

04.05.2022

Dear National Highways,

The problem of tragic increases in fatalities on Smart Motorways has been an unfortunate reality in recent years with the controversial removal of the hard shoulder and corresponding changes to the highway code.

I have been following the government's ongoing strategy to try to rectify the problem of increased accidents on parts of the smart motorways which require significant technological infrastructure as an ongoing project.

These changes to our highways increase wireless emissions as the infrastructure accommodates more sensors and communications fixtures for 5G and future signal propagation techniques and auctions of electromagnetic spectra for commercial and private communications and security networks will be added.

Recently I have become aware that as part of National Highways strategy to protect motorists on Smart Motorways National Highways intend to install **Radar Technology** on "smart" motorways. NH say that it is an effort to "help drivers feel safe." <https://nationalhighways.co.uk/our-work/smart-motorways-evidence-stocktake/stopped-vehicle-detection-upgrades/>

Making people "feel" safe is not the same as people "being safe".

Is radar the right approach?

There are reasons to think that radar isn't quite the right approach. Radar is a source of Radio Frequency Radiation (RFR) and it is proven occupationally unsafe and has wider implications because now populations are being exposed increasingly more to RFR. <https://www.naturalhealthresearch.org/radiation-exposure-associated-with-cancer-in-military-personnel/>

Not only is health an issue, there are privacy implications (what data is being produced, about whom and what transparency measures are in place?) and implications for the environment (sufficient scientific data about the impact of radar RFR (radiofrequency radiation) and pulsed, man-made electromagnetic fields exists to warrant extreme caution).

Have any of the risks been assessed?

I would like to ask if a thorough risk assessment been conducted with regards the proposed roll out of radar technologies on UK highways?

Many drivers on motorways and those who have broken down in their vehicles are likely to be exposed to radar RFR for long periods of time, with commuters and long-distance travellers possibly being exposed daily for extended periods.

Has all of this potential radiation been scientifically measured and the resulting assessment of the health risks and pertinent data published so the public can see NR are taking a responsible approach?

A consultation based on the data and helping people understand the potential and clear risks clear would be very helpful. I hope my letter can help you understand some of the risks.

Transparency in this regard should be a priority, considering NH have come under fire and have faced legal action, even been accused of corporate manslaughter in recent years because of the number of deaths on Smart Motorways owing to changes that include removal of the hard shoulder. Adding further risks on motorways should be carefully avoided.

What worries me, and it's something the public have taken seriously, especially the victims of Smart Motorway operations that have led to fatalities for their loved ones, is the fact that National Highways appeared not to have legally stated "duty of care" to motorists. <https://www.bbc.co.uk/news/uk-england-south-yorkshire-60214759>

Clear thinking, trust and duty to protect public health and safety

There is still growing concern about smart motorways and there is strong opposition because they are dangerous. Owing to the danger of Smart Motorways, and the fatalities to date in the UK there is a pending Judicial review. Yogi Amin, Partner and National Head at Irwin Mitchell LLP have been instructed to act on behalf of Clare Mercer. Her husband was killed on an All Lanes Running (ALR) 'Smart Motorway'.

How can the introduction of radar address the problems of potential collisions or other accidents when RF EMR (radio frequency electromagnetic radiation) is known to disrupt cognition and permanently affect brain function? "

Lushchak et al. [have] reported that EMR exposure may firstly produce the free radicals in the brain and later they are converted to ROS [Reactive Oxygen Species]. The elevation of ROS level can attack various biomolecules in the cell. The raised ROS can also in turn trigger calcium release, and then activate the genetic factors leading to DNA damage." <https://www.frontiersin.org/articles/10.3389/fpubh.2021.691880/full>

If you are in any doubt such biological effects can exist from RF EMR consider "Leach et al. analyzed 2,653 papers captured in the database examine the bioeffect outcomes in the 300 MHz–3 GHz range [**the range in which radar operates**]. The results showed three times more biological "Effect" than "No Effect" papers. <https://www.frontiersin.org/articles/10.3389/fpubh.2021.691880/full>

In relation to the roll out of radar, what government or corporate body has a duty of care to motorists to ensure their safety really is being protected?

The introduction of technology that can clearly cause biological issues and impair cognition is not acceptable, and someone/agency in the government has a duty of care to protect motorists. If it isn't National Highways, then please can you identify the authority that does?

Which MPs or MP has a duty of care to the public to protect their health interests?

