Question 1 – Perspective

Individual consumer and patient with long-term multi-source wireless exposure. Having been diagnosed with Parkinson's and having symptoms improve after major reduction in RF/EMF sources, my story might offer insight to others who have received devastating neurological diagnoses.

Question 2 –

My perspective Sari Bunnell, BS Biology (SUNY Buffalo, 1971), MA Biochemistry (UCLA, 1975). Early publications include *A Sensitive Assay for Human Enterokinase* (Clinica Chimica Acta, 1974) and thesis work on "*Proteolytic Enzymes from Rat Bone that Degrade Bone Morphogenic Property*. Worked as a scientist (Ethicon/J&J absorbable suture analysis submitted to FDA and approved without alteration; Hancock Laboratory on cardiac valve calcification). Later shifted to computer systems and programming, owned Maine Computer Consultants, taught Oracle, and operated a wireless ISP (Sierrasky.net) serving ~50 accounts via a relay on a tall pine. Long-term high phone use in technical support; later continuous cordless and Bluetooth exposure.

I developed progressive symptoms in 2018, including tremors; numbness in my face, head, hands, shins, and feet; and dropping objects without noticing. I fell frequently and experienced severe spatial and memory problems, such as getting lost a few blocks from home or putting ice cream in a cabinet. I experienced mental fog, used the wrong words, and sometimes could not finish sentences. I also had cataracts. My whole life was affected.

As my health declined, I tried many dietary changes, including organic, keto, gluten-free, and vegan diets, and added supplements. None improved my condition. After multiple MRIs that ruled out other structural causes, both my primary care physician and neurologist diagnosed Parkinson's disease. I was entered in the California Parkinson's registry.

After the diagnosis, we read that EMF exposure might contribute to neurological problems. I had used Bluetooth headphones much of the time and enjoyed the convenience of wireless technology, so we had reason to investigate whether EMF exposure might be contributing to my symptoms. We systematically replaced wireless connections with cables and shut down continuous wireless sources.

Over the following months, my symptoms gradually improved. After about a year, the tremors were gone, I had stopped falling, my speech had improved, and my brain fog had diminished. Can I state that EMFs caused Parkinson's? My symptoms led to a diagnosis of Parkinson's disease by both my primary care physician and neurologist. My substantial improvement after reducing wireless exposure when all other attempts failed, leads me to believe that EMF exposure was a major contributor to my symptoms.

My experience cannot establish causation, but the relationship between exposure reduction and recovery deserves careful investigation.

Many diseases involve neurological symptoms or decline, including ADHD and learning disorders in children, dementia in seniors, depression, and insomnia. Concerns have also been raised about fertility and overall health. I believe my experience offers a clue that warrants

further investigation into whether long-term, multi-source EMF exposure may contribute to health problems that develop over years before becoming debilitating.

Thousands of scientific studies have examined EMF exposure and biological effects, and some have reported adverse effects. We need to look carefully at the evidence, investigate long-term, real-world exposure, and determine whether cumulative exposure contributes to health problems that may take years to become apparent.

Question 3 – Public experiences

Years of occupational phone use (hours per day, including evenings and weekends, wireless router, a widescreen TV with internet access, wireless features on computers (we had 4 on most of the time (Bluetooth & WiFi) and a server; 3 tablets and an iPad (Bluetooth & WiFi) an 2 printers, 2 cell phones (Bluetooth & WiFi). WiFi speakers & DVD player. Wireless connection from each and they are all listening to see if they should wake up. Sometime draw a 2-way arrow going from each gadget to each other & imagine walking and sitting through that maze. Now it's much worse, even a refrigerator can become a router. I loved all those gadgets and even more staying connected to everything with cell phones and internet everywhere.

