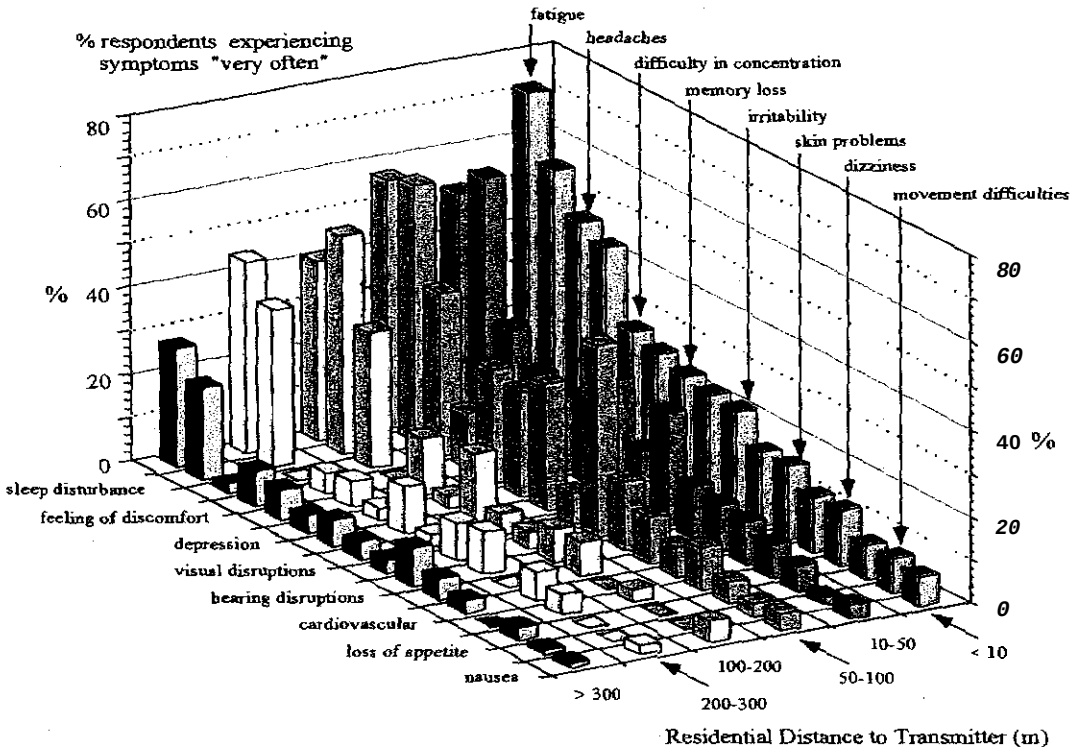


Figure 1. *Response* of *residents living* in the vicinity of a cellular phone base station in Spain (Santini 2001).

Electrohypersensitivity (EHS) is now recognized by the *World* Health Organization *(WHO)* and is defined as:

> *". . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . Whatever its cause, EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards.* [WHO International Seminar and Working Group meeting on EMF Hypersensitivity, *Prague, October* 25-27, 2004].

EHS is classified as a disability in Sweden. Between 2% to 35% of the population may be sensitive to electromagnetic energy and this syndrome may be increasing. Symptoms include: cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial flushing, skin rash; chest pressure, *rapid* heart rate; *depression*, anxiety, irritability, *frustration*, temper; fatigue, poor sleep; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia

Example #2: Naila Study, Germany (November 2004); Report by five medical doctors.

The aim of this study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumors. What the researchers found was that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the pasl ten years at a distance of up to 400 metres from the cellular transmitter site, which bas been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier. After five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area

SITING OF CELL PHONE ANTENNAS

Many jurisdictions worldwide are struggling with siting of cell phone base stations. They have yet to be confronted with WiFi antennas.

Example #3: The International Association of Fire Fighters (IAFF) ratified Resolution 15 in Boston, August 2004. Resolution 15 slates that ***"The IAFF oppose the use of fire stations as base stations for antennas and towers for the conduction of cell phone transmissions*** *until* ***such installations are proven to be hazardous to the health of*** *our* ***members."*** Evidence in California indicates that fire fighters in a fire hall with a cell phone antenna on the roof have abnormal brain activity.