Can you also clarify if the aforementioned lack of a "duty of care" apply specifically in the case of Highways England/National Highway regarding the publicised hard shoulder accidents that landed the agency in court, or is it also applicable to the deployment of radar technology?

If so, how can National Highways be trusted to have the public's health at heart, if in reality it appears not liable if anything goes extremely wrong, which we know it can?

A lot can go wrong – especially if relevant risk assessments have not been carried out – by deploying radar on our highways.

Exposing people to radar is nothing new?

We hear that the use of radio-frequencies is "nothing new".

Radar specifically has been used since World War II. However, not for commercial telecommunications or widespread deployment for use in public spaces such as schools, public squares, city streets or even motorways until now, with 5G and proposed radar motorway technologies. Previously radar was only used in some occupational and military settings.

These technologies, which focus on moving objects, are more useful for directing driverless vehicles and IoT.

Is the radar going to be used additionally for driverless vehicles to extend its purposes, or is the radar proposal in this case specifically for existing "road safety" applications?

Is the radar installation a type of infrastructure that will in future be replaced with larger installations to accommodate IoT purposes such as driverless vehicles and highway security applications?

If so, what projected increases in radiofrequency exposures can we expect? What is the forward plan to protect people from these exposures? Have the supposed benefits been adequately weighed against the risks?

5G, radar and safety

Most radar technologies operate between 400mhz and 36 Ghz and with 5G deployments covering the same frequency ranges as radar there are rightfully significant safety concerns.

These concerns have led some countries such as Switzerland and Belgium to override ICNIRP RFR exposure guidelines (which inform the UK, US and Europe's official stance on 5G and public exposure levels).

Switzerland and Belgium have already imposed precautionary measures as part of risk management put in place to protect the public, and the environment.

In the UK we have enacted no such precautions or provisions even though the 5G technologies still raise many safety questions. Radar and 5G systems both use millimetre waves, and these evidently pose a risk to human health, affecting individual health to different degrees.

Certainty and uncertainty

What is certain about RFR and millimetre waves is that they are man-made pulsed frequencies that change cellular structure, composition, and activity. In this way RFR influence the health of plants, animals and humans exposed to RF frequencies, which are man-made propagations of modulated, pulsed energy not harmonious with the naturally occurring electromagnetic fields that interact with organic bodies like the Schumann resonance.

Millimetre waves penetrate the skin, the body's biggest organ by 1 mm depth, but this is still significant because you can fit a lot of cells in 1 mm and there are blood vessels, follicles and glands that absorb millimetre waves.

Millimetre waves are being used to scan the human body in security technologies, while pulsed electromagnetic fields penetrate deeper into the body. There is scope for both to cause damage, and effect public health, especially with prolonged exposure and the densification of transmitters in the roll out of 5G. <https://www.sciencedirect.com/science/article/abs/pii/S0013935118300161?via%3Dihub>

With regards millimetre waves being absorbed in the blood, the effects vary from person to person and the frequency range: "At 42 GHz effects on human blood cells depended on the dose radiation and on the "individual peculiarities of donors of the blood cells" (study from 1998, provided in link). Scientists agree further "research on physiological effects of millimeter-waves on skin, and its impact on the physiology of the whole human body, is urgently needed."

<https://betweenrockandhardplace.wordpress.com/2019/05/31/leszczynski-brief-opinion-on-5g-and-health/>

There is key information on millimetre waves here: <https://www.saferemr.com/2017/08/5g-wireless-technology-millimeter-wave.html> "Thermal (or heating) effects occur when the power density of the waves is above 5–10 mW/cm². Such high-intensity MMWs act on human skin and the cornea in a dose-dependent manner—beginning with heat sensation followed by pain and physical damage at higher exposures. Temperature elevation can impact the growth, morphology and metabolism of cells, induce production of free radicals, and damage DNA."

Human exposure to RFR and sensitivity

Millimetre waves and electromagnetic fields are causing electro-sensitivity and electro-hypersensitivity (ES, EHS), resulting in physical and mental discomfort to the afflicted.

"In 2011 the Council of Europe addressed the issue of Electro-hypersensitivity (EHS) in Resolution 1815. It decreed that ALARA (As Low As Reasonably Achievable) zones should be set up so that Electro-hypersensitive people could have a tolerable environment in which to live and recuperate."

In recognition of ES, EHS, will there be designated areas where motorists afflicted with the condition will be free from being exposed to RFR?