Question 4 – Existing standards and frameworks

Federal agencies should examine the differences between U.S. thermal-threshold limits and the lower chronic limits used by other countries. Russia's public limit of 10 μW/cm² (approximately 100 times lower than the FCC public figure of 1,000 μW/cm²) and they have specific child protections. Cell phones not recommended under 18, no advertising to children, and base stations and WiFi are banned on school grounds. We allow cell towers, 5G antenna & relay antennas on school roofs and WiFi connections throughout. Italy maintained an indoor attention value of 6 V/m for homes, schools and hospitals for two decades; independent Italian scientists have called for still lower levels where people remain more than four hours. France, Cyprus and Israel have restricted or banned Wi-Fi in nurseries and early primary settings. These approaches treat children as a distinct risk group.

The 1973 Warsaw international symposium already documented the contrast between the U.S and Soviet baselines. The US approach was increased heat which caused cataracts (~10,000 μW/cm²) and Soviet non-thermal observations (~1 μW/cm²). The symposium presented substantial evidence of low-level EMFs interference.

Deficiencies of current FCC SAR and related testing:

Thermal endpoint primarily. The SAR limit (1.6 W/kg over 1 g) and MPE limits are based primarily on preventing adverse effects associated with RF energy absorption and heating. They do not establish whether non-thermal effects reported for decades at lower intensities occur or whether they pose health risks.

The FCC uses a plastic head modeled on a large adult male (the SAM phantom). Women, children, and smaller adults are not represented by this head model. Published head models have estimated localized absorption in a child's brain on the order of two to three times higher

than the large-male dummy for the same phone (exact multiples vary by frequency, position, and model). Clearly the most sensitive model would be closer to establishing safety rather than using the SAM phantom.

Compliance testing uses averaging periods of 6 minutes for occupational/controlled exposure and 30 minutes for general-population/uncontrolled exposure. There is no general requirement to evaluate cumulative exposure over days, months, or years as part of routine equipment authorization. Always-on devices such as routers and cordless phones can have different transmission patterns and duty cycles.

FCC testing does not necessarily evaluate every combination of devices transmitting simultaneously. Some assessments must account for simultaneous transmission from multiple radios, including cellular, Wi-Fi, and Bluetooth, depending on the device and applicable procedures. The average home or classroom may contain 15–20 emitting devices, although this figure requires a supporting source. Wi-Fi routers, cordless telephone bases, and baby monitors have different transmission patterns. Cellular and 5G antennas, relay antennas, and multiple carriers may also be present at the same location, including on school rooftops.

The FCC does not prescribe a universal maximum daily or lifetime usage time for cell phones, tablets held on the lap, hearing aids, or Bluetooth earbuds worn in the ear canal. The FCC sets no general recommended maximum number of daily or lifetime hours for phone-to-ear, tablet-on-lap, or in-canal Bluetooth exposure, nor does it require universal duty-cycle labeling for always-on wireless devices.

The FCC does not generally require manufacturers to demonstrate the absence of chronic health effects through multi-year studies of human health outcomes or cumulative exposure from multiple sources as a condition of routine equipment authorization. The regulatory limits rely primarily on established RF exposure criteria, including limits on SAR and other exposure measures, assessed under specified conditions and averaging periods.

The FCC's equipment authorization process does not generally evaluate every real-world combination of devices operating simultaneously. A person may be close to multiple transmitting devices or wear several devices at one time.

The FCC permits modeling and engineering analyses for RF exposure compliance assessments of applicable 5G infrastructure. The methods used depend on the equipment and circumstances; it is not accurate to say that all 5G infrastructure compliance is demonstrated solely through modeling or internal software power controls. Day-to-day power and beam adjustments can change exposure conditions. The availability of public information about antenna locations and compliance assessments varies by database and installation.

FCC equipment authorization records and technical exhibits can be difficult to locate, and some exhibits may be confidential or unavailable through a simple model-number search. A search returning no results does not necessarily mean that test records do not exist.

These gaps mean that compliance establishes conformity with applicable RF exposure limits under prescribed assessment conditions. It does not, by itself, establish the absence of every possible health effect for children, smaller adults, long-duration multi-source exposure, or reported non-thermal effects.

