PSGR

Physicians & Scientists for Global Responsibility

July 22, 2025

Ministry for the Environment Consultation

Proposed amendments to the: Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016.

Submitted to the:

Ministry for the Environment (and the Ministry for Business, Innovation and Employment).

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PSGR would welcome an opportunity to speak to this submission.

Physicians and Scientists for Global Responsibility Charitable Trust (PSGR) works to educate the public on issues of science, medicine, technology (SMT). PSGR work to encourage scientists and physicians to engage in debate on issues of SMT, particularly involving genetics and public and environmental health.

The Physicians and Scientists for Global Responsibility welcome the opportunity to respond to the proposal by the Ministry for the Environment (MftE) and the Ministry for Business, Innovation and Employment (MBIE) to amend the Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016.[1] (Hereafter referred to as NES-TF Regs 2016).

An Interim Regulatory Impact Statement proposing the deregulation of the NES-TF Regs 2016 was finalised on April 16, 2025[2], and a *Package 1 Discussion Document*[3] was released in May 2025 with a corresponding Attachment 1.5.[4] The proposing Ministers are Hon Chris Bishop, Minister Responsible for RMA Reform and Minister for Infrastructure and the Hon Paul Goldsmith, Minister for Media and Communication. Consultation closes on 27 July 2025.

The Interim Regulatory Impact Statement and the proposals in the Discussion Document (Part 2.5) propose significant and extensive deregulatory status for a broad group of technical devices which emit Radiofrequency Electromagnetic Fields (RF-EMF). The MBIE and the MftE propose to remove authority from regions and communities to decide on the appropriate location of these devices and they propose to expand the category definition and sweep other devices inside this category.

PSGR recommendations: Not fit for purpose, fails to adhere to legislative purpose.

New Zealand's standard, at the frequency range 2 GHz – 300 GHz, permits an electric field strength of 61 volts per metre (V/m root mean square). Any antennae fitted to a pole, mast, lattice tower, or similar structure or building, may sit in that frequency range, and hence have a maximum permitted electric field strength of 61 V/m.

Any deregulation which would bring any device closer to a building or area of recreation should not be permitted. New Zealand's standards are on par with the worst in the world.

An expanded category for sensitive areas will not appear to apply to urban areas. '*Sensitive activities that includes residential buildings (including visitor accommodation and retirement accommodation), care facilities, childcare facilities, schools, hospitals, custodial or supervised accommodation where residents are detained on site, marae, or a place of worship.'*

Increasing densification of towers and antennae is not required for public health, nor social or economic purposes. New Zealand has an extensive fibre optic broadband network. Government policy is required to maximise this for low-income populations. Fibre optic networks do not present the same safety risks as Radiofrequency Electromagnetic Fields (RF-EMF) and are relatively politically uncontroversial.

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[1] Order in Council. Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016. 2016/281. https://www.legislation.govt.nz/regulation/public/2016/0281/30.0/whole.html#DLM6985849

[2] MftE MBIE (April 16, 2025). Interim Regulatory Impact Statement: Amendments to the Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016. https://environment.govt.nz/assets/Interim-Regulatory-Impact-Statement-Amendments-to-the-National-Environmental-Standards-for-Telecommunication-Facilities-2016.pdf

[3] Ministry for the Environment. (May 2025). Package 1: Infrastructure and development – Discussion document. Part 2.5 National Environmental Standards for Telecommunications Facilities. Page 43-51. Wellington: Ministry for the Environment. ISBN: 978-1-991140-86-9 Publication number: ME 1895 https://environment.govt.nz/assets/publications/RMA/package-1-infrastructure-and-development-discussion-document.pdf

[4] Attachment 1.5 Proposed provisions – Amendments to the Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016 National direction consultation – Package 1: Infrastructure and development. https://environment.govt.nz/assets/publications/RMA/attachment-1.5-national-environmental-standards-for-telecommunications-facilities.pdf

The risk to health and safety is central to this discussion because densification increases radiation risk. The policy is not fit for purpose. Official powers to draft the NES-TF Regs 2016 arose from the Resource Management Act 1991 (RMA). The RMA requires that officials acting under the RMA must *provide for the health and safety of people and communities*.[5]

The proposal substantially expands categories without any focus on the risk from RF-EMF emissions, and then explicitly drafts out any discussion of risk to health and safety. The exclusion of consideration of health and safety is deliberate, yet the overarching legislative framework demands that officials take into account the health and safety of people and communities.

The cumulative biological impact from the use of technologies involved is central to telecommunications infrastructure policy. It is not the passive proximity to individual components such as cell towers or mobile devices in isolation but the risk to health and safety from the interactive dynamics between them. Specifically, the continual oscillation or bidirectional signalling exchange of radiofrequency electromagnetic fields (RF-EMFs), increases the intensity, variability, and complexity of exposure. Officials cannot ethically and legally discretely separate these issues out by choosing to exclude health and safety as a consideration. The telecommunications companies desire the deregulation directly because of potential use by the public. These interactive, combinatory factors drive risk.

The deregulatory context of the proposal directly concerns a claim that 'low-impact' telecommunication facilities do not require regulation because they are 'low impact'. The designation 'low-impact' is misleading. 'Low impact' has not been defined, nor accompanied by any scientifically rigorous analysis. Low-impact is not defined in the 2016 regulations, the 2016 Users Guide, the 2025 Interim Regulatory Impact Statement[6] nor the proposed policy.[7] [8] The Interim RIS did not provide a technical definition as to what a 'low impact' would constitute whether it was an emitting device or a location that is not just the physical location of towers/antennae but the regions where 5G is enabled. As such, there has been no disclosure as to the technology spectrum emitted by the claimed 'low impact' activities, any risks in urban environments and the greater risks to vulnerable communities which include babies and children.

While 'small poles' may remain 'small' – the antennae (where radiation levels as per New Zealand standards are arguably out-of-date) nevertheless present health risks. These health risks are unnecessary as access to fibre-enabled broadband is available to 87% of New Zealanders and all urban communities should have access. Fibre broadband is the backbone of telecommunications for the vast majority of New Zealanders, for industry, government and personal use, not mounted antennae.

There is no evaluation of risk from emissions burdens to vulnerable groups, yet this consideration is *of the essence*. The policy is silent on multisource exposure, cumulative for all stations and antennae affecting a site. This includes risk from highly localized intensity peaks, pulsed emissions, and the cumulative contribution of background radiation from multiple sources between devices and infrastructure and the interactive dynamics between them. Multi-source exposures concentrate RF-EMF radiation in certain areas, forming zones of constructive field overlap and spatial heterogeneity.

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[5] Resource Management Act 1991. Section 5(2)
https://legislation.govt.nz/act/public/1991/0069/latest/whole.html#DLM230265
[6] MftE MBIE (April 16, 2025). Interim RIS NES-TF Regulations 2016 amendment.
[7] Ministry for the Environment. (May 2025). Package 1: Discussion document. Part 2.5 NES-TF Regs Page 43-51
[8] NES-TF Regs Package 1: Infrastructure and development. Attachment 1.5 Proposed provisions

A significant weight of evidence, including mechanistic data strongly suggests that low dose Radiofrequency Electromagnetic Fields (RF-EMF) at levels currently considered safe, and at levels lower than this, can harm vertebrate systems. An increasing battery of evidence strongly suggests that prenatal and postnatal exposures, and exposures in childhood and youth carry additional risks that have not been sufficiently assessed in New Zealand. In addition, increasing literature highlights increasing hypersensitivity to RF-EMF.[9]

PSGR recommends that special attention is given to poor scientific process by the Ministry of Health, who have failed to review the scientific literature on non-thermal effects from RF-EMF and instead harmonise with an institution that does not follow independent scientific process to establish guidelines.

The MftE and MBIE claim that the deregulated telecommunications facilities would be 'low impact'. It may be presumed that panel antennas, dish antennas and small cell units are low impact, but no definition of 'low impact' has been provided.

As such any deregulatory actions by MftE and the responsible agency MBIE will be poorly timed, due to the advancing literature which suggests that current claimed safe levels cannot protect health.

PSGR recognise that this policy proposal may be hastily convened to secure weaker standards in advance of increasing acceptance of health risk from non-thermal effects. MBIE's industry colleagues may recognise that Ministry of Health claims concerning the alleged safety of non-thermal exposures, supporting the lock-in of relatively high exposure levels, are scientifically indefensible.

The economic impact of digital fibre/satellite infrastructure – not more antennae!

> *Fibre technology continuously evolves, giving us faster speeds, lower latencies, improved resiliency, greater security, and more flexible applications. Speed records are consistently being broken.*[10]

The New Zealand Government initiated the Ultra-Fast Broadband (UFB) initiative in 2009 with the rollout commencing in 2010. Fibre networks are safer than telecommunications facilities (including towers, antennae and small cells on power poles) and politically uncontroversial. Currently 87% of New Zealanders have remarkable access to fibre broadband and New Zealand ranks 9th in terms of fixed broadband connectivity. [11] [12]

The Ministry officials' argument for deregulation focused exclusively on reduced regulatory costs for the telecommunications industry and did not consider safety. There is no requirement for greater densification of towers and antennae in New Zealand urban environments which have, in the majority, fibre-optic cabling. Connectivity from handheld devices is demonstrated to be associated with cancer risk and household access to fibre broadband is high. Devices can be more safely enabled through

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[9] Increasingly referred to as *microwave syndrome*.

[10] *Belden (2024) Looking at the future of Fiber Broadband in 2024. https://www.ppc-online.com/blog/future-of-fiber-broadband-in-2024*

[11] *Deloitte (October 2024). Unleashing fibre: The future of digital fibre infrastructure in New Zealand https://www.deloitte.com/content/dam/assets-zone1/nz/en/docs/services/financial-advisory/2024/deloitte-unleashing-fibre-future-of-digital-fibre-infrastructure.pdf*

[12] *Wikipedia. Ultra-Fast Broadband (New Zealand). https://en.wikipedia.org/wiki/Ultra-Fast_Broadband_%28New_Zealand%29*

Wi-Fi, and devices can remain on airplane mode. The long-term operational performance and reduced maintenance may make fibre optic cabling more economically feasible over the longer term.[13]

The issue that the government needs to address is broadband connectivity for lower income groups.

> *'Nearly a quarter of Pacific peoples are without the internet in the home – three times the rate for New Zealand Europeans and almost twice the rate for Māori. Māori and Pacific peoples are particularly over-represented among younger people without internet access.'*

Remote and rural businesses and residences are extensively served by satellite-enabled telecommunications. Starlink supplies broadband to New Zealanders. Starlink is the largest constellation supplying satellite data to New Zealand and, of the 38 systems that will provide data in the future, it is expected to remain so.[14] Direct-to-satellite mobile services and satellite systems which form part of the network architecture, enhance early warning and emergency communications.

More antennae and towers will not add to wellbeing and quality of life for most Kiwis.

The proposing policies are not fit for purpose:

The Regulatory Impact Statement (RIS) demonstrates that any consideration of the health and safety of New Zealanders has been deliberately excluded from the current policy initiative. Health relating to exposures is explicitly drafted out of scope:[15] There is no evidence for benefits and well-being from this policy proposal, indeed the greater evidence in the literature suggests risk.

Policy problem: The changes to NES-TF is to enable 'greater efficiency in the deployment of telecommunications infrastructure'. The policy problem is concerned with *'low impact telecommunication facilities (e.g. antennas, cabinets, poles, telecommunication lines)'* where '*current rules in NES-TF are too restrictive and do not cover certain low impact telecommunication facilities. This is resulting in the inefficient deployment of telecommunications infrastructure*.' Where a new facility is not currently permitted, telecommunication providers must obtain resource consents which '*uncertainty, complexity, significant costs and delays for deploying telecommunications infrastructure and services'*.

Policy objective: To 'support efficient deployment of low impact telecommunication facilities that meet the needs of New Zealand households and businesses' and limit the capacity for territorial and local authorities to set their own standards. The approach consolidates agency power away from local governments. The policy mandate from Cabinet in June 2024 was to make changes to NES-TF [CAB-24-MIN 0246 refers], and so non-regulatory options (such as guidance for councils, voluntary standards, or global consents) were not considered.

Out of Scope (pages 20-22):

- Guidance for councils, voluntary standards or global consents) were not considered. Officials also consider that non-regulatory options would be inadequate in addressing the problem definition.

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[13] *Singh A. Integrating Fiber Broadband and 5G Network: Synergies and Challenges International Journal of Scientific Research in Engineering and Management. 9(2)1-8. DOI:10.55041/IJSREM18134*

[14] Katavich-Barton S.O.L. Investigating the usage and impacts of satellite data in New Zealand.Page 62. *Katavich-Barton S.O.L. (Feb, 2025). Investigating the usage and impacts of satellite data in New Zealand. A thesis submitted in fulfilment of the requirements for the degree of Master of Civil Engineering, The University of Auckland.p.62 https://researchspace.auckland.ac.nz/server/api/core/bitstreams/00f972de-15c5-40ad-aca7-638ecac032a4/content*

[15] MftE MBIE (April 16, 2025). Interim RIS NES-TF Regulations 2016 amendment. Pages 1-2 and 20-22.

