



**Maryland Children's Environmental Health and Protection  
Advisory Council**

**Wifi Radiation in Schools in Maryland  
Final Report**

**December 13, 2016**

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## INTRODUCTION

The Maryland Children's Environmental Health and Protection Advisory Council (the Council) identifies environmental health issues that impact children and seeks to protect them from exposure to environmental hazards. Under Md. Code Ann., Health-General §13–1506, one of the responsibilities of CEHPAC is to:

(4) Gather and disseminate information to the public, including the research and medical communities, community–based organizations, schools, and State agencies, on how to reduce, treat, and eliminate children’s exposures to environmental hazards to further the public’s understanding of the environmental hazards that may potentially affect children;

and

(5) Recommend uniform guidelines for State agencies to follow to help reduce and eliminate children’s exposure to environmental hazards, especially in areas reasonably accessible to children...

In May, 2014, the Council received a request from a member of the public to consider the health and safety of wireless radiation (microwave radiation). The Council subsequently discussed the issue and heard from the public over a series of meetings, and invited input from the public. It also received a presentation on the topic from a resident physician in training in the Johns Hopkins Preventive Medicine Residency Program, and a literature review prepared by a graduate student enrolled in the University of Maryland School of Public Health. Throughout the process, the Council has heard from concerned citizens about the issue.

Based on this input, a work group of the Council (see [Appendix A](#) for Council and work group members) prepared an initial draft of this report, which was then reviewed by the Council. The work group set out to answer the following questions:

1. What exposures are linked to WiFi technology?
2. What health outcomes are linked to exposure?
3. Is the Federal Communications Commission radio-frequency energy exposure limit protective of children when it comes to WiFi exposures? Is it overprotective?
4. What are the policy options?

## SCOPE OF THE REPORT

The original request concerned non-ionizing radiation generally, but focused on WiFi radiation in schools (see Background, below). In subsequent Council meetings the issue has at various times been framed as concerns about all WiFi radiation, or particular sources of non-ionizing radiation in schools (primarily, school-based WiFi routers), instructional electronic devices used by students (laptops, tablets), WiFi radiation sources near schools (cell towers located on or near school property), personal devices used by students (cell phones), or WiFi sources not related to schools (e.g., “smart meters”). The health effects of concern have included chronic health effects such as cancer, as well as chronic and acute effects such as impacts on vision from use of personal electronic devices, and non-health outcomes such as educational performance.

The Council recognizes that many decisions regarding electronic device use are under the personal control of parents and children, but has also heard concerns from parents that the increasing use of wireless electronic instructional devices in schools lessens their control of WiFi radiation exposures. In addition, the Council heard from the public about health concerns related to the use of electronic instructional devices (laptops, tablets) that include not only the potential exposure to WiFi radiation, but also related to ergonomics and effects on vision.

Even more than in other environmental health questions involving children, the Council recognized the complexity of isolating for consideration just some of the sources of WiFi radiation exposure. Humans live within an environment in which WiFi radiation is omnipresent, which adds to the difficulty of determining its health impacts. Further, even determining how much exposure an individual or population has over a lifetime is extremely complex, and the nature of electromagnetic radiation is such that there are many possible ways of evaluating exposure, such as mean dose, peak dose, or the measure used officially, the specific absorption rate (SAR).

The Council has attempted to respond to this complexity within its statutory mandate, which focuses on its role both as an advisory body to organs of State government (i.e., the General Assembly and State agencies) and its role in public education. This has led the Council to take a somewhat expansive view of the issue in this report, which, while it is focused primarily on the issue of WiFi radiation exposure from sources within schools (mainly school-based routers), it also mentions some of the other health concerns, with the goal of provoking public discussion as well as discussion within State agencies. Regarding cellular towers located on or near school properties, the Council notes that there are complex issues related to siting and Federal law that the Council cannot

address adequately in this report. The Council has also heard concerns expressed regarding WiFi exposures and sources outside of schools, such as so-called “smart meters.” This report does not address those issues.