Example #4: United Kingdom:

Belfast City Council rarified decisions of its Development Committee (Aug 18,1999) that no transmitter masts should be permitted on any Council Property, due to unknown risk and substantial public concern.

Wyre Borough Council, Lancashire believed it was unsuitable to site telecommunication towers 190 m from primary school and 40 m from houses.

Scotland Planning Authorities adopted "Precautionary Policy" due to "perceived inadequate official advice from Government Departments"

In England & Wales, the Local Government Association (LGA) advised member authorities to adopt "Precautionary Approach". This decision making process was based on the concept that waiting for "conclusive scientific evidence" before acting is potentially flawed.

EVIDENCE THAT RADIO FREQUENCY RADIATION IS HARMFUL.

Example #5: Laboratory Studies

A number of laboratory studies with rodents support the claim that RFR is genotoxic. Lai and Singh *(2005)* reported single- and double-strand breaks in the brains cells of microwave-exposed rats (at cell phone frequencies of 2450 MHz, continuous wave) compared with sham-exposed

animals. *[Lai and Singh. 2005 Interaction of Microwaves and a Temporally Incoherent Magnetic Field on Single and Double DNA Strand Breaks in Rat Brain Cells. Electromagnetic Biology and Medicine (formerly Electro- and Magnetobiology Volume 24, Number 1 / 2005 Pages: 23 - 29].* This energy has the potential to initiate tumors in cells.

Example #6: A *Review of the* Potential ***Health Risks of Radiofrequency Fields from Wireless Telecommunication Devices 1999. An Expert Panel Report prepared at the request of The Royal Society of Canada for Health Canada***

According to *this* expert panel there is a growing body of scientific evidence which suggests that exposure to RF fields at intensities far less than levels required to produce measurable heating can cause effects in cells and tissues. These biological effects include alterations in the activity of the enzyme ornithine decarboxylase (ODC), in calcium regulation, and in the permeability of the blood-brain barrier. Some of these biological effects brought about by non-thermal exposure levels of RF could potentially be associated with adverse health effects.

PRECAUTJONARY PRINCIPLE

Until appropriate guidelines can be introduced a number of international and national agencies, including the US National Institute of Environmental Health Sciences, are recommending adoption of the Precautionary Principle that was presented at the Rio Conference on Environment and Development in Brazil in 1992.

The Precautionary Principle (PP) states that: *"Inorder to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be* used *as a reason for postponing cost-effective measures to prevent environmental degradation."*

The overarching Considerations include:

1. Scientific Basis for Application
2. Transparency, Accountability & Public Involvement
3. Cost-Effectiveness
4. Legal Issues
5. International Considerations

I strongly urge all levels of government to adopt this principle to ensure protection of the populations living immediately around existing cell phone antenna installations and to place new antennas at a sufficient distance to minimize human and animal exposure. Similar advice relates to WiFi antennas.

Respectfully submitted, January 17, 2006
Magda Havas, B.Sc., Ph.D.

LIBRARY DIRECTOR RESIGNS BECAUSE OF WIFI

A Library Director at a college in Santa Fe, NM left her position due to wireless internet (WiFi) in the library. Rebekah Zablud Azen, MLIS, resigned from her position at Quimby Memorial Library, Southwestern College, on December 16th, 2006 after administrators refused to discuss the issue.

"I don't feel that I should have to jeopardize my health to secure or maintain employment, but allowing oneself to be irradiated is fast becoming a condition of employment for librarians. I just said no."

B. Blake Levitt, a medical journalist who has been researching the biological affects of nonionizing radiation since the late '70's, and author of: Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves, and Cell Towers: Wireless Convenience? or Environmental Hazard? wrote, "Once considered safe environments/professions, librarians and teachers are now in bigh risk professions."

Azen is not the first librarian to express opposition or leave her position because of WiFi. In Santa Fe, four librarians recently signed a petition against WiFi in the public libraries, while several others objected to WiFi but were afraid to speak out. There is a librarian on the west coast that has been told not to discuss this issue by library administration and a report of two librarians who moved to rural towns and left the profession.