Question 6 & 7 – Exposure assessment methods and needed improvements

Before 5G deployment, consumers could use relatively affordable RF meters to measure ambient radiofrequency exposure from common sources such as cell towers and Wi-Fi. Many consumer meters work adequately below approximately 6 GHz but cannot measure the higher frequencies used by 5G systems, including millimeter-wave bands. Although specialized commercial instruments can measure portions of this higher-frequency range, affordable meters that measure the full spectrum, potentially extending to 80 GHz, are not generally available to ordinary consumers. This makes it impossible for the public and independent researchers to measure and verify total ambient RF exposure without using expensive commercial grade equipment.

The FCC does not require wireless carriers to make a complete, current inventory of their networks publicly available. Although some tower and licensing information is available in FCC databases, there is no comprehensive public record of every cell site, small cell, rooftop antenna, carrier installation, frequency band, or operating parameter. Public records also do not provide real-time information about transmission power or beam direction.

The FCC does not conduct routine, random, unannounced field measurements across carrier networks to independently verify actual RF emissions at cell sites. Compliance is generally demonstrated through required assessments, which may rely on engineering calculations and computer modeling rather than independent, on-site measurements of actual operating conditions. There is no nationwide program of continuous, independent monitoring that verifies the combined RF exposure from all carriers and other sources at a given location.

This lack of comprehensive network disclosure and independent field verification, combined with the absence of affordable consumer meters capable of measuring the full range of frequencies now in use, leaves the public and independent researchers unable to reliably measure and verify total ambient RF exposure using publicly available information and ordinary consumer equipment,

Question 10 – Sensitive populations

Yes. Children and developing fetuses warrant separate consideration. The official SAR certification uses a plastic head modeled on the 90th-percentile U.S. Army male. Published modeling indicates localized absorption in a child’s brain can be two to three times higher than that large-male dummy for the same phone. Women and smaller adults also fall outside the test geometry. Russia, Italy (prior to the 2024 change), France, Cyprus and Israel have already adopted child-specific restrictions or lower indoor values. The United States has not.

Adult symptom clusters reported in clinical series and earlier occupational literature (headache, cognitive disruption, sleep disturbance, skin sensations, balance problems) overlap with the pattern I experienced. Child clusters reported by pediatric observers include restlessness, attention failure, sleep collapse and irritability that can improve when wireless sources are removed. These observations do not establish population causation; they indicate that sensitive or developing individuals may respond at levels the current thermal tests do not address.

Child and adolescent cluster

A child's skull is thinner, the brain has more water and more growing cells, and the remaining life is longer. RNCNIRP made that the reason children are a risk group, not a marketing group. Pediatric EMF practice treats restlessness, attention failure, rage, and autistic-spectrum dysregulation as load signs first.

Sign	How it shows up
Restlessness / cannot sit	Cannot stay in a chair. Classroom fidget that drops when the room is wired and the tablet leaves the desk.
Cannot focus / learning stall	Attention splinters. Reading from a screen worse than from paper. Tasks that were easy become noise.
ADHD-shaped picture	Impulsivity, incomplete work, poor working memory. Pediatric EMF clinicians treat this as load, not only as a brain-chemical label.
Anger / aggression	Short fuse, sudden rage after a long wireless session or a night next to a phone. RNCNIRP listed rising irritability as an expected child outcome.
Sleep collapse	Hard to fall asleep, night waking, school-morning crash. Night fields steal the only repair window a growing brain has.
Headache and ear pain	Same first signs as adults, often blamed on "screens" without measuring the radio.
Speech / sensory overload	Word retrieval, noise intolerance, light intolerance. Looks like sensory-processing disorder.
Autism-spectrum regulation	A subset of autistic children sleep, attend, and regulate better when house and classroom radios go off. A load-reduction observation, not a claim that autism is only EMF.
Immune / skin / gut	Eczema flares, frequent illness, bowel swings that move with the wireless week versus the wired weekend.
Prenatal / infant	Restless infant, poor sleep in a Wi-Fi nursery, monitor next to the crib. France and Cyprus banned nursery Wi-Fi for this geometry.