## BACKGROUND

### *What exposures are linked to WiFi technology?*

“WiFi radiation” (WiFi), also referred to as radiofrequency radiation (RFR), is non-ionizing radiation typically in the microwave frequencies of approximately 900 megahertz (million cycles/second, or MHz) to approximately 5 gigahertz (1,000 million cycles per second, or GHz). WiFi is used primarily for cellular telephones, local area networks (LANs), and other communications technologies. The primary bands used for WiFi are generally 2.4 GHz and 5 GHz.

WiFi radiation exposures are regulated by several agencies. The U.S. Federal Communications Commission (FCC) issues radiation exposure guidelines as specific absorption rates (SARs) for fixed antennas, hand-held cellular telephones, and personal communications services (PCS) devices.<sup>1</sup> These guidelines were last issued by the FCC in 1996. The U.S. Occupational Safety and Health Administration (OSHA) has established occupational exposure limits for microwave radiation.<sup>2</sup> The U.S. Food and Drug Administration (FDA) does not have standards for cellular telephones, but can take regulatory action if these devices are shown to have adverse health impacts.<sup>3</sup>

### *What Health Outcomes Are Linked to Exposure?*

Some of the biological effects of WiFi radiation are well characterized. In particular, WiFi radiation is known to have thermal effects on tissues, due to the absorption of microwave RFR by water, which results in heating of the water. These thermal effects can be seen in a variety of tissues, and form the basis for most of the health standards that currently apply to WiFi radiation. There are also concerns about non-thermal effects, including cancer.

The Council’s review included a wide variety of sources, including:

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<sup>1</sup> 47 Code of Federal Regulations § 1.1310, accessed 11/22/2016 at: [http://www.ecfr.gov/cgi-bin/text-idx?SID=005917bcee652d12d9ad4d725bf3e4d9&mc=true&node=se47.1.1\\_11310&rgn=div8](http://www.ecfr.gov/cgi-bin/text-idx?SID=005917bcee652d12d9ad4d725bf3e4d9&mc=true&node=se47.1.1_11310&rgn=div8).

<sup>2</sup> See <https://www.osha.gov/SLTC/radiofrequencyradiation/standards.html>.

<sup>3</sup> See <http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/default.htm>.

- A literature review prepared by a graduate student at the University of Maryland School of Public Health as part of the student's Capstone project ([Appendix B](#))
- A presentation prepared by a resident physician in the Johns Hopkins Preventive Medicine Residency Program ([Appendix C](#))
- Public comments received during Council meetings, and emails received by the Council ([Appendix D](#))

The Council heard from multiple sources about some of the organizations that have issued statements or findings relevant to children's health and RFR or WiFi. These include the World Health Organization's International Agency for Research on Cancer (IARC), which in 2011 classified radiofrequency radiation as a Class 2B (possible) human carcinogen, based on the evaluation of limited evidence for an association between cellular telephone use and the development of gliomas (a type of brain cancer) and acoustic neuromas.<sup>4</sup> These data are summarized in a 2013 IARC monograph on electromagnetic fields and cancer.<sup>5</sup>

In a May 19, 1999 letter to the National Toxicology Program of the National Institute for Environmental Health Science, the FDA nominated radiofrequency radiation emissions of wireless communications devices for study by the National Toxicology Program, due to concerns about potential long term health effects.<sup>6</sup> This prompted a large multi-year exposure study by the National Toxicology Program (NTP), which released its preliminary findings in 2016.<sup>7</sup> These findings were released during the Council work group's evaluation, and have informed its recommendations. While the NTP study focused on cellular telephones, it was the largest animal study of its kind, and the preliminary findings were discussed by the work group and the Council. The Council also heard that, based in part on the preliminary findings of the NTP study and other evidence, a number of other organizations have formally requested that the FCC

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<sup>4</sup> IARC classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans. IARC Press Release No. 208, May 31, 2011. Accessed November 26, 2016 at: [http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208\\_E.pdf](http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf).