The proliferation of wireless technologies is a growing and serious public health hazard, says Azen. "There is no evidence proving safety and an abundance of evidence demonstrating biological harm to living systems. Anyone who cares to look into the vast body of research that has been conducted over the past 80 years will find that the weight of evidence points to harm. The only sensible response is precaution."

Current safety standards adopted by federal agencies like OSHA were developed by industry groups and are obsolete. EPA senior scientist and radiofrequency (RF) radiation expert, Norbert Hankin, wrote, "Both the NCRP (National Council on Radiation Protection) and ANSI/IEEE standards are thermally based and do not apply to chronic non-thermal exposure situations." In other words, if it doesn't "cook tissue," it is assumed to be safe. Research indicates however that low-power exposure (WiFi is "low power') has been shown to have numerous biological effects which can lead to serious health consequences, including neurological, cardiological and hormonal disorders, breakdown of the blood-brain barrier, DNA damage, cancers, diabetes and asthma. Children, to whom public libraries cater, have brains and nervous systems that are still developing; they are particularly vulnerable.

Among the many scientists, organizations, government agencies and medical societies issuing bans or precautions, Lakehead University, in Canada, prohibits WiFi on its campus; the Public Health Department in Salzburg, Austria advises against WiFi in schools; the Schools Department in Frankfurt, Germany prohibits WiFi in schools; and the Austrian Medical Association warns against wireless technologies, including WiFi. The Benevento Resolution is the most recent and comprehensive pronouncement by 31 scientists internationally.

The Benevento Resolution http://www.icems.eu/docs/Benevento_press_release-pdf states, "Based on our review of the science, biological effects can occur from exposures to both Extremely Low Freqoency Electromagnetic Fields (ELF EMF) and Radiofrequency fields (RF EMF). More evidence has accumulated that there are adverse health effects from occupational and

public exposure to electric, maguetic and electromagnetic fields, or EMF at current exposure levels." Tbe resolution also specifically warns against exposure to WiFi systems

Azen is also opposed to WiFi in libraries because it creates barriers to access for people with disabilities. People with certain types of heart disease, epilepsy, and others with electromagnetic sensitivity react with pain, confusion, and neurological or cardiac symptoms and are effectively denied access to libraries with WiFi. In California alone, a 1998 survey by the California Dept. of Health Services found that 120,000 Californians were unable to work due to electromagnetic radiation. Today, this number is undoubtedly much higher due IO the rapid growth of wireless technologies.

Librarians have always upheld the principle that access to libraries and information is inviolate, says Azen. "Today, this important library principle is eroding due the unquestioned acceptance of WiFi. Libraries should retain their autonomy as "wireless-free" zones. Instead of rushing to join the herd to go wireless, libraries should be building collections on this topic and educating the populace about the hazards associated with this technology."

Azen says there are other issues as well with WiFi in libraries: libraries are relinquishing their unique role by morphing into internet cafés, the provision of special services to those who have the money 10 afford laptops is re-igniting the digital divide, WiFi service imposes a financial and personnel drain on libraries already struggling to build collections and maintain traditional library services, and unsecured networks compromise a library's commitment to protect user privacy and confidentiality. "Social security numbers, financial records, and yes, library records, are all vulnerable in unsecured wireless networks."

Azen says that librarians need to assess technological trends wisely and ensure that the adoption of new technologies does not adversely impact public health, restrict access, undermine the treasured principles upon which we stand, or erode libraries. She says there are simple solutions to providing more computer access, such as installing wired hubs for patrons.

WiFi is the proverbial elephant in the room. We must, as a profession, begin to open up a dialog on this critical issue that is affecting libraries and librarians everywhere, says Azen.

Release Date: August 31, 2007

BioInitiative Report:
A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF)

Organizing Committee:
Carl Blackman, USA
Martin Blank, USA
Michael Kundi, Austria
Cindy Sage, USA

Participants:
David Carpenter, USA
Zoreh Davanipour, USA
David Gee, Denmark
Lennart Hardell, Sweden
Olle Johansson, Sweden
Henry Lai, USA
Kjell Hansson Mild, Sweden
Eugene Sobel, USA
Zhengping Xu and Guangdin Chen, China

Research Associate
S. **Amy Sage, USA**

Synopsis and Press Statements

The BioInitiative Working Group Repon calls for exposure standards for human exposure to electromagnetic fields that are based on the weight of science from a biological perspective. Current US exposure standards are based on an engineering perspective - how strong can the electromagnelic fields he in order to allow machinery and technology Io function while only guaarding against the heating of living tissue.