- Established protections relating to environmentally significant places and areas.
- [47] Changes to radio frequency exposure standards are out of scope. Under NES-TF, telecommunications providers need to comply with the New Zealand radio frequency exposure standard NZS 2772.1:1999 by reference, which is administered and reviewed by the Ministry of Health and Health New Zealand (Te Whatu Ora). The protections for radio frequency exposures will be maintained with no changes. The Ministry of Health and Health New Zealand advised that the references to NZS 2772.1:1999 align with international best practice and remain fit for purpose.

The policy problem and objective has excluded any obligation to ensure the health and safety and hence protection of local communities. This has been enabled through fragmented and outdated policy and legislation which enables the Ministers for the Environment and for Media and Communication to prima facie absolve themselves from any risks that arise as a consequence of such a policy change.

The MftE and MBIE have not made a genuine effort to identify, understand, and estimate the various categories of cost and benefit associated with the options for change.

Reports and data are not held by the Ministry of Health, MBIE, or the MftE that publicly demonstrate that ongoing monitoring, evaluation and reporting is frequently undertaken, to signal that the agencies have the health of New Zealanders front and centre of this proposal. There is no route for reporting by hypersensitive groups, or groups and individuals that report shifts in health and wellness after a telecommunication facility is installed. Reporting of cases, and documenting them, produces a bank of policy-relevant information. Yet by failing to do this, authorities create a barrier to evidence. Global case studies are identifying changes in health status, and there should not be barriers to reporting this in New Zealand.[16] [17] [18]

There has been no systematic impact and risk analysis. No review of best-practice and the actions of countries that have more tightly regulated equipment, with awareness that the advancing science continues to fail to demonstrate absence of risk and increase knowledge of vulnerability, particularly in key developmental periods. The policy and subsequent proposals do not conform to any standard of safety and risk and are not evidence informed. Neither the RIS nor the Package 1, Part 2.5 NES-TF proposal does not conform to good regulatory practice, which is required by The Treasury.[19]

The supporting policy documents fail to review the safety of the status quo, against international best practice and compare this to the claimed safety of the proposed measures in the Consultation. The main argument appears to be to promote ‘efficiency’ because ‘the current rules in NES-TF are too restrictive and do not cover certain low impact telecommunication facilities’. Benefits are structured around reducing consenting costs, claiming that it would reduce downward pressure on prices for consumers, and reduced administrative costs for councils. The benefits are exclusively structure around efficient and timely deployment. No financial assessment was provided. The RIS stated:[20]

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[16] Nilsson M, Hardell L (2023) A 49-Year-Old Man Developed Severe Microwave Syndrome after Activation of 5G Base Station 20 Meters from his Apartment. *J Community Med Public Health* 7: 382. DOI: 10.29011/2577-2228.100382

[17] Hardell L, Nilsson M, Case Report: A 52-Year Healthy Woman Developed Severe Microwave Syndrome Shortly After Installation of a 5G Base Station Close to Her Apartment. Ann Clin Med Case Rep. 2023; V10(16): 1-10

[18] Nilsson M, Hardell L. Development of the Microwave Syndrome in Two Men Shortly after Installation of 5G on the Roof above their Office. Ann Clin Case Rep. 2023; 8: 2378

[19] The Treasury (April 2017). Government expectations for good regulatory practice. https://www.treasury.govt.nz/sites/default/files/2015-09/good-reg-practice.pdf

[20] MftE MBIE (April 16, 2025). Interim RIS NES-TF Regulations 2016 amendment. Page 7.

Based on the information held, officials consider that the benefits of the proposed changes to NES-TF outweigh the costs.

Responsibility to monitor and reassess the safety of the current allowable electromagnetic exposure limits appears to be drafted out of any white paper or regulatory legislation that has been produced, at minimum in the last decade. Safety was referred to in the RIS – but there was no discussion of the costs of monitoring to ensure that there was standards compliance, and the cumulative level of radiation emissions would not exceed limits.

The action of MBIE and MftE to deregulate reflects a global pattern, where governments act to centralise regulatory power and oversight over the deployment and location of telecommunications facilities, and constrain regulatory discretion. These streamlining clauses remove local government autonomy over these decisions.[21] [22]

However, globally, regions are contesting this increasing regulatory oversight, with increasing numbers of local resolutions being passed and with countries independently acting to lower radio radiofrequency exposure limits. These ordinances are feasible because of fibre optic broadband. [23] [24]

Ministry of Health science inadequate for the purpose of policy development:

Public trust in the safety of telecommunications NES-TF regulations based on Ministry of Health claims of the alleged safety of non-thermal exposures, cannot be sustained. The regulations are predicated on current standards (NES-TF Regs 2016, Subpart 7) being safe.

The standards are upheld by claims of the 'evidence' for safety, which arises from unauthored 'Reports to Ministers' that are expected to be scientifically authoritative but lack any comprehensive methodology that heavily references a non-government institution which itself fails to demonstrate scientific rigor.

Public trust cannot be expected to be sustained when the government

- Explicitly excludes discussion of major concerns about health risk.
- Does not transparently publish and update monitoring data.
- Does not evaluate such data against published data on risk (including in vitro, case control and cohort studies).
- Does not compare NZS 2772.1 with maximum-allowable standards elsewhere, particularly in Russia and Europe.

In short, NZS 2772.1:1999 is now 26 years out of date. This New Zealand Standard remains in force comprehensively relitigated -- and not by members of ICNIRP, which is closely associated with the telecommunications industry. In the current consultation public concerns as to the safety of the measures would be dismissed as outside the scope of the current proposal.

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[21] Meese J, Hegarty K, Wilken R, Yang F, Middleton C. (2024). 5G and urban amenity: regulatory trends and local government responses around small cell deployment. *Digital Policy, Regulation and Governance*. 26:6 DOI 10.1108/DPRG-10-2023-0150

[22] Environmental Health Trust. Ordinances to limit and control wireless facilities, small cells, and rights of ways. Accessed July 18, 2025.https://ehtrust.org/usa-city-ordinances-to-limit-and-control-wireless-facilities-small-cells-in-rights-of-ways/

[23] See E.g. Hawaii. Bill 24. Ordinance amending chapter 25 of the Hawaii County Code 1983. https://records.hawaiicounty.gov/weblink/DocView.aspx?dbid=0&id=1108131&cr=1

[24] Hawaiian Telcom. (Jan 10, 2025). Hawai'i to Become the First Fully Fiber-Enabled State by 2026. https://blog.hawaiiantel.com/connections/hawaii-to-become-the-first-fully-fiber-enabled-state-by-2026

The New Zealand Ministry of Health has tended to downplay and dismiss cancer risk, while European reviews tend to take risks more seriously. A 2021 European review recognised the seriousness of the cancer risk, finding that radiofrequency radiation is harmful for health[25], while a Committee reviewing 5G deployment stated that:[26]

> *The 5G radio emission fields are quite different to those of previous generations because of their complex beamformed transmissions in both directions – from base station to handset and for the return. Although fields are highly focused by beams, they vary rapidly with time and movement and so are unpredictable, as the signal levels and patterns interact as a closed loop system. This has yet to be mapped reliably for real situations, outside the laboratory.*

In the conclusion, PSGR lists standards in European countries that more closely reflect these risks.

5G carrier waves create added complexity and health risks that increase risk-based uncertainties:

- Use a much broader part of the microwave spectrum including waves with wavelengths in the millimetre range (hence called 'millimetre waves').
- Extremely complex modulation patterns involving numerous frequencies form novel exposures.
- Beam formation[27] characteristics can produce hotspots of high unknown intensities.
- Increased numbers of antenna arrays and small cell antennas (which are erected at 200-500m distances along streets) increase exposures.[28]

[A] OVERARCHING ACT AND REGULATORY PLATFORM.

The New Zealand public is profoundly under-served by the current governance framework for telecommunications equipment and devices. Regulatory powers are bifurcated, siloed and confusing. MftE appears as the public 'face' of NES-TF regulations, however MBIE have administrative powers and control while the Ministry of Health (MoH) effectively controls levels through the recommendation of standards.

No National Policy Statement[29] which would provide guidance on the stewardship of the health and safety of New Zealand people and the environment can be identified.

The 2016 regulations are made under the Resource Management Act 1991 (the RMA) and replace the Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2008. While the Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2008 were previously administered by the MftE, the Order

[25] Belpoggi F. Health impact of 5G, study for the panel for the future of science and technology, panel for the future of science and technology. In: European parliamentary research service, scientific foresight unit. Brussels; 2021. Available from: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690012/EPRS_STU(2021)690012_EN.pdf.
[26] Blackman C, Forge S. (2019) 5G deployment: state of play in Europe, USA and Asia, study for the committee on industry, research and energy, policy. Luxembourg: Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament. P.11 https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf
[27] Albanese, R., Blaschak, J., Medina, R. and Penn, J. Ultrashort electromagnetic signals: Biophysical questions, safety issues and medical opportunities (Report No. AL/OE-JA-1993-0055).Occupational and Environmental Health Directorate, Brooks Air Force Base, San Antonio, Texas, USA. (1994).
[28] Bandara P, Chandler T, Kelly R et al (2020). 5G Wireless Deployment and Health Risks: Time for a medical discussion in Australia and New Zealand. *ACNEM Journal* Vol 39 No 1 – July 2020
[29] E.g. See 2010 National Policy Statement on Electricity Transmission. https://environment.govt.nz/assets/Publications/Files/nps-electricity-transmission-mar08.pdf

in Council NES-TF Regs 2016 transferred powers of administration to the Ministry of Business, Innovation, and Employment (MBIE).

Prior to MBIE securing the oversight powers, in August 2015, the MftE and MBIE had produced a regulatory impact statement (RIS) on 20 August 2015 to help inform the decisions taken by the Government relating to the contents of the new 2016 regulations.[30] This RIS has been culled from government records. However, it did not discuss risk and safety to human health either.

While the consultation asks that the public respond to the MftE, it is MBIE and the Ministry of Health (MoH) who have the greatest oversight and control over current standards and human health.

MBIE's Minister for Media and Communications sets the policy direction for the communications regulatory system and related infrastructure investments. Funding for MBIE's components of this portfolio is provided from the Vote Business, Science and Innovation appropriations. As such, there is capacity to provide for monitoring and scientific research to ensure that wireless communications networks are safely stewarded to protect human and environmental health.

However, as the 2024 Briefing[31] to the incoming minister demonstrates, MBIE's concern revolves around the regulatory framework for the supply of telecommunications services, rather than the safety of them. The Ministers' powers include oversight of the regulatory framework for allocating spectrum and licensing radio technology equipment.

In contrast, the MftE Briefing for Incoming Ministers[32] does not mention any responsibility for telecommunications or telecommunications infrastructure, wireless communications or radiation.

The Ministry of Health has an outsized role.

Legal status is established for the standards in *Subpart 7 – Radiofrequency fields*. Section 55(6)[33]:

- AS/NZS 2772.2 means AS/NZS 2772.2:2016 Radiofrequency fields – Part 2: Principles and methods of measurement and computation – 3 kHz to 300 GHz
- NZS 2772.1 means NZS 2772.1:1999 Radiofrequency fields – Maximum exposure levels – 3 kHz to 300 GHz.

The standards in section 55(6) were developed under Ministry of Health recommendations which became legally binding once incorporated into the RMA regulations. The current standards were drafted for 2G in 1991.

The regulatory framework delegates assessments of risk and safety—including those underlying the proposed 2025 deregulatory measures—to the Ministry of Health. The scientific basis for the safety of the guidelines in section 55(6) rests on the conclusions of an anonymous and unattributed technical advisory body: the Interagency Committee on the Health Effects of Non-ionising Fields (the

[30] Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016. https://www.legislation.govt.nz/regulation/public/2016/0281/30.0/whole.html#DLM6985849
[31] MBIE (April 26, 2024). Briefing for the incoming Minister for Media and Communications. https://www.mbie.govt.nz/dmsdocument/28491-briefing-to-the-incoming-minister-for-media-and-communications
[32] MftE (November 2023). Briefing for Incoming Ministers – Environment, Climate Change and RMA Reform. https://environment.govt.nz/assets/publications/MfE-Briefing-for-the-Incoming-Ministers-2023.pdf
[33] Resource Management (NES-TF) Regulations 2016. Section 55(6). https://www.legislation.govt.nz/regulation/public/2016/0281/30.0/whole.html#DLM6985849

Committee).[34] Historically, MftE and MoH had published National Guidelines on Managing the Health Effects of Radiofrequency Transmissions (2000). [35]

> *'A key function of the Committee is to review recent research findings, especially recent research reviews published by national and international health and scientific bodies, to determine whether it should recommend any changes to current policies.'* [36]

As such, the Ministry of Health is 'ground zero' for administering and reviewing New Zealand radio frequency exposure standards which then enable MBIE, who control the regulations, to deregulate and weaken standards, due to a claimed safety.