<sup>5</sup> IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, 2013. *Non-ionizing radiation part 2: Radiofrequency electromagnetic fields*. International Agency for Research on Cancer, vol. 102: Lyons, France.

<sup>6</sup> Letter of William T. Allaben, PhD, May 19, 1999: Accessed on November 15, 2016 at: [http://ntp.niehs.nih.gov/ntp/htdocs/chem\\_background/exsumpdf/wireless051999\\_508.pdf](http://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/wireless051999_508.pdf).

<sup>7</sup> Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure). Accessed November 25, 2016 at: <http://biorxiv.org/content/early/2016/06/23/055699>.

reconsider its exposure standards, including the American Academy of Pediatrics (2013).<sup>8</sup>

## FINDINGS

### *Is the Federal Communications Commission radio-frequency energy exposure limit protective of children when it comes to WiFi exposures?*

Regarding the third question, the Federal Communications Commission (FCC) guidance is decades old and some groups have called for it to be updated to reflect current science and newer exposures, especially to children. The Council recommends that the Maryland Department of Health and Mental Hygiene ask the United States Department of Health and Human Services to **formally petition the FCC to revisit the exposure limit to ensure it is protective of children's health** and that it relies on current science.

### *What are the policy options?*

There are a range of policy approaches to address environmental exposures: from adopting the precautionary principle to experimenting directly on humans. Below are some examples of policy approaches from around the world (more can be found at <http://www.parentsfor safetechnology.org/worldwide-countries-taking-action.html>):

- In Massachusetts, the [Ashland Public School District](#) reduces wireless radiation exposures through a “best practices for mobile devices”.
- France banned WiFi in nursery schools and ruled that routers in schools for children up to 11 should be turned off when not in use for pedagogic purposes.
- In [Vitoria City, Spain](#) citizens will be informed of the location of wireless transmitters are in civic centers and municipal buildings.
- In [Israel, the Ministry Of Education](#) issued guidelines limiting WiFi in schools including.
  - Preschool through 2nd grade have banned the use of wireless networks.
  - A hard wired direct cable connection is required if the teacher has a computer in the class. Magnetic fields below 4MG are being reduced.
  - In third and fourth grade class internet is restricted to 3 hours per week.

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<sup>8</sup> Letter of Thomas K. McInerney, MD, FAAP, August 29, 2013: Accessed November 26, 2016 at: <https://ecfsapi.fcc.gov/file/7520941318.pdf>.

- [The German Federal Ministry for Radiation Protection](#) states, "supplementary precautionary measures such as wired cable alternatives are to be preferred to the WLAN system."

## RECOMMENDATIONS

The literature review of exposures and health effects from WiFi prepared for the Council indicated that the research is still ongoing. While scientists work to answer questions about the impact of WiFi on children's health, the Council recommends limiting exposures as much as feasibly practical<sup>9</sup>, without negatively impacting education.

- The Council recommends that the Maryland Department of Health and Mental Hygiene ask the United States Department of Health and Human Services to formally petition the FCC to revisit the exposure limit to ensure it is protective of children's health and that it relies on current science.

The following recommendations are based on principles of industrial hygiene and occupational health. The Council also recommends that:

- The Maryland State Department of Education should recommend that local school systems:
  - Consider using wired devices.
    - Where classrooms have internet access with a wireless connection, WiFi can be turned off and wired local area network (LAN) can provide a reliable and secure form of networking for as many wireless devices as necessary without any microwave electromagnetic field exposure.
    - If a new classroom is to be built, or electrical work is to be carried out in an existing classroom, network cables can be added at the same time, providing wired network access with minimal extra cost and time.
  - Have children place devices on desks to serve as barrier between the device and children's bodies.
  - Locate laptops in the classroom in a way that keeps pupil heads as far away from the laptop screens (where the antennas are) as practicable.
  - Consider using screens designed to reduce eyestrain.
  - Consider using a switch to shut down the router when it is not in use.