Below are listed the sections of the BioInitiative Report that are directed to the general public audience. The complete repon includes sections that address each of the pertinent areas of the scientific record that demonstrate biological effects and adverse health effects at levels below the current US policy for electromagnetic safety.

At the end of this synopsis are the September 17. 2007 statement of the European Environmental Agency endorsing the BioInitiative Report recommendations and the BioInitiative press release which serves as a summary of the thrust of the repon and its recommendations.

BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF).

The complete report is found at: www.bioinitiative.org

Sections directed to the general public audience setting out the argument that. based on the weight of evidence in the science, the current policies in the United States and many other countries for exposure Io ELF and RF electromagnetic fields to do not protect the public.

SECTION 17: Key Scientific Evidence and Public Health Policy Recommendations
Specific recommendations for changes in allowed exposures limits and References bare found at pp. 17-28.

SECTION i. Preface - lays out the motivation rhar brought about the BioInitiative Working Group Report

SECTION 1: Summary for the Public

SECTION 2: Statement ofthe Problem

Statement in support of the BioInitiative Report posted on the website of the European Environmental Agency:

www.eea.europa.eu/highlights/radiation-risk-from-everyday-devices-assessed

Radiation risk from everyday devices assessed
Published: 17 Sep 2007

A new report raising concerns about the effecls of electromagnetic fields (EMF) on human health calls for tougher safety standards to regulate radiation from mobile phones, power lines and many other sources of exposure in daily life. The report, 'Bioinitiative: A Rationale for a Biologically-Based Public Exposure Standard for Electromagnetic Fields' was compiled hy the BioInitiative Working Group, an international group of scientists. researchers and public health policy professionals. The EEA has contributed to this new report with a chapter drawn from the EEA study 'Late lessons from early warnings: the precautionary principle 18962000 published in 2001

The EEA study reviews the histories of a selection of public and environmental hazards, such as asbestos,

benzene and PCBs, from the first scientifically based early warnings about potential harm, to subsequent precautionary and preventive measures. Cases on tobacco smoking and lead in petrol are forthcoming.

Although the EEA does not have specific expertise in EMF, the case studies of public hazards analysed in the 'Late lessons' publication show that harmful exposures can be widespread before there is both 'convincing' evidence of harm from long-term exposures, and biological understanding of how that harm is caused.

'There are many examples of the failure to use the precautionary principle in the past, which have resulted in serious and often irreversible damage to health and environments. Appropriate, precautionary and proponionate actions taken now to avoid plausible and potentially serious threats to health from EMF are likely to be seen as prudent and wise from future perspectives. We must remember that precaution is one of the principles of EU environmental policy,' says Professor Jacqueline McGlade, Executive Director of the EEA.

Current evidence, although limited, is strong enough to question the scientific basis for the present EMF exposure limits, according to the Biolnitiative Working Group.

Biolnitiative Working Group Press Release Announcing Release of the Biolnitiative Report

State University of New York at Albany - August 31 /Serious Public Health Concerns Raised Over Exposure to Electromagnetic Fields (EMF) from Power Lines and Cell Phones

An international working group of scientists, researchers and public health policy professionals (The Biolnitiative Working Group) has released its repon on electromagnetic fields (EMF) and health. It raises serious concern about the safety of existing public limits that regulate how much EMF is allowable from power lines, cell phones. and many other sources of EMF exposure in daily life.

Electromagnetic radiation from such sources as electric power lines, interior wiring and grounding of buildings and appliances are linked to increased risks for childhood leukemia and may set the stage for adult cancers later in life. A report from the Biolnitiative Working Group (www.bioinitiative.org) released on Friday. August 31, 2007 documents the scientific evidence that power line EMF exposure is responsible for hundreds of new cases of childhood leukemia every year in the United States and around the world.