As PSGR reference above, any criticism about the safety of current guideline levels has been explicitly drafted out of scope[37] and the policy document advise that Ministry of Health and Health New Zealand advise that:

> *NZS 2772.1:1999 align with international best practice and remain fit for purpose.*

The Reports that are released by the MoH Committee are portrayed as scientifically rigorous. However, there are no established or impartial mechanisms for assessing evidence that challenges its conclusions. The governance framework does not permit any feedback or independent and expert peer review of the Committee reports, which reinforce and uphold the 25-year-old Section 55(6) regulations.

Reports are simply published and accepted. Scientific process is not part of identifying whether EMF-RF exposures are harmful to the public and upholding standards. The composition and expertise of this Committee are neither declared nor publicly verifiable, despite its purported role in monitoring and reviewing research on the health effects of electromagnetic fields.

The focus is not on health but efficiency. The Ministry for the Environment (MftE) advise that:

> *The standards provide national consistency in the rules surrounding the deployment of telecommunications infrastructure across New Zealand. This is while ensuring the effects on the environment are minimised and managed appropriately.* [38]

The RMA 1991 provides officials with the powers to produce regulations, as Orders in Council and the NES-TF guidelines were created under the powers of the RMA 1991. All actions, laws and guidelines arising under the RMA 1991 are subject to the provisions of that overriding Act and must achieve the purposes of that Act.

As such, officials charged with developing and updating National Environmental Standards for Telecommunication Facilities must be sustainably managed in such a way that:

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[34] NB. Electromagnetic radiation of lower frequencies and longer wavelengths is referred to as non-ionising radiation.
[35] New Zealand Report on EMF Activities. 9th International Advisory Committee Meeting on EMF June 2004. https://cdn.who.int/media/docs/default-source/radiation/emf-international-project-country-reports/wpro-region/newzealand0304.pdf
[36] Ministry of Health. 2018. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2018. Wellington: Ministry of Health. Page 4. https://www.health.govt.nz/system/files/2018-11/interagency-committee-health-effects-non-ionising-fields-report-ministers-2018.pdf
[37] MftE MBIE (April 16, 2025). Interim RIS NES-TF Regulations 2016 amendment.Page 20-22.
[38] https://environment.govt.nz/acts-and-regulations/regulations/national-environmental-standards-for-telecommunication-facilities/

Enables people and communities to provide … for their health and safety.[39]

Similarly, all persons exercising functions and powers under the RMA 1991 must have particular regard to kaitiakitanga and the ethic of stewardship, among other factors.

The incoming MBIE Media and Communications Minister is not advised of an obligation to steward the safety of wireless communications devices and networks.

The Minister for Media and Communications is advised that they: '*set policy direction for the communications regulatory system and related infrastructure investments*.' Ministers are not advised of a responsibility to protect the health and safety of people.[40]

Industry bodies seem to have an outsize role in drafting regulatory content. A Users Guide (2018), which appears to be the sole document *'to assist with the interpretation and implementation of the regulations*'. The users guide is not concerned with risk and safety concerns from electromagnetic radiation nor with providing pathways to update information should evidence of risk be identified.[41]

Production of the users' guide contracted to a consultancy, 4Sight Consulting. A 'Technical Advisory Group (TAG)' provided advice and technical input in the production of users' guide. Members of the TAG were from the following organisations: Local Government New Zealand, Wellington City Council, New Zealand Telecommunications Forum, Tasman District Council, Porirua City Council, Chorus Ltd, Northpower Fibre Ltd, Enable Network Services Ltd, Spark New Zealand Ltd, 2Degrees Mobile Ltd, Vodafone New Zealand Ltd, Te Runanganui o Ngati Porou, Crown Fibre Holdings, Nga Pu Waea and Auckland City Council.

A review of public information held on the MftE and MBIE websites, including information supporting the current proposed change in the regulations, strongly suggests that neither the MftE nor MBIE are concerned protecting the health and safety of people, under the NES-TF 2016 regulations (including current proposed changes). Accessible literature on the MftE website (search:NES-TF, 19 results) identified the following documents:

2015. Report of the Outcome Evaluation of the National Environmental Standards for Telecommunication Facilities. Wellington: Ministry for the Environment.

2015. Proposed Amendments to the National Environmental Standards for Telecommunication Facilities: Preliminary evaluation under section 32 of the Resource Management Act 1991. Wellington: Ministry for the Environment.

2015. Proposed Amendments to the National Environmental Standards for Telecommunication Facilities. Discussion Document. Ministry for the Environment.

2018. Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016: Users' guide Ministry for the Environment. ISBN: 978-1-98-852580-8. Publication number: ME 1379
2021 (April 8). Web page: National Environmental Standards for Telecommunication Facilities

[39] Resource Management Act 1991. Section 5 Purpose.
[40] MBIE (April 26, 2024). Briefing for the incoming Minister for Media and Communications. https://www.mbie.govt.nz/dmsdocument/28491-briefing-to-the-incoming-minister-for-media-and-communications
[41] Ministry for the Environment (2018). Users Guide. Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016. https://environment.govt.nz/assets/Publications/Files/NES-TF-2016-Users-Guide-FINAL-pdf.pdf

A search on the MftE for (NZS 2772.1:1999, all topics, publication) was unable to identify a policy or regulatory document discussing this key regulation.

Accessible literature on the MftE website (search:NES-TF, 4 results) includes the following:

> Fast broadband policy and regulation
>
> 2010. Public Version. Regulatory Impact Statement. Ultra-fast broadband Initiative.
>
> *The objective: To accelerate the roll-out of ultra-fast broadband to 75 percent of New Zealanders over ten years, concentrating in the first six years on priority broadband users such as businesses, schools and health services, plus greenfield developments and certain tranches of residential areas. The problem definition for this RIS did not include safe management to protect health and wellbeing.*
>
> *2016. Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016: Users' guide Ministry for the Environment.*
>
> *April 2023: 2122-2885 Meeting with the New Zealand Telecommunications Forum*
>
> *May 2022: 2122-1751 Feedback and proposals regarding the National Environmental Standards for Telecommunications Facilities (NES-TF)*

Content on the MftE and MBIE websites, provide further evidence that stewardship and health are not part of any policy document, any risk assessment or guideline relating to EMF-RF exposures. Without a substantial change in culture and practice, future policies will continue to downplay health, Ministers will not be briefed on health, and officials will advance economic, efficiency and industry-based rationales for guideline amendments.

[B] RF-EMF – PUBLIC INFORMATION ON NEW ZEALAND'S EXPOSURE LIMITS

As noted above, the key function of the Interagency Committee on the Health Effects of Non-ionising Fields[42] is to see whether the evidence on risk and harm from non-ionising fields warrants a change in policy, i.e. the exposure standards: NZS 2772.1:1999. These standards are enshrined in section 55 of the 2016 regulations that MBIE is seeking to lower restrictions on, via the current July 2025 MftE consultation (where concerns about safety are out of scope).

The safety of the public is theoretically ensured, through the findings in past Committee Reports to Ministers.

Published in 1991, the standards in the NZS 2772.1:1999 Radiofrequency fields – Maximum exposure levels are paywalled ($147.60[43]). A search on the MBIE site (search: NZS 2772.1:1999) did not locate any documents. A search on the MftE site (search: NZS 2772.1:1999, all topics, publication) returned 136 results.

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[42] Non-ionising fields are low-energy electromagnetic waves that do not remove electrons from atoms. Ionisation typically begins at photon energies above 10–12 electron volts (eV). Non-ionising radiation from microwaves and radiowaves commences at ~10^{-5} to 10^{-3} eV

[43] Standards New Zealand. Radiofrequency fields - Maximum exposure levels - 3 kHz to 300 GHz. NZS 2772.1:1999. https://www.standards.govt.nz/shop/nzs-2772-11999

The Ministry of Health states[44]:

> *The limits are based on a careful review of the research into the health effects of exposure to radiofrequency radiation, and include wide margins for safety.*
>
> ***Limits under NZS 2772.1:1999***
>
> *NZS 2772.1:1999 sets basic restrictions on the amount of radiofrequency power absorbed in the body. This is measured as the specific absorption rate (SAR) – the rate at which radiofrequency radiation is absorbed in the body, measured in watts per kilogram (W/kg).*
>
> *Under NZS 2772.1:1999, for exposures of the public the SAR averaged over the whole body must be less than 0.08 W/kg. When using a transmitter close to the body (for example, a cellphone), localised increases up to 2 W/kg over any 10 g of body tissue are allowed.*
>
> *The limits for the general public are stricter than for occupational exposures. Public exposures are set at levels more than 50 times lower than the recognised threshold for established effects.*
>
> *For some transmitters (for example, AM radio transmitters), there is a second basic restriction on the current density induced in the body.*
>
> *As the SAR is difficult to measure, NZS 2772.1:1999 also prescribes reference levels in terms of the more easily measured electric and magnetic field strengths, and power flux density.*
>
> *Compliance with the reference levels ensures compliance with the basic restrictions, and in most situations, they can be effectively regarded as 'exposure limits' (although this term is not used as such in the Standard).*
>
> ***Basis for NZS 2772.1:1999***
>
> *NZS 2772.1:1999 was adopted in April 1999. The limits in the Standard are based on guidelines published in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).*
>
> *ICNIRP is an international scientific body which has been recognised by the World Health Organization for its independence and expertise in this area. Their guidelines have formed the basis for many other international and national exposure standards. They are based on consideration of all relevant health research data, from both long and short term exposures, and without presupposing any particular type of effect.*
>
> *Following reviews of more recent research, ICNIRP reaffirmed the validity of their exposure guidelines in 2009, and again in 2017. Reviews of the research by other health bodies around the world (see, for example, the reports listed near the bottom of Research into non-ionising radiation) support ICNIRP's conclusions.*

[44] Health New Zealand (March 2025). Radiofrequency field exposure standard. https://www.tewhatuora.govt.nz/health-services-and-programmes/environmental-health/non-ionising-radiation/radiofrequency-field-exposure-standard

> *ICNIRP published revised guidelines in March 2020. The underlying basis of the new guidelines is the same as in 1998, but there are refinements in the limits at frequencies above 6 GHz, and a few other small changes that help in the practical application of the limits. The guidelines and accompanying explanatory material, are available on the ICNIRP website(external link). The ICNIRP 2020 Guidelines have been incorporated into the Australian Radiation Protection and Nuclear Safety Agency Standard for Limiting Exposure to Radiofrequency Fields – 100 kHz to 300 GHz(external link) (RPS S-1).*
>
> *ICNIRP considers that the 1998 guidelines are still protective for current commercial applications of radiofrequency fields, but recommended that countries adopt the new guidelines in order to ensure protection for potential new applications. The Ministry has reviewed the ICNIRP 2020 Guidelines, and RPS S-1, and advises that compliance with either would provide protection at least equivalent to that offered by NZS 2772.1:1999.*

[C] THE MINISTRY OF HEALTH DEFERS TO SCIENTIFICALLY DUBIOUS AUTHORITY

The MoH Committee Reports to Ministers provide the justification for whether the exposure standard is appropriate to protect the health and safety of people and communities, as referenced in the RMA 1991 and the Health Act 1956. However, MoH reports are consistently published after ICNIRP releases and reflect the ICNIRP position.[45][46] The MoH does not appear to act independently of ICNIRP, even if the scientific literature contradicts ICNIRP-claimed safe exposure levels and the claimed benign status of non-thermal effects.

It's difficult to appreciate the considerable increase in radiofrequency radiation which has been prompted by non-native, man-made densification. Vertebrates, including humans, evolved in environments where RF-EMF levels were orders of magnitude lower than the MoH's claimed safe level which excludes the potential for physiological and neurological effects that are non-thermal, i.e. not directly related to heating. Current considered safe levels of EMF-RF exposure were previously unknown to biological life:

> *'levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 10^{18} times.'*[47]

In a 2023 meeting of the TC95: International Committee on Electromagnetic Safety (ICES), [48] an attendee noted at the end of the meeting:

> ***Conclusion:** the current ICNIRP/FCC limits are nonsensical once one takes off the blinders of "thermal effects only" on current IEEE so-called scientific inquiry.*

The Ministry of Health has the powers to promote and monitor public health through guidelines and advice. This appears to be the legal base for issuing the recommendations, such as the adoption of exposure standards such as NZS 2772.1:1999.[49] The 2018 Users Guide states that:

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[45] Ministry of Health. 2018. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2018.
[46] Ministry of Health. 2022. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022.
[47] Bandara, P, Carpenter DO (2018). Planetary electromagnetic pollution: it is time to assess its impact. Comment. *The Lancet. The Lancet Planetary Health,* Volume 2, Issue 12, e512 - e514
[48] TC95: International Committee on Electromagnetic Safety (ICES) Invitation for IEEE TC95/ICES Meetings: Jan 17-19, 2023. https://wireamerica.org/ieee/tc95/
[49] Health Act 1956, section 3(a)

> *NZS 2772: Part 1: 1999 incorporates advice on health effects and appropriate exposure levels from exposure guidelines published in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP 1998 guidelines).*[50]

The Ministry of Health does not accept that harm from prolonged exposure to microwave radiation (as RF-EMFs) can occur at non-thermal levels and that the harm may occur at levels much lower than the current levels, which are exclusively based on risk from thermal (heating) effects.