The electrosensitive continue to be marginalised and discriminated against forcing many seek legal advice and bring their cases to court.

An appeal in 2020 saw a claimant successfully win an “Appeal for Universal Credit on the grounds of Electrohypersensitivity. She submitted widely collated medical evidence and had the support of her GP and Neurologist.” <https://www.radiationresearch.org/wp-content/uploads/2020/02/Press-Release-3-Feb-2020.pdf>

Making motorways zones of increased and prolonged electromagnetic exposures is a health issue, both an occupational one and in terms of a huge number of people using the highways and being exposed to radiofrequency radiation. RFR is a health issue leading to discrimination against the electrosensitive, and this may have implications for any occupational health issues that arise, ie, health conditions arising and them being taken seriously as adverse effects from RFR.

Do National Highways have a commitment to be keeping all people safe, recognise RFR is a health issue, and have protections in place for everyone including the electrosensitive?

Risk management should be key

A paper called “Risks to Health and Well-Being From Radio-Frequency Radiation Emitted by Cell Phones and Other Wireless Devices” can be accessed here which explains and shows why National Highways should have a duty to mitigate public exposures to RFR forms radar, stimuli like millimetre waves, and other RFR: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6701402/>

Risk management is key. A good business assesses the risks before making any decision, and matters of public health are very serious in this regard. There are many potential risks with millimetre waves.

National Highways should reconsider deploying radar and other millimetre wave technology, especially as “few studies have examined prolonged exposure to low-intensity MMWs, and no research...has focused on exposure to MMWs combined with other radiofrequency radiation.”

It is already clear millimetre waves cause cellular changes. They are used therapeutically for this reason. They can have both positive and negative results. Therapeutic exposures are controlled and limited. Exposures on highways is a different context, just like at airports it is different. Exposures causing biological changes should be of huge concern, not just for human beings but the wider environment.

With regard to radar/millimetre waves affecting the environment it is known millimetre waves affect microbes such as bacteria.

In a study “MMW affected Escherichia coli and many other bacteria, mainly depressing their growth and changing properties and activity. These effects were non-thermal and depended on different factors. The significant cellular targets for MMW effects could be water, cell plasma membrane, and genome....The consequences of MMW interaction with bacteria are the changes in their sensitivity to different biologically active chemicals, including antibiotics....These effects are of significance for understanding changed metabolic pathways and distinguish role of bacteria in environment; they might be leading to antibiotic resistance in bacteria.” <https://www.saferemr.com/2017/08/5g-wireless-technology-millimeter-wave.html>

“**In sum**, the peer-reviewed research demonstrates that short-term exposure to low-intensity millimeter wave (MMW) radiation not only affects human cells, it may result in the growth of multi-drug resistant bacteria harmful to humans.”

Clearly there are biological effects from millimetre wave exposures worthy of concern, and as radar is being proposed by National Highways to help people “feel safe”, that doesn’t sound the same to everyone, especially when it is apparent RFR exposures from radar of 5G can be far from safe.

Feeling safe or being safe? That is the question

"Feeling safe" is a term in this context that would not be applicable to electrosensitive people because National Highways are actually creating a significant obstacle to travel, with radar and millimetre waves, which 5G smart motorways use.

Electro-sensitivity is a growing health condition, around even before 5G and electrosensitive people have a right to travel just like everyone else, and this needs to be recognised, especially in this case. <https://www.es-uk.info>

Lloyds of London and the evidence

Lloyds of London in their risk assessment of RFR considered RFR a pollutant like asbestos. Exposures to RFR are causing health issues including chronic diseases. This is happening, has been happening for a long time, and is likely to increase because densification of telecommunications infrastructure and resultant electro-smog are increasing.

Consequently Lloyds will not insure against harm from RFR. That is how sure they are, after looking at the available scientific evidence back in 2010, showing that RFR exposure will potentially be the cause of major public health issues. <https://assets.lloyds.com/assets/pdf-emf-final-november-2010/1/pdf-emf-final-november-2010.pdf>

In 2011 the World Health Organisation gave RFR exposure carcinogenic status.

Lloyds had recognised there are thermal and biological effects in its examination of the scientific literature.

International Commission on Non-ionising Radiation Protection (ICNIRP): Problems

In Europe and at home the problem of using ICNIRP's exposure guidelines to evaluate health risks from RFR comprehensively and in a balanced way is recognised. In that regard they fail in highlighting known biological effects and implications from a wide body of evidence.