The report provides detailed scientific information on health impacts when people are exposed to electromagnetic radiation hundreds or even thousands of times below limits currently established by the Federal Communications Commission (US FCC) and International Commission for Non-Ionizing Radiation Protection in Europe (ICNIRP). The authors reviewed more than 2000 scientific studies and reviews. and concluded that the existing public safety limits are inadequate to protect public health. From a public health policy standpoint. new public safety limits, and limits on further deployment of risky technologies are warranted based on the total weigh of evidence.

The repon documents scientific evidence raising worries about childhood leukemia (from power lines and other electrical exposures), brain tumors and acoustic neuromas (from cell and cordless phones) and Alzheimers disease. There is evidence that EMF is a risk factor for both childhood and adult cancers

Public health expert and co-editor ofthe Report Dr. David Carpenter, Director, Institute for Health and the Environment at the University of Albany, New York asserts:

This report stands os a woke-up call that long-term exposure to some kinds of EMF may cause serious health effects. Good public health planning is needed now to prevent cancers ond neurological diseases linked to exposure ropower lines ond orher sources of EMF. We need to educate people ond our decision-makers that business as usual is unacceptable.

Health questions about power line EMFs were initially raised by Nancy Wenheimer. a Colorado public health erpert and Ed Leeper, an electrical engineer in *1919.* Wertheimer noticed that children were twice or three limes as likely to have leukemia tended to live in homes in the Denver, *CO* area close to power lines and transformers. Now, there are dozens of studies confirming the link. but public health response has been slow in coming, and new standards to protect the public are necessary.

Brain tumor specialist Dr. Lennart Hardell, MD, PhD and Professor at University Hospital in Orebro, Sweden is a member ofthe BioInitiative Working Group. His work on cell phones. cordless phones and brain tumors is widely recognized to be pivotal in the debate about the safety of wireless radiofrequency and microwave radiation. He states:

The evidence for risks from prolonged cellphone ond cordless phone use is quite strong when you look or people who hove used rhese devices for 10 years or longer, and when they ore used mainly on one side ofrhe heod.

Brain tumors normally take a long time to develop, on the order of 15 to *20* years. Use of a cell or cordless phone is linked to brain tumors and acoustic neuromas (tumor of the auditory nerve in the brain) and are showing up after only 10 years (a shorter time period than for most other known carcinogens). *This indicates we need research on more long-term users to undersfandrhe full risks* says Dr. Hardell.

Dr. Hardells work has been confirmed in other studies on long-term users. A summary 'estimate of all studies on brain tumors shows overall a 20% increased risk of brain tumor (malignant glioma) with ten years of use. But the risk increases to *200%* (a doubling of risk) for tumors on the same side ofthe brain as mainly used during cell phone calls. He adds:

Recent studies that do not report increased risk of brain tumors ond acoustic neuromas have nor looked at heavy users. use over ten years or longer, ond do nor look at the part of the brain which would reasonably have exposure to produce a tumor.

Wireless technologies that rely on microwave radiation to send emails and voice communication are thousands of times stronger than levels reponed to cause some health impacts. Prolonged exposure lo radiofrequency and microwave radiation from cell phones. cordless phones. cell towers, WI-FI and other wireless technologies have linked to physical symptoms including headache, fatigue. sleeplessness. dizziness. changes in brainwave activity, and impairment of concentration and memory Scientists repon that these effects can occur with even very small levels of exposure, if *it* occurs on a daily basis. Children in particular are vulnerable to harm from environmental exposures of all kinds.

Co-editor of the report, Cindy Sage of Sage Associates slates:

Public health ond EMF policy experts have now given their opinion ofthe weight of evidence The existing FCC ond international limits for public and occupational exposure to electromagnetic fields ond radiofrequency radiation ore nor protective ofpublic health. New biologically-based public and occupofionol exposure ore recommended to address bioeffects and potential adverse health effects of chronic exposure. These effects ore now widely reported to occur at exposure levels significantly below most current national and international limits.

Biologically-based exposure standards are needed to prevent disruption of normal body processes. Effects

are reported for **DNA** damage (genotoxicity that is directly linked to integrity of the human genome), cellular communication. cellular metabolism and repair, cancer surveillance within the body: **and** for protection against cancer and neurological diseases. Also reported are neurological effects including changes in brainwave activity during cell phone calls, impairment **of** memory, attention and cognitive function: sleep disorders, cardiac effects: and changes in immune function (allergic and inflammatory responses).