Other organisations take into account non-thermal effects including the European Academy of Environmental Medicine, the Bioinitiative group, and the Russian Commission for Protection from Non-Ionizing Radiation.[51]

MoH Committee Reports to Ministers persistently cite and imitate the information and findings held by the International Commission on Non Ionizing Radiation Protection' (ICNIRP).[52] [53]

ICNIRP do not adopt a robust, scientifically rigorous approach that transparently declares methods of data collection and evaluation. ICNIRP establishes guidelines for radiation limits, and is a private organisation that does not have an open process for election. ICNIRP scientists can produce science which excludes data which would contradict their research and then reference their own papers in the ICNIRP reports.

Scientists are drawing attention to the problem of stacking experts across committees who are current or former members of ICNIRP, and the absence of experts who agree with the consensus position.[54] [55] [56] Seventeen self-referencing authors appear to have prominent roles across ICNIRP and the organisations that are affiliated with it. Instead of independently reviewing the science, these authors and organisations are tightly networked with substantial overlap.[57]

The Interagency Committee on the Health Effects of Non-ionising Fields Reports directly reflect the position of ICNIRP. MoH reports over the years by the Committee, consistently reflect the timing of ICNIRP releases, downplay similar issues (such as mechanistic evidence), and omit studies which show non-thermal harm. It appears remarkably like the MoH delegates scientific curiosity and regulatory authority to ICNIRP.

Monitoring studies remain undone, and the MoH does not consider risk from chronic exposures. The increasing concentration (or density) of radiofrequency electromagnetic field radiation (RF-EMF) that

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[50] 2016. Resource Management (National Environmental Standards for Telecommunication Facilities) Regulations 2016: Users' guide Ministry for the Environment. Page 71.

[51] Hardell Land Carlberg M. (2021) Lost opportunities for cancer prevention: historical evidence on early warnings with emphasis on radiofrequency radiation. *Reviews on Environmental Health*, 36(4):585-597. DOI:10.1515/reveh-2020-0168

[52] Ministry of Health. 2018. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2018.

[53] Ministry of Health. 2022. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022. Wellington: Ministry of Health. https://www.health.govt.nz/system/files/2022-06/interagency-committee-health-effects-non-ionising-fields-report-ministers-2022-jun22.pdf

[54] Buchner K, Rivasi M. The International Commission on Non-Ionizing Radiation Protection: Conflicts of interest, corporate capture and the push for 5G. Available online: https://www.michele-rivasi.eu/wp-content/uploads/2020/06/ICNIRP-report-FINAL-JUNE-2020_EN.pdf (2021).

[55] Hardell L. World Health Organisation, radiofrequency radiation and health – a hard nut to crack (Review). Int J Oncol. 2017; 51(2): 405-13.

[56] GSMA (2021) International EMF Exposure Guidelines Explaining the 2020 RF-EMF exposure guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) October 2021 https://www.gsma.com/solutions-and-impact/connectivity-for-good/public-policy/wp-content/uploads/2021/10/GSMA_International_EMF_Exposure_Guideline_Oct21.pdf

[57] Nordhagen EK, Flydal E. Self-referencing authorships behind the ICNIRP 2020 radiation protection guidelines. Rev on Environ Health. (2022). doi: 10.1515/reveh-2022-0037

occurs through cell towers, small cell towers, cell phones, and wireless technologies results in chronic lifetime exposures from conception, until death. Therefore, simple dose response studies will not elucidate the complexity of risks that arise in a pregnant mother, a baby, infant, child, adolescent – all the way through to risk in aged care from persistent RF-EMF radiation.

As an example, a French study demonstrated that radiation from a mobile phone base-station was the dominant source of exposure in 64% of houses in urban areas that resided within 250 m of a mobile-phone base stations.[58] The relationship between personal devices and telecommunications antennas and towers is the main source of radiation. [59]

The Ministry of Health does not do research to triangulate data on the lifetime risk relating to the health effects of these telecommunications facilities, which would include evaluating the emissions capacity against the scientific literature, the mechanistic data, case studies and cohort studies. This work would include a review of evidence of risk to vulnerable populations from lifetime exposures, commencing in infancy. The work remains undone.

The MoH anonymous Reports do not follow a sequential, methods-based process, similar to toxicological approaches that consider developmental vulnerability.

Following a 2015 Report to Ministers[60], in 2018 the Ministry of Health released an anonymous Committee Report to Ministers that was 'not intended to be an exhaustive review' but rather would highlight key findings from '*comprehensive reviews undertaken in recent years by national and international health and scientific bodies'*.[61]

MoH's November report was evidentially rushed out to follow ICNIRP's August 2018 note on recent animal carcinogenicity studies.[62] ICNIRPs note was clearly drafted to diffuse the political fallout from the findings which were published in papers by the U.S. National Toxicology Program (NTP)[63] [64] [65] [66] and the other by the Ramazzini Institute (Falcioni et al 2018[67]) on the associations of mobile phones with cancer.

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[58] De Giudici P, Genier JC, Martin S, Dor□e JF, Ducimeti□ere P, Evrard AS,Letertre T, S□egala C. 2021. Radiofrequency exposure of people living near mobile-phone base stations in France. Environ Res. 194: 110500.
[59] Hinrikus H, Koppel T, Lass J, Roosipuu P & Bachmann M. (2023). Limiting exposure to radiofrequency radiation: the principles and possible criteria for health protection, International Journal of Radiation Biology, DOI: 10.1080/09553002.2023.2159567
[60] Ministry of Health. 2015. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2015. Wellington: Ministry of Health. https://www.health.govt.nz/system/files/2015-05/interagency-committee-on-health-effects-on-non-ionising-fields-may15.pdf
[61] Ministry of Health. 2018. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2018.
[62] ICNIRP (Sept 4, 2018) ICNIRP note on recent animal carcinogenesis studies. https://www.icnirp.org/cms/upload/publications/ICNIRPnote2018.pdf
[63] NTP (2018a) Technical report on the toxicology and carcinogenesis studies in Hsd:Sprague Dawley SD rats exposed to whole-body radio frequency radiation at a frequency (900 MHz) and modulations (GSM and CDMA) used by cell phones. National Toxicology Program; NTP TR 595.
[64] NTP (2018b) Technical report on the toxicology and carcinogenesis studies in B6C3F1/N mice exposed to whole-body radio frequency radiation at a frequency (1900 MHz) and modulations (GSM and CDMA) used by cell phones. National Toxicology Program; NTP TR 596.
[65] NTP (2018c). Actions from Peer Review of the Draft NTP Technical Reports on Cell Phone Radiofrequency Radiation, March 26-28, 2018.
[66] NTP (2018d). Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposures) Updated draft 2-1-2018 of report issued 2016. National Toxicology Program.
[67] Falcioni L, Bua L, Tibaldi E, et al. 2018. Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environmental Research 165: 496–503.

The NTP demonstrated that exposure of rats to simulated 2G or 3G MT emissions (2 years, 9 h per day) induced brain cancer (glioma) and heart cancer (malignant schwannoma). Effects were found at both lower and higher radiation levels than the officially accepted limits. The researchers noted significantly increased DNA damage (strand breaks) in the brains of exposed animals. DNA damage is a recognised precursor for cancer. Falcioni's life-span exposure study of rats to a simulated 2G MT EMF also found induction of heart schwannomas and brain glial tumors.[68] Falcioni separately corroborates the results of the NTP study, strengthening the implications of the findings.

The MoH report concluded that the '*Committee considers that the fundamental basis for exposure limits currently recommended in New Zealand is still valid.'*

This was followed by a MoH addendum.[69] This addendum made a series of key points relating to the beam-forming action of 5G antennas. The paper noted that while 5G sites would operate at frequencies around 3.5GHz, the Ministry of Health expected that higher frequencies around 26GHz would be used in future. The document noted that this was '*within the range covered by the New Zealand exposure standard*.'

The MoH addendum did not include a search in the scientific literature to further inform readers on the issues outlined, the authors of the addendum were not disclosed.

- 5G is just a new application of radio technology, and so existing research on the health effects of radiofrequency (RF) fields is equally information about the possible effects of 5G.
- The current New Zealand exposure Standard NZS 2772.1:1999 already covers 5G.
- Regulations under the Resource Management Act about exposures to RF fields from tower and antennae sites apply to 5G sites.
- There is no good reason to believe that exposures from 5G that comply with current limits will cause adverse health effects.

The Addendum stated:

> *None of the characteristics of 5G radio systems is particularly distinctive. As mentioned previously, the signal modulation (the way information is encoded onto the radio signal) resembles that used by 4G. Research has not suggested that health effects relate to modulation.1 For these reasons the research already undertaken on health effects of exposures to RF fields is as applicable to 5G as to other radio signals.*
>
> *There is a common misconception that higher frequency signals are more harmful. In fact, the most important parameter is the intensity of the radio wave. Frequency only affects where the energy in the radio signal is absorbed: at 26 GHz the energy is almost entirely absorbed in the skin (some of the energy is also reflected by the skin), whereas at 3.5 GHz the energy is absorbed at depths up to about 20 mm.*

The Ministry of Health noted that the NZS 2772.1:1999 covers frequencies up to 300 GHz, which is well above than the highest frequencies envisaged for 5G. The Addendum noted:

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[68] Falcioni L, Bua L, Tibaldi E, et al. 2018. Report of final results regarding brain and heart tumors in Sprague-Dawley rats

[69] Ministry of Health. 2019. 5G Radiofrequency Fields and Health. Addendum. Wellington: Ministry of Health. https://www.health.govt.nz/system/files/2018-11/5g-radiofrequency-fields-and-health-oct19.pdf

> *New Zealand standard follows limits recommended by the International Commission on Non-Ionising Radiation Protection (ICNIRP), an international scientific body recognised by the WHO for its independence and expertise in this area*

The MoH did not conduct an in-depth review of findings of the NTP and Ramazzini papers that had earlier prompted the hasty ICNIRP 2018 paper.[70] [71] [72]

Transparent reviews of scientific papers are critical to shed light on risk.

For example, in 2018 UK researchers not aligned with ICNIRP published a paper reporting a sustained and highly statistically significant increase in the incidence of glioblastoma multiforme (GBM) tumours in the UK between the years 1995-2015. While most cases were in the over 54 age group, the increased rise was consistent across all age groups studied. The authors suggested that: 'suggest that widespread environmental or lifestyle factors may be responsible.'[73]

Soon after, an Australian paper by ICNIRP members Rodney Croft and Ken Karipidis, declared that there was no association with mobile phones and brain tumour risk in Australia. The 'ecological' paper excluded people over 60, the primary risk group for tumours, that the UK researchers had identified. The UK paper was cited. Exclusion of the critical 59+ age group would support the study authors to confirm that brain tumours have not increased in the past two decades. The study authors considered predicted incidence rates and estimated phone use rather than directly sourcing data from individuals diagnosed with tumours. The paper does not disclose Croft and Karipidis' ICNIRP role. [74] Karipidis is currently leading an ICNIRP project group tasked to revise the revision of the low frequency guidelines (from 10MHz and below). The low frequency guidelines will combine, and be:

> *relative to that of ICNIRP 2009 (static magnetic fields), ICNIRP 2010 (low frequency fields) and ICNIRP 2014 (induced electric fields). Where appropriate, the underlying logic of the 2020 RF guidelines will be used.*[75]

The U.S. NTP programmes are globally respected and follow robust scientific processes of research and data analysis, which result in in-depth, trustworthy findings on human health and risk. NTP programmes on an issue of importance can continue over decades. Despite finding risk, which would lead to more research, the NTP programme on radiofrequency radiation was disestablished in 2024.[76] Often when harm is identified, more research is funded, to further identify how harm arises, and an important role of the NTP is to consider threshold effects. However, when U.S. non-governmental

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[70] Hardell L, Nilsson M, Koppel T, Carlberg M (2021). Aspects on the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020 Guidelines on Radiofrequency Radiation. *Cancer Sci Clin Ther* 2021; 5 (2): 250-285. DOI: 10.26502/jcsct.5079117

[71] Hardell L, Carlberg M. Lost opportunities for cancer prevention: historical evidence on early warnings with emphasis on radiofrequency radiation. Rev Environ Health (2021). https://doi.org/10.1515/reveh-2020-0168.