ICNIRP conservatively focus on thermal effects, which is not sufficient for taking account of or in assessing possible harm from RFR exposures. If National Highways are using ICNIRP guidelines to gauge the risks to human health, this would be wholly inadequate for protecting the public from exposures to radar and 5G on the highways. Smart motorways are arguably not safer than conventional motorways, and currently there are many reasons. If ICNIRP guidelines are used for any risk assessments, this is another aspect of smart motorway safety we should scrutinise and question, and ultimately resolve.

The sensible scientific consensus is, if thermal and biological effects are to have equal relevance in any discussion about health and RFR, then we need independent scientific advice. Oncologist Lennart Hardell, like many scientists has stated: "For really independent scientific advice we cannot rely on ICNIRP." <https://lennarthardellenglish.wordpress.com/2020/07/20/icnirp-guidelines-conflicts-of-interest-and-eu/>

ICNIRP: Problems and failures

ICNIRP guidelines focus on specific thermal effects and not biological or non-thermal effects arising from RFR exposures. That is a reliable snapshot of the main problem.

Thus, in using those guidelines to make health decisions a large body of supporting science becomes ignored, which isn't helpful in helping governments act on the RFR health risk.

Governments making any meaningful decisions about public health in this regard should be taking into account all of the known risk factors and available evidence.

With asbestos, and smoking the whole science, including that which was unfortunately suppressed, was finally acknowledged proving each a significant health hazard after years of industry marketing and public relations had claimed the opposite. Currently ICNIRP guidelines are an obstacle, in the UK, to the science of RFR's non-thermal effects becoming widely recognised by the public. History seems to be repeating itself and the full science needs to be acknowledged.

ICNIRP guidelines can be said to have had a devastating effect on public health and continue to do so through misapplication and abuse. This is widely recognised and has been legally acted upon because people are already suffering ill health as a result.

This is a situation that many scientists knew would come, and the situation Lloyds of London predicted by paying attention to them, and it is only a matter of time that RFR will be widely recognised for what is, an unacceptable carcinogenic environmental contaminant.

Already a clear scientific consensus exists to solidify the argument that current findings are worrisome. Further investigation of the health effects of 5G in particular is necessary. Some of 5G studies concerning signal propagation and health effects are already yielding concerning findings, which warrants precautionary measures by policy makers.

ICNIRP's guidelines are inadequate in addressing the public health risks of RFR and governments should not persist in using them as mandatory prescriptions for safety. They were never meant to be.

ICNIRP guidelines are not "prescriptions for safety" or "defensive walls"

In 2008 Paolo Vecchia, chairman of ICNIRP at the time, stated the guidelines are not "Mandatory prescriptions for safety" or "The "last word" on the issue" or are "Defensive walls for Industry or others". Yet that is largely how we see them being used and applied by industry and governments. https://www.radiationresearch.org/wp-content/uploads/2018/06/021145_vecchia.pdf

Legal action against governments using ICNIRP guidelines as "defensive walls"

Reputable Legal teams see these guidelines are being abused to support an unimpeded roll out of 5G in ways that can potentially harm the public and cause irreversible effects. Governments are facing legal action on a global scale over the 5G roll out and safety issues with measurable success: Please see: <https://childrenshealthdefense.org/seeking-justice/legal/chd-v-federal-communication-commission-fcc/> and <https://actionagainst5g.org> and https://www.radiationresearch.org/wp-content/uploads/2020/01/Turin-Verdict-ICNIRP_Judgment-SUMMARY-of-the-Turin-Court-of-Appeal-9042019_EN-min.pdf

I hope that National Highways realise unimpeded roll out of 5G or radar will potentially harm the public.

ICNIRP guidelines are not a "mandatory prescription for safety" and I'd like to see National Highways take account of the biological harm that 5G and radar can cause without using ICNIRP to side line the evident exposure risks on Smart Motorways.

ICNIRP guidelines are exclusively and stringently employed by UKHSA today to advise the UK government ONLY giving weight to thermal effects of RFR and unfortunately by focusing on thermal effects exclusively, we see the "harmful effects at lower non-thermal intensities" having little meaning for policy makers. UKHSA must realise that using ICNIRP guidelines as "mandatory prescriptions for safety" and "defensive walls" puts an ever-greater number of people at risk from exposure to man-made electromagnetic frequencies, especially now as 5G coverage expands and radar is being introduced as a road safety tool.