On autism: Martha Herbert treats it as a whole-body, environmentally loaded state that can move. Clinics that strip Wi-Fi, cordless bases, and crib monitors report better sleep, fewer meltdowns, and more attention in a subset. That is a two-week load test. It is not a claim that every autism diagnosis is a radio injury.

Question 11 (evidence below current federal limits)

Hasn't anyone from the CDC, FDA, or EPA ever done basic research on EMFs? In my view this entire RFI approaches the topic as if it were a brand-new problem. It should have been asked after agencies first reviewed the publicly available record that has existed since the 1950s and 1970s. Instead of beginning with the newest studies, it is useful to start with information that has been in the open literature for decades and then note a short reading list of later syntheses.

When an agency asks for personal experiences and then treats every one of them as an isolated n-of-1 that cannot establish causation, the invitation becomes performative. The experiences are collected, labeled "anecdotal," and set aside. That's why I spent the time on the Early Radar and 1973 Warsaw record below. The non-thermal observations were already presented there as experimental and occupational data, not as single-person stories. The basic research existed; it was not incorporated into the regulatory endpoint. Reports that effects occurred 'below 100 μW/cm²' or 'at non-thermogenic intensities' often include observations at the low end of that range (on the order of 1–10 μW/cm²).

Early radar and Tri-Service observations (1950s–early 1960s)

In the late 1950s and early 1960s the U.S. Tri-Service (Army, Navy, Air Force) conferences reviewed both laboratory and occupational findings from radar and microwave sources. Reports from that period noted ocular effects (including lens changes later linked to heating), behavioral and neurological changes in animals, and hematologic alterations. Small-animal studies were used extensively; investigators observed that effects appeared more readily in smaller species and discussed surface-area and body-size scaling when extrapolating to humans. These conferences established that radar and microwave energy could produce biological changes and that exposure duration mattered. The dominant U.S. interpretation that emerged emphasized thermal mechanisms and cataract risk as the primary basis for exposure limits. Non-thermal or low-intensity findings were recorded in detail but did not become the regulatory endpoint. Reports that effects occurred 'below 100 μW/cm²' or 'at non-thermogenic intensities' often include observations at the low end of that range (on the order of 1–10 μW/cm²).

The same thermal rationale was still the U.S. position when the Warsaw symposium convened in 1973 and remains the foundation of current FCC SAR and power-density limits.

Non-thermal effects were already documented more than 50 years ago

The 1973 Warsaw International Symposium on Biologic Effects and Health Hazards of Microwave Radiation (proceedings published 1974, sponsored by WHO, the U.S. Department of Health, Education and Welfare, and Polish authorities) explicitly compared the two approaches then in use.

The preface recorded the central divergence: the usual U.S. occupational recommendation of 10,000 μW/cm²) was based mainly on the risk of cataract formation from heating, while the Soviet full-time occupational standard was 10 microwatts per square centimeter (10 μW/cm²)—one thousand times lower—based on reported low-intensity non-thermal biologic effects.

Soviet and Polish contributors (including Gordon and colleagues) stated that pronounced biologic effects at intensities that do not produce bulk heating (below 10 mW/cm²) had been shown by multiple independent groups. They defined non-thermal ("extrathermal") effects as those arising from conversion of electromagnetic energy into other non-thermal forms (molecular resonance, photochemical reactions, etc.). Intensity ranges presented at the meeting placed non-thermal effects in the range of roughly 1–100 μW/cm².