[72] Falcioni L, Bua L, Tibaldi E, et al. 2018. Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environmental Research 165: 496–503.

[73] Phillips A, Henshaw DL, Lamburn G, O'Carroll MJ. (2018) Brain Tumours: Rise in Glioblastoma Multiforme Incidence in England 1995–2015 Suggests an Adverse Environmental or Lifestyle Factor. *Journal of Environmental and Public Health* Volume 2018, Article ID 7910754, 10 pageshttps://doi.org/10.1155/2018/7910754

[74] Karipidis K, Elwood M, Benke G, Benke G, Sanagou M, Tjong L, Croft RJ (2018). Mobile phone use and incidence of brain tumour histological types, grading or anatomical location: a population-based ecological study BMJ Open 2018;8:e024489. doi: 10.1136/bmjopen-2018-024489

[75] Annual Report 2023. ICNIRP Activities. https://www.icnirp.org/cms/upload/doc/Annual_Report_2023.pdf

[76] Cell Phone Radio Frequency Radiation. https://ntp.niehs.nih.gov/research/topics/cellphones

organization Children's Health Defense made a request for official information, they were provided with a heavily redacted document.[77]

Ministry of Health approaches imitate the ICNIRP and favours the safety of the status quo without addressing increased strength, density and sources of exposure, which of course, are all under ICNIRP levels. The approach of the Ministry of Health is based on a claim of low certainty of evidence that drafts out risk for vulnerable populations.

The Ministry of Health fails to adequately recognise credible signals of risk or to weigh the breadth of evidence concerning the uncertainty that harm may occur. The Committee makes no effort to address intersecting issues—for example, to concurrently assess individual risk among vulnerable populations such as pregnant women, infants, children, or individuals with electromagnetic hypersensitivity. Nor does it undertake a transparent and methodologically robust review of the literature spanning in vitro studies, mammalian toxicology, case reports, and cohort data. Likewise, there is no accessible or transparent mechanism for members of the public to report adverse health effects from a device, nor any public database in which such reports are collected, assessed, or published.

In 2020 a report was prepared for the Ministry of Health discussing the results of measurements to RF-EMFs in seven sectors at five different sites in Queenstown and Auckland. Data in the report was expressed as percentages as public limits, and so were not disclosed.[78]

The Ministry of Health can provide funding for studies. A recent partially funded MoH study[79] arrived at a conclusion of *low certainty of evidence*. Tentative conclusions do not rule out risk. There will consistently be uncertainty with RF-EMF exposures. This is why it is important to, for example, identify mechanisms at the cellular level, incorporate biomarker studies from animal trials and triangulate the data to form a greater appreciation of the degree of risk.

The Ministry of Health has historically been involved in radiation protection legislation.[80]

In 2016 the Radiation Safety Act 2016 was passed. The Ministry of Health then established a regulatory body called the Office of Radiation Safety. The Act, administered by the Ministry of Health, appears to be the only 'radiation' related legislation that includes a specific purpose to protect the health and safety of people, however the application of the Act is limited to ionising radiation from radioactive material and does not extend to ionising or non-ionising radiation from electromagnetic fields.

The purposes of this Act are to—

> *(a) establish a framework to protect the health and safety of people and protect the environment from the harmful effects of ionising radiation while allowing for the safe and beneficial use of ionising radiation; and*
>
> *(b) enable New Zealand to meet its international obligations relating to radiation protection, radiation safety and security, and nuclear non-proliferation. (Ed. under various nuclear conventions).*

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[77] Children's Health Defense, U.S. https://childrenshealthdefense.org/wp-content/uploads/Redacted-records-from-NIH.pdf
[78] Gledhill M. (April 30, 2020). Exposures to radiofrequency fields near 5G cellsites. EMF Services. Report 2020/40.
[79] Karipidis K, Baaken D, Loney T *et al (2025).* The effect of exposure to radiofrequency fields on cancer risk in the general and working population: A systematic review of human observational studies– Part II: Less researched outcomes. *Environment International* 196 (2025) 109274. https://doi.org/10.1016/j.envint.2025.109274
[80] Ministry of Health (Nov 2002). A Review of the New Zealand Radiation Protection Legislation: A discussion document. ISBN 0-478-25578-0. https://www.health.govt.nz/system/files/2019-02/radiation-regulation-review-2002.pdf?

Therefore, the public cannot conflate the associated Office of Radiation Safety[81] and the Radiation Safety Advisory Council (RSAC)[82] with stewardship of RF-EMF stewardship.

There are no equivalent institutions or bodies charged with oversight of monitoring, evaluation and research of the safety of electromagnetic fields to protect the health and safety of people

[D] UNSUITABLE FOR POLICY PURPOSES? MOH'S UNSCIENTIFIC PAPER

The June 2022 Report to Ministers[83] was timed to follow the ICNIRP's recently updated guidelines and harmonise with ICNIRPs scientific position.[84]

ICNIRPS guidelines predominantly drew from other collegial institutions. For their 2020 update, this included the WHO 2014 environmental health criteria public consultation report, SCENIHR 2015 and the Scientific Council on electromagnetic Fields at the Swedish Radiation Safety Authority (SSM) 2015, 2016, 2018. The papers that the ICNIRP relied on include studies where data has not been published in the peer reviewed literature, and the process of peer review (aside from internal review by colleagues) has not been permitted.

The MoH 2022 unauthored report contains several outdated or questionable assertions: [85]

- 'RF exposures that comply with NZS 2772.1 … provide no clear or persuasive evidence of health effects'. This harmonises with the ICNIRP position. This ignores mounting evidence of non-thermal effects which include oxidative stress[86], DNA damage and neurological damage.[87]
- Effects have been detected at exposure levels below the Ministry of Health's current limits and risk can increase from cumulative exposures over time.[88] [89]
- Cumulative, long-term effects continue to be downplayed by officials. This includes cumulative exposures which is associated with risk of cancer children under five[90], risk of fetal

[81] Ministry of Health. Role of the Office of Radiation Safety. https://www.health.govt.nz/regulation-legislation/radiation/role-of-the-office-of-radiation-safety
[82] Ministry of Health. Radiation Safety Advisory Council (RSAC) https://www.health.govt.nz/regulation-legislation/radiation/radiation-safety-advisory-council-rsac
[83] Ministry of Health. 2022. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022.
[84] International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP Statement on Diagnostic Devices Using Non-ionizing Radiation: Existing Regulations and Potential Health Risks. Health Physics 112(3):p 305-321, March 2017. | DOI: 10.1097/HP.0000000000000654
[85] Ministry of Health. 2022. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022.
[86] Zothansiama, Zosangzuali M, Lalramdinpuii M, et al. Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations. Electromagn Biol Med 36 (2017): 295-305.
[87] Hinrikus, H., Koppel, T., Lass, J., Roosipuu, P., Bachmann, M., 2022. Limiting exposure to radiofrequency radiation: the principles and possible criteria for health protection. *Int. J. Radiat. Biol.* 0, 1–11. DOI:10.1080/ 09553002.2023.2159567.
[88] Brabant C, Geerinck A, Beaudart C, *et al.* (2023). Exposure to magnetic fields and childhood leukemia: a systematic review and meta-analysis of case-control and cohort studies. Reviews on Environmental Health, vol. 38, no. 2, 2023, pp. 229-253. https://doi.org/10.1515/reveh-2021-0112
[89] Zosangzuali M, Lalremruati M, Lalmuansangi C,*et al* (2021): Effects of radiofrequency electromagnetic radiation emitted from a mobile phone base station on the redox homeostasis in different organs of Swiss albino mice, Electromagnetic Biology and Medicine, DOI:10.1080/15368378.2021.1895207
[90] Malavolti M, Malagoli C, Wise LA et al. (2024). Residential exposure to magnetic fields from transformer stations and risk of childhood leukemia. *Environmental Research,* 245(2024)118043. DOI: 10.1016/j.envres.2023.118043

and childhood abnormalities, [91] risk of miscarriage and abortion, [92] and the unaddressed issue of cumulative exposures in workplaces and classrooms[93]

- The Ministry of Health downplays hypersensitivity and patronisingly focuses on a 'nocebo effect'. The basis of the Ministry of Health's discussion revolves around the evidence of uncertainty to provide weight for and support the ministry in downplaying and dismissing this effect, rather than sincerely and methodically reviewing increasing data that supports hypersensitivity as a phenomenon. [94] [95] [96]
- The Ministry of Health has an obligation to protect health, and it is unscientific and unethical to simply ignore increasing weight of evidence supporting a causal relationship with exposures and hypersensitivity. Therefore there, is an ethical and scientific obligation to seriously assess the risk of both non-ionising man-made electronic risks and the risk to vulnerable groups and to do this methodically through scientifically robust channels.[97]
- The approach to cancer by the Ministry of Health is ethically questionable. The MoH fails to comprehensively address non-thermal evidence of harm, and does not take action to consider the weight of evidence from mechanistic studies (including concerning reactive oxygen species and DNA damage).[98] [99] [100] [101] For example, the MoH refers to a paper evidencing increased incidence of tumours at low exposures (Falcioni et al 2018[102]) that explicitly calls on the IARC to re-evaluate its conclusions. The MoH references the Hardell group but fails to evaluate their findings and fails to reference them. Astonishingly the ICNIRP group failed to refence the study also.

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[91] Kashani ZA, Pakzad R, Fakari FR et al. (2023) Electromagnetic fields exposure on fetal and childhood abnormalities: Systematic review and meta-analysis. Open Medicine. 18(1) DOI:10.1515/med-2023-0697

[92] Irani M, Aradmehr M, Ghorbani M, Baghani R. Electromagnetic Field Exposure and Abortion in Pregnant Women: A Systematic Review and Meta-Analysis. Malays J Med Sci. 2023 Oct;30(5):70-80. DOI: 10.21315/mjms2023.30.5.6. Epub 2023 Oct 30. PMID: 37928787; PMCID: PMC10624444.

[93] Soares NE, Bulla G, Fernández-Rodríguez CE, de Salles AAA (2025). SAR Estimations in a Classroom with Wireless Computers J. Microw. Optoelectron. Electromagn. Appl. 24 (02) DOI: 10.1590/2179-10742025v24i3288526

[94] Leszczynski, Dariusz. (2024). The lack of international and national health policies to protect persons with self-declared electromagnetic hypersensitivity.*Reviews on Environmental Health*, vol. 39, no. 2, 2024, pp. 163-189. https://doi.org/10.1515/reveh-2022-0108

[95] Belpomme D and Irigaray P. (2020) Electrohypersensitivity as a Newly Identified and Characterized Neurologic Pathological Disorder: How to Diagnose, Treat, and Prevent It. *Int J Mol Sci*. 2020 Mar 11;21(6):1915. doi: 10.3390/ijms21061915.

[96] Bandara P, Hunter J (2020). Case Study: Could electromagnetic-hypersensitivity be exacerbating this case of chronic fatigue syndrome? *ACNEM Journal*. Vol 39 No. 3.

[97] Belpomme D and Irigaray P. Why electrohypersensitivity and related symptoms are caused by non-ionizing man-made electromagnetic fields: An overview and medical assessment. *Environmental Research*.212(2022)113374. https://doi.org/10.1016/j.envres.2022.114840, https://doi.org/10.1016/j.envres.2022.114839.

[98] Yakymenko I, Tsybulin O. Carcinogenic effects of non-thermal exposure to wireless communication electromagnetic fields In: DJ Panagopoulos, editor. Electromagnetic fields of wireless communications: biological and health effects. Boca Raton: CRC Press (2022)

[99] Lai H, Singh NP. Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. Int J Radiat Biol 69 (1996): 513-521.

[100] Ruediger HW. Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology 16 (2009): 89-102.

[101] Smith-Roe SL, Wyde ME, Stout MD, et al. Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure. Environ Mol Mutagen 61 (2020): 276-290.

[102] Falcioni L, Bua L, Tibaldi E, et al. 2018. Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environmental Research 165: 496–503.

The Ministry of Health continues to rely on ICNIRP 1998 and claim that this is 'protective' Criticisms that ICNIRP is unsuitable as a scientific authority for the safety of ionic and non-ionic RF-EMF radiation remain, and countries are adopting lower protective levels. [103] [104]

The Ministry of Health policy position will be reflected in Ministry of Health/Health New Zealand promotional content.

In 2025 HealthEd published an educational resource Radiofrequency Fields. The resource document downplays health risks, suggesting that associations of cell phone and brain cancer may have happened because of '*biases in the way the studies were carried out*'.

The resource states that '*exposure from modern cellphones is typically 50–100 times lower than from older generation models*'. [105]

Kiwi's young and old alike, will be influenced by these claims which are generalist, and not scientifically accurate.

[E] RECURRING THEMES ACROSS THE LITERATURE:

Governments do not know the threshold at which RF-EMF exposure causes harm — that is, the point beyond which genetic damage, oxidative stress, and cellular senescence exceed a vertebrate's capacity for biological repair.