Sage says:
The *Working Group recommends a biologically-based exposure limit rhar is protective against extremely-low frequency (power line) and radiofrequency fields which. with chronic exposure. can rrasonoblv be presumed to resulr in significant impacts to health and* ***well-being.***

Contributing author Dr. Martin Blank, Columbia University professor and researcher in bioelectromagnetics, wrote the section on stress proteins for the **BioInitiative** Report. He points out:

Cells *in rhe body react to EMFs as potentially harmful. just like to other environmenlal* ***toxins.*** *including heavy metals and toxic chemicals. The DNA in living cells recognizes* ***electromagnetic fields*** *or* ***very*** *low levels of exposure: and produces a biochemical stress response. The scientific evidence tells us that our safety standards are inadequate, and* ***that we*** *must protect ourselves from exposure to EMF due to powerlines. cell phones and the like.*

Contact:
E-mail - info@bioinitiative.org
Tel. - Co-editor Cindy Sage ***(805)969-0557***
Co-editor David O. Carpenter (518)525-2661

The EMR Policy Institute
A Non-Profit Corporation www.EMRPolicy.org

Advancing Sound Public Policy
on the Use of Electromagnetic Radiation (EMR)
P. O. Box 117 Marshfield VT 05658
E-mail: info@emrpolicy.org
Tel: 802-426-3035 FAX: 802426-3030

Blind Faith in Wireless Technology — Facts Everyone Should Know

Humans are electromagnetic beings. Our cells continuously communicate with each other through electrical micro currents. Wireless technology (i.e. cell phones, wireless computers, radar, radio/television broadcast) transmits information through the use of electromagnetic radiation (EMR). This ever-increasing background radiation has the ability to disrupt the communication between our body's cells, resulting in abnormal functions in the developing cells of children, as well as adults and other living creatures.

Even though some radiation is natural, the emissions coming from these technologies contain very different characteristics than anything that exists in nature, at levels much higher than the earth's natural background. The intensity level of 900 Megahertz radiation required to operate a cellular telephone is 2 billion times higher than the earth's natural radiation or the levels at which human beings evolved.

People who live in close proximity to a transmitling facility (such as roof-mounted antennas or freestanding towers) have already begun to exhibit symptoms of environmental EMR exposure. Symptoms include: short-term memory loss, sleep disturbances, nausea, chronic headaches, skin rashes, fatigue and disorientation. In August of 2004, the International Association of Firefighters — the largest labor union for firefighters in the **US** and Canada — voted not to allow new antenna facilities to be placed on or near fire stations. Firefighters are among the first workers to be exposed to low-level transmitting antennas for sustained periods of time over the past few years. Many are now beginning to show symptoms of environmental EMR exposure. This should automatically raise concerns for children in schools with wireless computer networks, and send up red flags to boards of education considering leasing school property for cell towers.

The United States government safety rules for maximum allowable exposure to citizens from an antenna or cell phone do not take scientific studies past 1985 into consideration. The current Federal Communications Commission (FCC) standards for ambient exposures were established in 1996, but the FCC has thus far refused to revisit them or incorporate 20 more years of pertinent research into their allowances. Adverse effects to living cells have been shown worldwide in numerous studies of EMR at levels far below those now allowed by the FCC. For example, studies have found that one ***two***-minute cell phone call made by a child affects his/her brain activity for up to an hour afterward.

When we use wireless technology we are not only potentially harming ourselves but also those around us — the same way second hand smoke affects others. EMR is a form of air pollution, too. A cell phone emits radiation in a radius of approximately 2 yards. Children are particularly vulnerable because their cells are still developing.

Unfortunately because we can't see EMR, we tend to think it's not there. But just because you can't see radio and television waves, doesn't mean you don't hear ***the*** sounds or see the pictures. You can't see cell phone transmissions but the phones still ring.

Contrary to popular belief, wireless technology has not been proven safe by the FCC or the wireless industry itself. This technology has advanced at an unprecedented rate without regard to the impact on the health and well being of the people engaged in its use, or living in the vicinity of antenna sites. Who will be held responsible?