Specific findings reported at the symposium included:

- Clinical observations over 20 years of industrial exposure showing that effects became more severe with longer duration of work at low intensities (less than 1 mW/cm²).
- Intermittent exposure (matching real production regimes) produced stronger changes in weight, blood pressure, EEG, electromyography, and hypothalamic neurosecretion than steady irradiation of the same average strength.
- Endocrine, pituitary-thyroid, and pharmacological responses at low intensities.
- Hematologic and lymphocytic changes.
- Greater effects from pulsed microwaves than from continuous-wave radiation of equal average power.
- Persistence of some metabolic changes (e.g., brain carbohydrate metabolism) one month after exposure ended.

U.S. participants were present and the proceedings were published openly. The meeting's stated aim was not to settle the standards debate but to present the underlying studies and identify needed research on cumulative, delayed, and low-intensity effects. Despite that record, the United States continued with a primarily thermal/cataract-based standard and did not require long-term non-thermal testing as a condition of equipment authorization. The same thermal endpoint remains the basis of the current FCC SAR and MPE limits.

Question 12 – Cumulative exposure patterns

In congested areas multiple carriers deploy additional sites, panels, and beams. Beamforming concentrates energy toward active users. Each operator remains subject to its own power caps and averaging requirements, and carriers implement software power-lock features to support the use of power-reduction factors under standards such as IEC 62232. The practical result is more sources and greater spatial variability rather than unrestricted continuous maximum power.

However, because combined ambient levels are not continuously measured and published, and because day-to-day adjustments are not reported as exposure events, the cumulative pattern experienced by the public is not independently verified.

Satellite systems such as Starlink Direct-to-Cell operate in existing cellular bands (approximately 1.9–2.2 GHz) and add low-level ground exposure plus documented unintended electromagnetic radiation that primarily affects radio astronomy. Space-based solar power concepts under study would create localized higher-density beams at dedicated ground sites. Neither changes the core measurement gap for terrestrial multi-source environments.

Question 15 – Highest-priority research gaps

1. Suspend reliance on the current FCC SAR/MPE thermal tests as the sole basis for concluding safety. Those tests do not address multi-source, long-duration, child-relevant, or non-thermal exposure.
2. Require independent measurement and public reporting of actual ambient levels in both high-density urban areas and rural areas (where base stations often operate at higher power to cover larger distances). Include cell towers, 5G small cells and beamforming arrays, boosters/repeaters, and co-located multi-frequency sources. High-power electrical infrastructure should be included in the same ambient surveys.
3. Remove or prohibit new wireless infrastructure on and immediately adjacent to schools and childcare facilities as a first step, consistent with policies already adopted in several other countries.
4. Direct manufacturers and carriers to reduce emissions (lower power, better duty-cycle control, preference for wired connections where feasible) rather than continuing to authorize new higher-frequency deployments under the existing thermal framework.
5. Establish a clear public education program on cumulative exposure, the limitations of current testing, and practical source-reduction steps, so that individuals, schools, and local governments are not left without usable information.
6. Only after the above measurement and reduction steps are underway, fund the long-term multi-source and non-thermal studies that the current authorization process has never required.

Question 17 – Additional information

Until actual multi-source ambient levels are measured and the thermal-only test is no longer treated as sufficient, further expansion of higher-frequency infrastructure should be paused.

The current system is largely self-certification supported by computational modeling, software power controls, and selective enforcement. Compliance for base stations is demonstrated primarily by modeling rather than continuous independent field measurement of combined multi-carrier exposure. When service problems (dropped calls, capacity) arise, carriers adjust power, beams, or site density; those operational changes are not automatically reported to the FCC as RF-exposure events.

The FCC does not ever monitor the combined field from multiple operators at street level and does not require publication of real-time ambient measurements. The burden of demonstrating long-term safety under realistic multi-source conditions has effectively been shifted onto the public and independent researchers. Federal health agencies should reverse that posture: require industry to generate the missing long-term, multi-source, child-relevant data before further expansion of higher-frequency infrastructure, and support independent measurement capability so that claims of compliance can be checked outside the laboratory.

Thank you for the opportunity to comment.