Thousands of scientific articles suggest overlapping and dynamic mechanistic effects at low levels of microwave radiation that does not heat tissues – it is non-thermal. The MoH makes no effort to consider the mechanistic data that has deepened over decades, which persistently draws attention to why non-thermal radiation might easily penetrate the skin[106] [107] [108] [109], to highlight pathways and effects relating to protein damage, biochemical changes and oxidative stress.

In vitro, laboratory and epidemiological studies consistently demonstrate associations between low frequency signals and cancer, infertility, hypersensitivity and other conditions. Studies demonstrating RF-EMF induced genetic damage (including DNA damage, chromosome damage and mutations), oxidative stress and cell senescence and death, help to untangle the underlying causes.

> *While man-made EMFs cannot directly ionize molecules, they are capable of doing this indirectly in biological tissue, by triggering the biosynthesis of Reactive Oxygen Species (ROS) which can damage biomolecules, including DNA.* [110]

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[103] Lin JC (2025). Health and Safety Practices and Policies Concerning Human Exposures to RF/Microwave Radiation. Front. Public Health Sec. Radiation and Health DOI: 10.3389/fpubh.2025.1619781. (Provisionally accepted as at July 2025).
[104] International Committee on Electromagnetic Safety. ICES (SCC-39) Annual Report: 2015 – 2016. https://www.ices-emfsafety.org/wpcontent/uploads/2017/01/SCC39-Annual-Report2015-2016.pdf (2021).
[105] HealthEd. (Feb 2025). Radiofrequency fields – HE1103. https://healthed.govt.nz/products/radiofrequency-fields?
[106] Betzalel N, Ishai PB, Feldman Y. The human skin as a sub-THz receiver–Does 5G pose a danger to it or not? Environ Res. (2018) 163:208–16. doi: 10.1016/j.envres.2018.01.032
[107] Zalyubovskaya NP. Biological effects of millimeter radiowaves. Vrachebnoye Delo. (1977) 3:116–9.
[108] Leszczynski D. Physiological effects of millimeter-waves on skin and skin cells: an overview of the to-date published studies. Rev Environ Health. (2020) 35:493–515. doi: 10.1515/reveh-2020-0056
[109] Feldman Y, Puzenko A, Ben Ishai P, Caduff A, Davidovich I, Sakran F, et al. The electromagnetic response of human skin in the millimetre and submillimetre wave range. Phys Med Biol. (2009) 54:3341. doi: 10.1088/0031-9155/54/11/005
[110] Panagopoulos DJ, Yakymenko I, De Iuliis GN and Chrousos GP (2025) A comprehensive mechanism of biological and health effects of anthropogenic extremely low frequency and wireless communication electromagnetic fields. *Front. Public Health* 13:1585441. doi: 10.3389/fpubh.2025.1585441

There is no evidence that current levels are safe from age 0-25, when the brain is maturing. The particular risk to developing brains has been neglected and downplayed by policy-makers and agency-contracted scientists. Babies (prenatal and post-natal) infants and children, are not developmentally mature, and hence are at greater risk exposure. Safe levels in adults can be unsafe for children, and adverse effects in childhood can lead to long-term harms and reduced quality of life. The blood-brain barrier is more permeable in babies and children, myelination of the brain is in process and bones remain immature. Exposures may lead to blood-brain barrier leakage. Exposure to telecommunications facilities and wireless devices may increase risk for neurodevelopmental and behavioural disorders. [111] [112]

The long-term impact of repeated low-level breaches in the growing brain is unknown and the lifetime exposures to vulnerable populations, pregnant women, infants, children and young people is unknown.

Emerging evidence suggests that RF-EMFs have specific patterns that impair genetic and cellular function from the mitochondria upwards, which then trigger a spectrum of pathologies. A June 2025 international review of low frequency and wireless communication EMF fields stated:

> *It seems that the combination of polarization/coherence and low-frequency variability is the key to EMF-bioactivity. Polarized and coherent EMFs/EMR (in contrast to, e.g., light and other types of natural EMFs/EMR) possess net electric and magnetic fields, in addition to radiation intensity, which exert forces on every electrically charged/polar particle/molecule such as the mobile ions and the charged/polar macromolecules in all biological systems. It is those unique features that make all anthropogenic EMFs, and most of all WC EMFs, significantly more adversely bioactive than natural EMFs*
>
> *Modulated or pulsed RF-EMFs are significantly more bioactive than non-modulated or non-pulsing fields of the same carrier frequency and the same intensity with that of the pulses.* [113]

How does this apply to the human brain? The human brain is mostly water and salts (ions like sodium, potassium, calcium). It uses tiny voltage shifts to transmit information (neurons fire at around 0.1 volts). Therefore, the brain is electrically excitable and tightly regulated, like a liquid crystal system.

An EMF wave has an electric and magnetic field that oscillates. In a polarised field, the direction of that electric field is locked and doesn't vary randomly like sunlight does. In contrast, most natural EMFs (like sunlight or lightning) are non-polarised, they vibrate in many directions, which tends to cancel out effects in living tissue. Artificial EMFs (from antennas, WiFi, 5G, etc.) are strongly polarised. The waves consistently oscillate in one plane, which makes them more biologically active.

In a coherent wave, all the individual wavelets are in sync, much like a whole stadium doing the same chant at once. Natural EMFs tend to be incoherent: lots of frequencies, amplitudes, and timings mixed together. Artificial EMFs are highly coherent: same frequency, same pulse pattern, even chopped up into pulsed bursts. This uniformity allows artificial fields to interact with biological molecules more effectively — like a battering ram hitting a door in rhythm.

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[111] Divan HA, Kheifets L, Obel C, Olsen J. Prenatal and postnatal exposure to cell phone use and behavioral problems in children. *Epidemiology* 2008; 19: 523–29

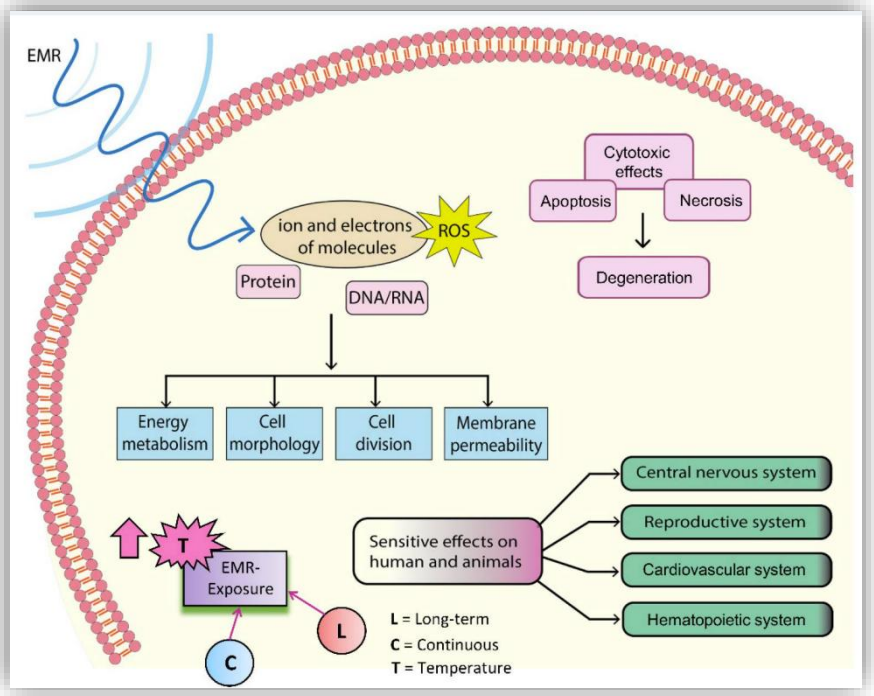
[112] Kashani ZA, Pakzad R, Fakari FR et al. (2023) Electromagnetic fields exposure on fetal and childhood abnormalities: Systematic review and meta-analysis. Open Medicine. 18(1) DOI:10.1515/med-2023-0697

[113] Panagopoulos DJ, Yakymenko I, De Iuliis GN and Chrousos GP (2025) A comprehensive mechanism of biological and health effects of anthropogenic extremely low frequency and wireless communication electromagnetic fields. *Front. Public Health* 13:1585441. doi: 10.3389/fpubh.2025.1585441

A polarised, coherent EMF field is like a *laser pointer* compared to a *flashlight*. It's focused, directional, and rhythmically consistent — making it far more likely to interact with the delicate electrical processes in liquid, ion-rich vertebrate brains than diffuse, natural fields ever would.

Scientists are increasingly concerned with the problems that can arise from a variable, oscillating electric fields (such as travelling in a car or bringing devices closer to children). These actions might vibrationally prompt protein 'gates' which are based on the external plasma membranes of cells to open. Inappropriate activation and opening, and an influx of positively charged calcium can impair intracellular activities, trigger Reactive Oxygen Species overproduction and promote oxidative stress.[114] [115] [116] [117] As Panagopoulos *et al* noted: [118]

> *ROS overproduction in the mitochondria may damage DNA both in the mitochondria and the nucleus, and may initiate a signaling cascade leading to apoptosis. In turn, excessive apoptosis induced by increased ROS levels, has been linked to inflammatory diseases and cancer.*



Panagopoulos DJ, Yakymenko I, De Iuliis GN and Chrousos GP (2025) A comprehensive mechanism of biological and health effects of anthropogenic extremely low frequency and wireless communication electromagnetic fields. Front. Public Health 13:1585441. doi: 10.3389/fpubh.2025.1585441

[114] Adey WR. Biological effects of electromagnetic fields. *J Cell Biochem.* (1993) 51:410–6. doi: 10.1002/jcb.2400510405
[115] Pall ML. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med. (2013) 17:958–65. doi: 10.1111/jcmm.12088
[116] Pockett S. (May 2025). Electrosmog: The Health Effects of Microwave Pollution. https://saferemrtechnology.org.nz/wp-content/uploads/2021/04/ELECTROSMOG-May-2021.pdf
[117] Calabrò E, Magazù S. Parallel β-sheet vibration band increases with proteins dipole moment under exposure to 1765 MHz microwaves. *Bioelectromagnetics.* (2016) 37:99–107. doi: 10.1002/bem.21956
[118] Panagopoulos *et al.* (2025) A comprehensive mechanism of biological and health effects. Page 05.

Oxidative stress is a recognised precursor and driver of many chronic diseases. Studies directly show an association between EMF-RF-mediated oxidative stress and allergies atopic dermatitis, and autoimmune diseases including diabetes and eye conditions.[119]

Many associated effects from exposures can result in feedback loops that set the stage for a range of illnesses.

The impact on fertility and reproduction is significant, and it is likely that RF-EMF at low levels substantially drives combinatory effects of oxidative stress, ROS overproduction, cellular aging and death and genetic damage to reproductive cells and embryos, inhibiting reproduction.

A 2017 study reported that people living in the vicinity of mobile phone base stations had increased DNA damage. The authors noted that the persistence of such unrepaired damage led to genomic instability, creating potential for health disorders including the induction of cancer.[120]

> *Low frequency EMFs from power lines and high-voltage transformers (50–60 Hz) are linked to childhood leukemia and other cancer types for magnetic field intensities down to 2 mG (0.2 μT), or distances from power lines up to 600 m, and electric field intensities down to 10 V/m. Wireless communication EMFs from various antennas, especially radio broadcasting and MT antennas, have been linked to various forms of cancer and genetic damage*

Direct radiation from cordless phones is strongly associated with brain cancer risk.[121] [122] [123] The International Agency for Research on Cancer (IARC) evaluated RF radiation in the frequency range 30 kHz–300 GHz, and determined this to be a possible human carcinogen, Group 2B. The decision was based on studies looking at neurological effects from mobile phones.[124] The WHO recently analysed 52 studies and concluded that there is evidence that RFEMF exposure increases the incidence of cancer in experimental animals with certainty of evidence strongest for malignant heart schwannomas and gliomas.[125]

The MoH unauthored Report to Ministers, does not evaluate the potential for RF-EMF radiation to alter gene expression via epigenetic processes, such as the potential to alter DNA methylation patters within the genome. Gene expression can be altered while the DNA sequence remains stable. This can occur at low (presumed safe) levels. A recent study which looked at changes in DNA methylation patterns within human keratinocytes demonstrated that low-dose exposures produced genome-wide DNA methylation changes in human skin cells. Six genes were identified which showed both

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[119] BERENIS. "Is there evidence for oxidative stress caused by electromagnetic fields?," in A Summary of Relevant Observations in Experimental Animal and Cell Experiments Related to Health Effects in the Last Ten Years, Mevissen M and Schürmann D, editors. Department of Epidemiology and Public Health Environmental Exposures and Health Unit: Basel, Switzerland (2021). Available online at: https://ehtrust.org/wp-content/uploads/Newsletter-BERENIS-Special-Issue-January-2021-1.pdf

[120] Zothansiama, Zosangzuali M, Lalramdinpuii M, et al. Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations. Electromagn Biol Med 36 (2017): 295-305.