For more information and to view many of the international scientific studies on record visit our website www.emrpolicy.org. Please feel free to copy and distribute this pamphlet.

PLEASE HELP BY MAKING A DONATION THROUGH OUR WEBSITE!

Addendum - 290-2/07

Subject: An Interesting Letter to B. Blake Levitt "Our WiFi was making our son Sick!"

Dear Ms. Levitt,

My son has been having serious ailments over the last 6 months including: Severe and constant headaches, leg pains, poor sleep, and even heart palpitations. Various specialists were at a loss as to why he had these conditions! The only thing that showed up in extensive bloodwork was a low IgA level. I did some research and figured out that it may be the WiFi Wireless Internet I installed in our home exactly 6 months prior.

So I quietly unhooked the system, and monitored my son so not to tell him of my changes. Sure enough, within hours his headache that he had without pause for 6 months went away. We're about 2 weeks from when I first disabled the WiFi system and my sons ENTIRE medical symptom list has complete cleared up! No longer does he complain of sore legs or headaches, which is a big relief to us.

Most importantly, his blood panel showed that his IgA levels returned to normal. Upon investigation I found that EMF/EMR from Wreless Networks can lower Melatonin, which indirectly lowers IgA - there are studies that confirm this. IgA itself is responsible for fighting a VARIETY of illness. So we can say indirectly that EMF/EMR may be responsible for an extremely wide range of human ailments.

I have found some schools and some countries are already removing WiFi systems because of extremely high levels of complaints from teachers and students about ill effects afler their installation.. I believe this issue is vastly more dangerous than Cellular towers because of the highly concentrated continuous signal nature of wireless internet.

I believe there needs to be some detailed and up to date works to reflect the rapid increase of high powered wireless internet networks being installed in schools, homes, and cities nationwide.

Any opinions on this? Kind Regards,

Robert McNaughton

— Original Message —
From: Paul Doyon
To: doyon.paul@gmail.com
Sent: Tuesday, March 27.2007

Without disclosing adverse health consequences, and in disregard of our right to live and work in a safe environment, WiFi networks are being installed in homes, schools, libraries, public bldgs., etc.

At 2450 MHz, most wireless internet radiates at the same frequency as a micro-wave oven.

For more info. on the "downside" of wireless, called members of WRAN, (Wireless Radiation Alert Network @ 469-4395 or 688-4603

Dear Robert.

Thanks for this email. I will pass it along to appropriate people in federal regulatory agencies who need to hear this exact kind of information. Just so you know, this is about the 10th such communication within the last year that I have gotten describing pretty much the same symptoms. WiFi is certainly a problem. When I lecture on cell towers, I now say that it never ceases to amaze me that people will fight a cell tower in their neighborhood, then throw in a WiFi system at home which is just like inviting a cell tower indoors. The problem with towers/infrastructure now is that they are using

significantly higher frequencies due to the FCC licensing of broadband, i.e. telecom companies can now offer Internet access, TV, text messaging, music downloads, etc. etc. Yesterday's old analog cell tower that could cover a 10-15 mile radius morphed into digital PCS that could cover about a 3-mile radius, and now the "next generation" infrastructure requires antennas/towers every 1-2 miles. These are likely all unsafe technologies, it's just a question of degree and exposure parameters. But personal WiFi domestic systems are by *far* the worst right now due to Is very close proximity to people and the higher frequencies at which they operate. And of course whole cities are going WiFi. Unfortunately the learning curve on this is steep, there are literally NO research funds available in America, and the FCC, which controls for exposure standards, is a non-health agency. So everyone is learning about this one individual anatomy at a time, literally. Eventually the adage that the "plural of anecdote is data" will come to pass. But someone needs to collect the information and we don't even have that going on. No one wants to monitor this. Everyone just wants it to be fine. People who get into difficulties have no one to tell but a journalist like me. And most MDs are clueless.
I am glad that you figured out your son's problems so quickly. That's unfortunately rare. Please let me know how he progresses.

Best Regards,
Blake Levitt (medical journalist, author)
P.S. I wrote about melatonin in my first book on this subject and there is another book called The Melatonin Hypothesis, edited by Stevens, Wilson &Anderson. That latter is mo- 291 -t powerline frequencies but it is full of good information.