Please can you offer assurance that RFR risks on our highways will be comprehensively addressed and a report made available taking account of the full evidence that RFR causes harm and that harm is being sufficiently mitigated to create an inclusive motorway environment that is optimally safe?

Inclusive motorways that are safe for all

It is important that governments and industry do not continue to neglect the existence of electro-sensitivity symptoms and recognise electrosensitivity (ES) as a functional disability arising from RF and make available places where ES sufferers can avoid being exposed to RFR. This is sensible and would also make provisions for other vulnerable people who want to avoid exposure.

In Sweden "electro-sensitivity, also known as microwave syndrome, is not discriminated against.

ES is more common than we thought and through being misdiagnosed or "denied", can only harm the victims further. With an unimpeded roll out of 5G and radar technologies in the UK it is important to recognise the

value of spaces where people can avoid exposures and make a choice to protect their health. National Highways can play a role in making this happen. making an environment where people are constantly exposed is not acceptable and increases the possibility of health problems and ES continuing to be growing issue.

Lennart Hardell, an oncologist from the Research Foundation Environment & Cancer and Mona Nilsson from the Radiation Protection Foundation have shown from their study of a 5G apartment roof installation in 2022 that 5G RF emissions caused residents to suffer microwave syndrome (a.k.a. Electrohypersensitivity or EHS) from a significant increase in microwave radiation. <https://www.stralskyddsstiftelsen.se/2022/02/22/forsta-studien-av-effekter-av-5g-stralning-pa-manniska-visar-att-5g-orsakar-mikrovagssyndromet/>

Problems with signal propagation and exposure levels

Already pulsed electromagnetic frequencies in our environment from wireless equipment and telecommunications installations relaying data via an ever increasing network of transmitters is producing powerful and unpredictable propagations of energy contributing to what scientists have come to call “electrosmog”. With 5G and radar we can expect “unpredictable propagation patterns that could result in **unacceptable levels of human exposure to electromagnetic radiation.**” The **Scientific Committee on Health, Environmental and Emerging Risks** (SCHEER), which provides scientific advice to the European Commission, have said this aspect of 5G will, “present us with a real problem as far as health is concerned...” [https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA\(2019\)631060_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf)

It is Lennart Hardell’s professional view as a renowned oncologist studying the effects of 5G and pulsed electromagnetic fields that, “the issue on RF radiation risks is ongoing and in fact increasing despite decades of research showing adverse effects on human health, plants, insects and birds.” https://multerland.files.wordpress.com/2021/02/lost_opportunities_for_cancer-prevention_historical_evidence_hardell_carlberg.pdf

It is clearly of vital importance policy makers recognise the carcinogenicity of RFR. As James Lin, former ICNIRP board member says ““The time is right for the The International Agency for Research on Cancer (IARC) to upgrade its previous epidemiology based classification of RF exposure to higher levels in terms of the carcinogenicity of RF radiation for humans.” <https://ehtrust.org/science/whoiarc-position-on-wireless-and-health/>

Protecting human health and the environment

I hope National Highways can appreciate why there is so much public concern over RFR exposures and over the continued roll out of technologies, like 5G and the proposed radar that is meant to save lives, but can be shown to be harm health, and have the opposite effect of what National Highways are perceived to be doing in its intent to make people “feel safe”. It might make people “feel” safe, but can radar really be **called safe**?

RFR is clearly a health concern and for some who are very sensitive a form disability that is set to increase if measures aren’t taken to mitigate harm from RFR.

You can access studies about the vast number of known biological effects here: <https://www.5gfrequencyfreefairbanks.org>.

23,000+ studies are linked here: www.EMF-portal.org.

Over 4000+ studies can be found here: <http://www.bioinitiative.org>.

Clearly no-one can say there is a lack of data, and a realistic response to safeguarding public health is urgently required, on our highways and beyond.

RF emissions are endangering public health but also the environment.

To call RFR an environmental pollutant would be accurate because, it is not natural electromagnetic energy as we'd expect to find in nature, it is modulated and pulsed energy, and still many of the effects haven't been studied but enough certainly have to warrant extreme caution, especially if you are claiming to use them to make people "feel safe".

The World Health Organisation, who have monitored the health effects of man-made pulsed electromagnetic fields have recognised the potential of this **2B category carcinogen** to cause harm.

RFR can cause varying biological changes through brief or sustained exposures as studies show.

We are increasingly seeing symptoms of illness from RFR, generally recognised as electro-sensitivity, the impacts of which the government should acknowledge and actively mitigate.