[121] Hardell L, Näsman A, Påhlson A, et al. Use of cellular telephones and the risk for brain tumours: A case control study. Int J Oncol 15 (1999): 113-116.

[122] Hardell L, Hansson Mild K, Påhlson A, et al. Ionizing radiation, cellular telephones and the risk for brain tumours. Eur J Cancer Prev 10 (2001): 523-529.

[123] Hardell L, Carlberg M. Mobile phone and cordless phone use and the risk for glioma - Analysis of pooled case-control studies in Sweden, 1997-2003 and 2007 2009. Pathophysiology 22 (2015): 1-13.

[124] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Non-ionizing radiation, Part 2: Radiofrequency electromagnetic fields. IARC Monogr Eval Carcinog Risks Hum 102 (2013): 1-460.

[125] Mevissen M, Ducray A, Ward JM *et al (2025).* Effects of radiofrequency electromagnetic field exposure on cancer in laboratory animal studies, a systematic review. *Environment International.* 199(2025) 109482

methylation and expression alterations shortly after exposure—suggesting swift epigenetic signalling via RF exposure.[126]

The military is likely well aware of the non-thermal impact on the brain. A 2021 simulation found that:

> *tissue-injuring level of high-power microwave-induced acoustic pressure waves inside the human brain, the microwave pulse-induced temperature elevation would be substantially below the assumed threshold for RF effects (1 °C), which is again considered "safe".*[127] [128]

A miniscule rise in temperature in the brain from absorption of pulsed microwave radiation can create a thermoelastic expansion in brain matter, creating knock-on effects throughout the brain. Many of these microwave pulses are above the threshold of auditory perception, yet have potential to injure tissues.[129]

The MoH does not survey the scientific literature to identify the changing evidence on neurological risk, but effectively proxies this work out to external authorities, in the form of reviews by other governments and transnational bodies (see Appendix D, MoH,2022).[130]

In a world where cancer is occurring with increasing frequency, and at younger ages, it is difficult to understand why the MoH has followed ICNIRP to downplay and dismiss the mechanistic and animal studies[131] [132] [133] that elucidate the exposures to RF-EMF induce DNA damage[134] [135] [136] and reactive oxygen species (ROS)[137]. These are known precursors and pathways for cancer. It is surprising that data, particularly in the NTP and Falcioni studies has simply been downplayed and dismissed.

Information on the scientific literature is close at hand.[138] The Australian-based Oceania Radiofrequency Scientific Advisory Association (ORSAA) maintains the world's largest categorized

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[126] Cantu, J.C., Butterworth, J.W., Peralta, X.G., Payne, J.A. and Echchgadda, I. (2023), Analysis of global DNA methylation changes in human keratinocytes immediately following exposure to a 900 MHz radiofrequency field. Bioelectromagnetics, 44: 77-89. https://doi.org/10.1002/bem.22439

[127] A. M. Dagro, J. W. Wilkerson, T. P. Thomas, B. T. Kalinosky, and J. A. Payne, "Computational modeling investigation of pulsed high peak power microwaves and the potential for traumatic brain injury," Sci. Adv., vol. 7, no. 44, pp. 1–10, Oct. 2021, doi: 10.1126/sciadv.abd8405.

[128] J. C. Lin, "A Paradigm Shift? [Health Matters]," in *IEEE Microwave Magazine*, vol. 24, no. 12, pp. 16-18, Dec. 2023, doi: 10.1109/MMM.2023.3313788.

[129] Lin JC (2022). The Microwave Auditory Effect. IEEE J. Electromagn., RF, Microw. Med. Biol., vol. 6, no. 1, pp. 16–28, Mar. 2022, doi: 10.1109/JERM.2021.3062826.

[130] Ministry of Health. 2022. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022.

[131] National Toxicology Program. NTP technical report on the toxicology and carcinogenesis studies in B6C3F1/N mice exposed to whole-body radio frequency radiation at a frequency (1,900 MHz) and modulations (GSM and CDMA) used by cell phones Available online: https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/tr596peerdraft.pdf (2021).

[132] National Toxicology Program. NTP technical report on the toxicology and carcinogenesis studies in Hsd:Sprague Dawley rats exposed to whole-body radio frequency radiation at a frequency (900 MHz) and modulations (GSM and CDMA) used by cell phones. NTP TR 595

[133] Falcioni L, Bua L, Tibaldi E, et al. 2018. Report of final results regarding brain and heart tumors in Sprague-Dawley rats

[134] Lai H, Singh NP. Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation. *Int J Radiat Biol* 69 (1996): 513-521.

[135] Ruediger HW. Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology 16 (2009): 89-102.

[136] Smith-Roe SL, Wyde ME, Stout MD, et al. Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure. Environ Mol Mutagen 61 (2020): 276-290.

[137] Choi, J., Min, K., Jeon, S. et al. Continuous Exposure to 1.7 GHz LTE Electromagnetic Fields Increases Intracellular Reactive Oxygen Species to Decrease Human Cell Proliferation and Induce Senescence. Sci Rep 10, 9238 (2020). https://doi.org/10.1038/s41598-020-65732-4

[138] Leach V, Weller S, Redmayne M. A novel database of bio-effects from non- ionizing radiation. Rev Environ Health. (2018) 33:273–80. doi: 10.1515/reveh-2018-0017

database of scientific studies on the biological and health effects of electromagnetic fields on humans, animals and the environment, the ORSAA Database of EMF Bioeffects (ODEB). Initially storing Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), the database has since expanded to over 4,000 publications, of which over half are dedicated to radiofrequency research. Not only is the database an extraordinary information bank, the scientists are actively interested in health policy, which suggests that curious Ministry of Health officials would receive extensive support from the scientists that maintain the database, and carry out research.[139]

[F] COPYING ICNIRP TO WRITE OUT DATA – IS EUROPE DISTANCING ITSELF?

Recent attention has domestic nations do not do their own research, instead they:

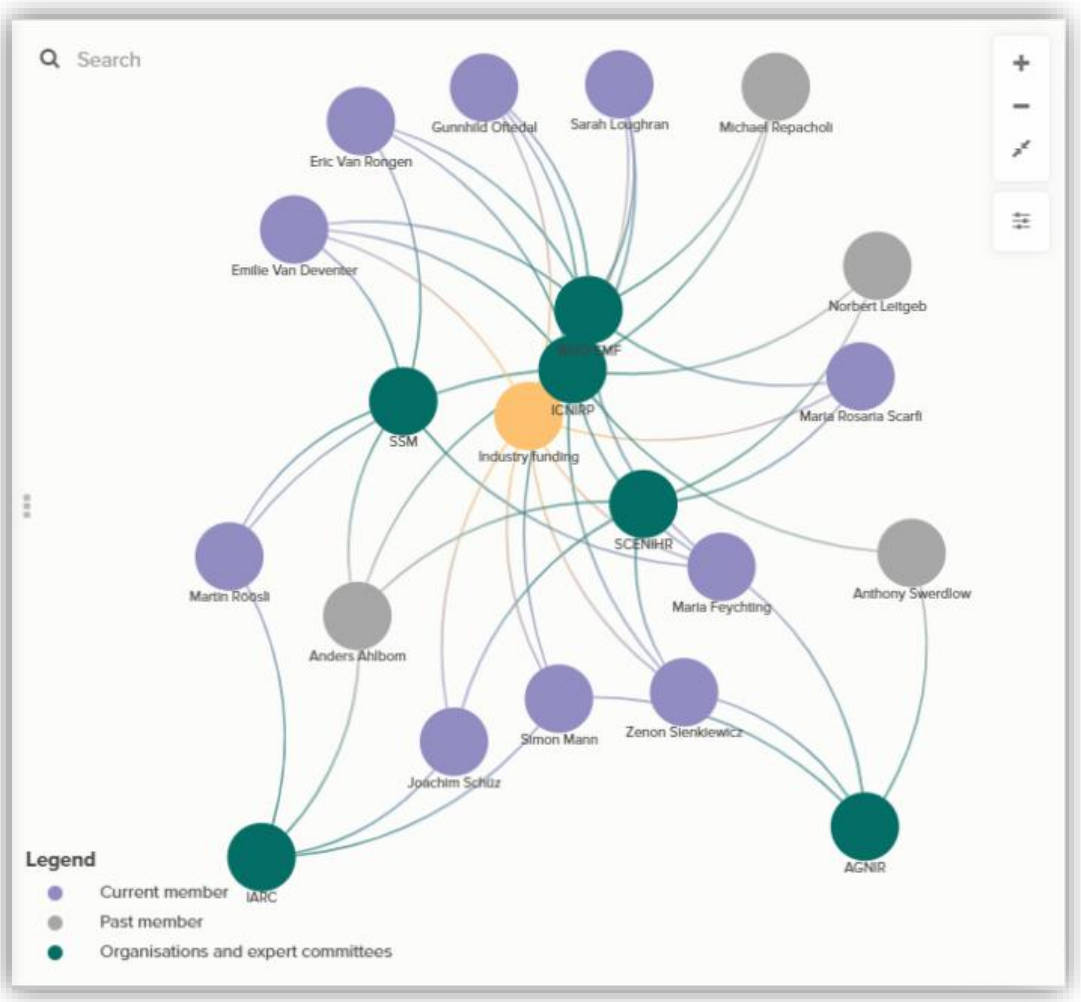
> *lean on reviews made by international expert groups. These consider all available science, evaluate it and draw conclusions based on the overall scientific picture*.[140]

Europe may be distancing itself from the ICNIRP as groups have drawn attention to the close links between ICNIRP and the EU Scientific Committee on Health, Environment and Emerging Risk, SCENIHR / SCHEER, World Health Organisation WHO's International EMF Project and the WHO Cancer Unit IARC, International Agency for Research on Cancer.

ICNIRP has historic ties to industry, the founder, Mike Repacholi also founded the WHO EMF project, and then left to become an industry consultant. While these organisations exclude researchers who have received industry research in the past three years, this does nothing to prevent the 'revolving door' effect between these institutions and industry, as frequently a research project with government could take 2-5 years.[141] The current policies enable researchers could move between industry and ICNIRP, unimpeded as funding projects change.

[139] McCreddon JE, Cook N, Weller, S, Leach V. (2022). Wireless technology is an environmental stressor requiring new understanding and approaches in health care. *Front. Public Health,* 10:2022. DOI: 10.3389/fpubh.2022.986315
[140] Investigate Europe (Jan 5, 2019). How Much is Safe? Radiation authorities rely on controversial group for safety advice. https://www.investigate-europe.eu/en/posts/how-much-is-safe
[141] Investigate Europe (Jan 5, 2019). How Much is Safe? Radiation authorities rely on controversial group for safety advice.

Evidence suggests that these organisations corroborate and act more like a cartel than independent scientific organisations. ICNIRP does not have an open process for the election of new members. After 2019 criticisms, the tightly managed organisation appears to have taken steps to increase transparency.[142]



Investigate Europe (Jan 5, 2019). How Much is Safe? Radiation authorities rely on controversial group for safety advice.

A 2020 Report commissioned by two Members of the European Parliament – Michèle Rivasi (Europe Écologie) and Klaus Buchner (Ökologisch-Demokratische Partei) may have prompted this move.[143] The report investigated the conflicts of interest of 2020-2024 serving ICNIRP experts.

The report queried the strong association of members with industry, maintaining fluid relationships with industry sectors while also developing guidelines that the industry is required to adhere to. The report showed how industry funding can be bundled and essentially laundered through different

[142] ICNIRP. Funding and Governance. *Accessed July 19, 2025.* https://www.icnirp.org/en/about-icnirp/funding-governance/index.html

[143] Buchner K and Rivasi M (June 2020). The International Commission on Non-Ionizing Radiation Protection: Conflicts of interest, corporate capture and the push for 5G. https://www.politico.eu/wp-content/uploads/2020/06/ICNIRP-report-JUNE-2020-BUCHNER-RIVASI.pdf

agencies. Substantial overlap of military, media and defence occurs, for example, with ICNIRP members also members of the International Committee on Electromagnetic Safety (ICES).

The report referenced a meeting that demonstrated how industry organisations work closely to ensure guideline levels are conservative and consistent across issues from radiofrequency exposures to laser exposure limits. ICNIRP presented to military and telecommunications industries ICES attendees, emphasising the preliminary nature of the report and the need for feedback from the industry attendees.[144]

Scientists with findings that contradict the status quo have been broadly ignored by the English speaking nations. An appeal to the European Union, currently signed by over 400 scientists and medical doctors requests a halt to:[145]

> *the 5G RF-EMF expansion until independent scientists can assure that 5G and the total radiation levels caused by RF-EMF (5G together with 2G, 3G, 4G, and WiFi) will not be harmful for EU-citizens, especially infants, children and pregnant women, as well as the environment.*

The appeal requests an increase in dedicated efforts to advise and inform about potential health risks, particularly near vulnerable places including daycare centers, schools, homes, workplaces, hospitals and elderly care; and requests the establishment of a task force separate to industry influence and the prevention of lobbying efforts that directly influence regulation.