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<sup>9</sup> Wifi in Schools Australia: Reducing EMR. [http://www.WiFi-in-schools-australia.org/p/blog-page\\_13.html](http://www.WiFi-in-schools-australia.org/p/blog-page_13.html).



- Teach children to turn off WiFi when not in use.
- Consider placing routers as far away from students as possible.
- Share this document with teachers and parents.
- The General Assembly should consider funding education and research on electromagnetic radiation and health as schools add WiFi to classrooms.
- The Maryland Department of Health and Mental Hygiene should provide suggestions to the public on ways to reduce exposure:
  - Sit away from WiFi routers, especially when people are using it to access the internet.
  - Turn off the wireless on your laptop when you are not using it.
  - Turn off WiFi on smartphones and tablets when not surfing the web.
  - Switch tablets to airplane mode to play games or watch videos stored on the device.
- This report should be posted on the Council website and shared with the:
  - United States Department of Health and Human Services
  - Federal Communications Commission
  - Maryland State Department of Education
  - Maryland General Assembly

## **CONCLUSION**

Many members of the public participated in Council meetings and contributed documentation relevant to these deliberations (Appendix B); we appreciate their input and dedication. While this report focused on WiFi radiation in schools, there are additional concerns about mobile phones and cell phone towers. CEHPAC plans to take a look at these broader issues over the next year.

## APPENDIX A: Members of the Children’s Environmental Health and Protection Advisory Council

Name	
	<b>Appointed by the Governor, representing the following:</b>
Abney, Dr. Diana	Maryland Association of County Officials
Bishai, Dr. David	Economist skilled in measuring the economic costs of illness and the benefits of prevention
Carrella, Veronika*	Parent or guardian whose child has been clinically diagnosed as having been exposed to
Diette, Dr. Gregory	Representative from an academic institution who has expertise in studying the impact of environmental exposures on childhood disease
Gitterman, Dr. Benjamin*	Licensed health care provider with expertise in the field of children’s environmental health
Latshaw, Dr. Megan**	Epidemiologist with expertise in children’s environmental health
Levy, Julian	Representative of private industry representing the regulated community
Matsui, Dr. Elizabeth	Licensed health care provider with expertise in the field of children’s environmental health
Witherspoon, Nsedu*	Environmental toxicologist with expertise in issues of importance to children’s environmental health
Thomas, Benoy	Maryland Commission on Environmental Justice and Sustainable Communities
	<b>Appointed by:</b>
Church, Christina	Special Secretary of the Governor’s Office for Children
Del. Angela Angel	Speaker of the House
Senator Guy Guzzone	President of the Senate
Hofstetter, Rob	Secretary of Agriculture
Mezu, Alicia	Secretary of Education
VACANT	Secretary of the Environment – Vice Chair
Mitchell, Dr. Clifford	Secretary of Health and Mental Hygiene - Chair
Stocksdale, Brandi	Secretary of Human Resources
Varney-Alvarado, Caroline	Secretary of Housing and Community Development

\*WiFi work group member. \*\*Chair of WiFi work group.

## **APPENDIX B: Review and Analysis of Wi-Fi Devices and Radiofrequency Radiation in Schools**

This presentation can be found online at:

<http://phpa.dhmh.maryland.gov/OEHFP/EH/Pages/WiFiCEHPAC.aspx>

## **APPENDIX C: Presentation to CEHPAC on WiFi (September 9, 2014)**

This presentation can be found online at:

<http://phpa.dhmh.maryland.gov/OEHFP/EH/Pages/WiFiCEHPAC.aspx>

## **APPENDIX D: Materials Provided to CEHPAC by the Public**

These materials can be found online at:

<http://phpa.dhmh.maryland.gov/OEHFP/EH/Pages/WiFiCEHPAC.aspx>