EMF exclusions may be standard in insurance policies with EMF risk classified as a 'pollutant' with EMF risks regarded as a long-tail risk.[146] Insurance markets typically follow global norms and 'electromagnetic field exclusions' include harm caused by long-term non-ionizing radiation exposure. Global insurers and domestic insurance companies that are syndicate participants, that have multinational parent companies and that harmonise with generic global policy approaches that excludes liability for health effects from EMF exposures.[147] [148] [149]

CONCLUSION

The current safety threshold for adverse RF-EMF effects remains unknown and risk arises from the dynamic interplay between telecommunications infrastructure and whatever device is currently in use. The weight of evidence for risk from RF-EMF emissions presents a complex policy challenge that cannot be delegated to personal responsibility or left to industry self-regulation.

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[144] ICES International Committee on Electromagnetic Safety Approved Meeting Minutes IEEE/ICES TC95 Subcommittee 3 Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 - 3 kHz and IEEE/ICES TC95 Subcommittee 4 Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz Motorola Solutions, Inc., 8000 West Sunrise Blvd, Plantation, FL 33322, USA. https://www.ices-emfsafety.org/wp-content/uploads/2017/08/TC95-Minutes-SC3-SC4-January-2017.pdf

[145] 5G Appeal. https://www.5gappeal.eu/scientists-and-doctors-warn-of-potential-serious-health-effects-of-5g/

[146] Quantadose. General Insurance Exclusions for EMFs (Electromagnetic Fields). *Accessed July 18, 2025*. https://www.quantadose.com/general-insurance-exclusions-for-emfs-electromagnetic-fields/?

[147] Complete Markets. Electromagnetic Fields (Utilities) Liability Insurance. *Accessed July 18, 2025*. https://completemarkets.com/Electromagnetic-Fields-Utilities-Liability-Insurance/Storefronts/

[148] Environmental Health Trust. Electromagnetic Field Insurance Policy Exclusion Are The Standard. *Accessed July 18, 2025*. https://ehtrust.org/electromagnetic-field-insurance-policy-exclusions/?

[149] See e.g. CFC Underwriting. CFC A&E CAN V1.7. Electromagnetic fields directly or indirectly arising out of, resulting from or contributed to by electromagnetic fields, electromagnetic radiation, electromagnetism, radio waves or noise. https://www.jrseco.com/wp-content/uploads/Insurance-AE-CFC-Underwriting-Limited-Lloyds-Latest-Version-February-7th-2015.pdf

The scientific literature currently does not support further deregulation of telecommunications infrastructure that emits RF-EMF radiation. Evidence supports increasing caution based on the ALARA principle, *as low as reasonably achievable*, which can be enabled though maximising optic fibre broadband. There is currently no evidence for safety to vulnerable populations: pregnant mothers, infants, children, adolescents and sensitive populations – and harm in early years can translate to years lived with disease, and lower quality of life.

RF-EMF exposures impose an unavoidable burden on vulnerable individuals, denying them the basic right to protect their health in shared environments — an invisible breach of bodily autonomy. A society that saturates its environment with involuntary RF-EMF exposures, knowing some are harmed, cannot claim to uphold the principles of precaution, justice, or public health.

New Zealand policies can *proactively care* while increasing access to fibre optic broadband – uptake is what is required for low-income groups.

Monitoring and reporting by government agencies is negligible. Writing out risk by failing to comprehensively recognise the pattern of risk that arises from mitochondrial and cell-level mechanistic evidence (from oxidative stress to DNA damage and epigenetic alterations) to the epidemiological evidence, from case reports, cohort studies to the larger population-level findings.

Streaming while moving through environments increases risk to health. High data transmission, including video streaming or mobile tethering (through Bluetooth, USB and hotspotting) can instead be achieved by accessing fibre-enable broadband more safely. Cellular network (e.g. 4G, 5G)- device streaming or tethering involves *simultaneous* two-way feedback between the device and the telecommunications infrastructure. Signal handovers between towers/antennae and devices increase the RF-EMF radiation burden and recognised cell-level effects include oxidative stress and inflammation.

Information to communicate protective and safety-based measures, particularly for pregnant mothers, infants and children can be more comprehensively addressed by agencies. This includes maintaining devices on airplane mode, and encouraging downloads before leaving home.

Telecommunications devices can be kept a strict distance from places where people work, play and sleep to minimise the probability of biological effects, particularly to babies and children. Other, technically practical solutions can reduce the exposures to people from mobile phones, and optical fibre solutions can be emphasised and supported in policy.[150]

The New Zealand NZS 2772.1:1999 standard aligns with the *weakest* global standards. It provides for a 61 V/m limit (equivalent to 10 W/m^2 power density at 2–300 GHz) is a generic limit applied uniformly across all environments — schools, homes, public spaces. There are no stricter limits for sensitive environments (e.g. childcare centres and hospitals). No differentiation is made for vulnerable populations. New Zealand does not consider that non-thermal exposures and hypersensitivity are scientifically legitimate risk-based parameters.

[150] Héroux, P.; Belyaev, I.; Chamberlin, K.; Dasdag, S.; De Salles, A.A.A.; Rodriguez, C.E.F.; Hardell, L.; Kelley, E.; Kesari, K.K.; Mallery-Blythe, E.; et al. Cell Phone Radiation Exposure Limits and Engineering Solutions. *Int. J. Environ. Res. Public Health* 2023, *20*, 5398. https://doi.org/10.3390/ijerph20075398

The minimal level of RF-EMF that has produced a biologic effect is around 1.7 V/m. A body of evidence supports reducing current limits to a peak value of 6 V/m – as a minimal level that may reduce health risks.[151]

Typical values (attrib. ChatGPT) are given as:

Feature	Retrofitted Pole-Mounted Small Cell	Purpose-Built Small Cell Tower	Macrocell Tower
Power Output (EIRP)	1–10 W	10–50 W	60–100+ W
RF Range	100–200 m	200–500 m	1–35 km
Frequency Bands	700 MHz–6 GHz (FR1)	700 MHz–6 GHz; some mmWave	700 MHz–3.5 GHz (mostly FR1)
Typical Height	4-10 metres	20-30 metres	20-50 metres+
V/m at Ground (typical)	0.3–2 V/m	0.5–4 V/m	0.5–10+ V/m (direct path)

Other countries have stricter standards which demand that cumulative emissions do not exceed the standard:[152] [153]

- **Switzerland (ORNI Regulation):** applies 'installation limits' with a limit of 4–6 V/m in locations with prolonged exposure (homes, schools, hospitals). Swiss standards are cumulative for all stations affecting a site.
- **Italy (Framework Law 36/2001):** sets a 6 V/m limit for all living environments (indoor and outdoor). This applies across the full 100 kHz–300 GHz band. Italy's rule targets 'sensitive areas' and cumulative exposure, with no allowance for exceedance even short-term. Local authority measures do exist.
- **Belgium (Brussels/Wallonia):** A zoned approach where regional governments apply varying limits: 3–6 V/m typically near schools, hospitals, and residential zones. The strictest are in

[151] Hinrikus H, Koppel T, Lass J, Roosipuu P & Bachmann M. (2023). Limiting exposure to radiofrequency radiation: the principles and possible criteria for health protection, International Journal of Radiation Biology, DOI: 10.1080/09553002.2023.2159567

[152] National Institute for Public Health and the Environment, RIVM. Stam R. (January 2018) Comparison of international policies on electromagnetic fields (power frequency and radiofrequency fields). https://www.rivm.nl/sites/default/files/2018-11/Comparison%20of%20international%20policies%20on%20electromagnetic%20fields%202018.pdf

[153] https://ehtrust.org/wp-content/uploads/Color-5G-cell-tower-policy-EHT-10.pdf?

Brussels (3 V/m for combined emissions). Municipalities often display antenna maps, requiring pre-installation public notice, and in some cases enforce setback policies.[154]

- **Russia (SanPiN standards):** Takes into account non-thermal effects. 10 μW/cm^2 ≈ ~6.1 V/m. Cell towers and antennas explicitly prohibited on school grounds and children's facilities.[155]

We cannot expect exposures to have a benign effect on body systems. A huge body of scientific evidence tells us that exposures are not benign, but harmful. Vertebrate bodies have not altered (or calibrated) in the past hundred years, to account for exposures that have increased by orders of magnitude, through the increased densification of non-native EMF-RF emissions in the surrounding environment.

The Ministry of Health and ICNIRP do not methodically account for the complexities of densified RF-EMF environments, including highly localized intensity peaks, pulsed emissions, and the cumulative contribution of background radiation from multiple personal and infrastructure-based sources. No formal public assessment addresses the chronic, low-level, multisource exposure or the health relevance of peak intensities and modulation patterns.

The concentration of RF-EMF in certain areas — forming zones of constructive field overlap and spatial heterogeneity — remains unassessed. PSGR remains deeply concerned about the biological plausibility of harm from time-varying exposures: asynchronous signals from technologies such as 4G, 5G, and Wi-Fi generate pulsing and modulation patterns that may have effects even where average power densities remain within current guidelines. There is growing evidence linking such exposures to oxidative stress, altered calcium ion signalling, and disruptions to melatonin regulation.

Scientists faced barriers to research exploring and reporting the biological effects of RF power densities less than 10 mW/cm2. In New Zealand, science on RF-EMF is unlikely due to the current policies that are in place by the Ministry of Business, Employment and Innovation. Current science policies reflect MBIE's innovation focus, and stewardship, basic research and monitoring is not a priority of MBIE.[156]

Historically, agencies tasked with caring for environmental and human health would hold powers of stewardship of man-made technologies. However, in New Zealand, business-facing MBIE, as we have discussed, secured control of telecommunications RF-EMF National Environmental Standards for Telecommunication Facilities regulations. Unauthored reports by a secretive Ministry of Health (MoH) committee then provide the justification for retaining 1999 standards in MBIE's regulations.

PSGR do not believe that MBIE is the appropriate body to steward these regulations. PSGR do not consider that MoH papers form any approximation of scientifically rigorous review.

PSGR considers that the New Zealand population is poorly served by the current governance framework.

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[154] Environmental Health Trust (May 2017). Belgium Policy recommendations on cell phones, wireless radiation and health. https://ehtrust.org/belgium-policy-recommendations-cell-phones-wireless-radiation-health/?

[155] Grigoriev Y.(2018). Russian National Committee on Non-Ionizing Radiation Protection and EMF RF standards. New conditions of EMF RF exposure and guarantee of the health to population. https://www.radiationresearch.org/wp-content/uploads/2018/06/021235_grigoriev.pdf?

[156] *PSGR (2025) When powerful agencies hijack democratic systems. Part II: The case of science system reform. Bruning, J.R.. Physicians & Scientists for Global Responsibility New Zealand. April 2025. ISBN 978-1-0670678-1-6*

The tens of thousands of published papers on the health effects of non-native EMF-RF produce a weight of evidence or a burden of proof. The weight of evidence on risk does not require to be 'balanced out' by the evidence of safety, like a game of noughts and crosses. Ethics-based judgement by officials and scientists requires them to categorically protect health. Research demonstrating harm has frequently been undertaken by independent institutions who are not aligned with industry groups or engaged in research on radiation development for medical, military or other purposes.

There are different scientific approaches to understanding whether a technology is harmful. A policy-relevant, science-based approach involves, firstly, an appreciation of daily to lifetime exposures: the breadth (from different devices), duration (from seconds to all day) and extent (from lowest levels to pingback beams between towers and devices).

Secondly, a policy-relevant, science-based approach requires a methods-based evaluation of the existing scientific literature of risk and harm, from mechanistic data to case studies. It involves scrutinising pathways of potential risk to vulnerable populations – pregnant women, infants, children and adolescents, and hypersensitive populations.

A policy-relevant approach involves recognising that there is no known threshold where harm starts. This does not mean there is no evidence of risk or harm – but no evidence for *safety*.

Harm from environmentally relevant non-native RMF-RF exposures to a developing infant, like the particles emitted from a combustion engine, or the formulation of a chemical in a workplace, cannot be discretely parsed. As with any acute or chronic environmental exposure that disrupts homeostasis, latency, the delay between exposure and disease can occur over years and decades and is inconsistent across people. Hence, an appreciation of the weight, or strength of the evidence is central to any discussion if it is to ethically involve the protection of human and environmental health.

The safeguarding and protection of human and environmental health is a fundamental duty of the New Zealand government. Yet under current RF-EMF governance frameworks and regulatory settings in New Zealand, this duty is not, and cannot be, fulfilled.

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