Radar technology is a phased array technology sending out powerful electronically modulated pulsed radio-frequencies, and 5G is essentially the same technology, using beam-forming and phased arrays and generating modulated electromagnetic fields in new propagations and configurations. The complex interacting factors of this new technology and their implications for health as a progressing mix of old and new RF technology remain a priority to study and address.

Already we have seen reports showing concerns over safety around 5G and citizen safety at airports.

Recently "The 10 biggest US airlines have warned that the impending switch-on of 5G mobile phone services will cause "major disruption" to flights." <https://www.bbc.co.uk/news/business-60036831> British airways and "Air India, Japan-based ANA, Japan Airlines, and Korean Air." All followed suit. <https://www.itv.com/news/2022-01-19/why-airlines-including-ba-and-emirates-are-cancelling-us-flights-over-5g-fears> Concern is over 5G interfering with C band radar navigation having implications for passenger safety and British airways remain so concerned that the situation is "under constant review." Does it make sense to increase the possibilities of radar interference even more by installing it on motorways? "There is a major risk that **5G telecommunications systems in the 3.7–3.98 GHz band** will cause harmful interference to radar altimeters on all types of civil aircraft."

Is installing radar on highways really the best solution for National Highways to keep people "safe", especially on roads near airports or near residential areas? Radar is one of the reasons radiation at airports is so high. Why do we have to make the highways high in radiation also?

It is known that flocks of birds and swarms of insects as well as atmospheric conditions and environmental structures including trees, buildings and infrastructure can interfere with radar. <https://www.pagerpower.com/news/radar-interference-2/>

National Highways have said "We may need to cut back some vegetation to ensure the radar units can see the road, but we will keep this to a minimum and we don't expect to have to remove any mature trees."

"Don't expect" does not mean "won't".

I hope National Highways will consider the evidence of harm from RFR and never be in a position to chop down trees. This will harm ecosystems. National Highways should consider that to put in place infrastructure that can harm humans and the environment, and contradict many of the government's environmental policies doesn't seem like an effective way to keep people safe. It is more likely to have wider repercussions.

National Highways should be aware that RFR studies have found "in plants reduced growth, increased infection and physiological and morphological changes" (Balodis et al. 1996, Haggerty 2010, Waldmann-Selsam et al. 2016, Havas and Symington 2016, Vian et al. 2016, Halgamuge 2017). Plants and fauna are imperilled by increased RFR.

It is my understanding that **stopped vehicle detection** radar has "high-resolution radar sensors **scan 360°** and can detect stopped vehicles across **multiple lanes**, despite poor weather and lighting." Also "The system monitors traffic in real-time" which requires low latency high frequency RF signals. <https://navtechradar.com/explore/stopped-vehicle-detection/> Both 5G and radar are phased array

technologies. 5G comprises MIMO and Massive MIMO propagation of signals incorporating millimetre wave into the existing mixture of frequencies. The interactions of MM wave and other frequencies can be unpredictable and has an uncertain impact on health, though certain biological impacts are known.

If you are exposing travellers of all ages to increased RFR can you please provide a helpful breakdown of the corresponding risk management for each age range with regards RFR exposure and the reasoning behind your mitigation measures?

Please can these findings be made accessible to the public for reference?

Because millimetre wave technologies are controversial it is vital National Highways assess the risks sufficiently to protect citizens' health from RFR exposures, and other possible effects, to be able to make a safe environment for all.

In deploying radar/millimetre waves/5G National Highways must be aware that use of millimetre waves for widespread deployments and continuous exposures are not adequately studied in context, in terms of assessing human safety for adults, children, elderly people or pregnant women and babies, all of whom will be travelling on your motorways.

What is your data on long term exposures to millimetre waves of the kind being used on highways? What measures are you taking to keep people safe?

Millimetre waves can create biological effects which don't fall into the remit of aforementioned ICNIRP guidelines which measure only thermal effects. So this is very concerning, to think that much health data isn't being considered because of ICNIRP's narrow criteria of measuring only thermal effects. ICNIRP's guidelines, to my understanding, do not cover millimetre wave propagations in light of the novel propagation technologies and novel measurement systems required to gauge exposures.

What guarantees will you be providing to citizens that their health is being protected in terms of thermal and non-thermal effects?

Beyond the concern over health for humans from infrastructure using radar technology under the umbrella term "5G roll out", there has been persistent concerns about the impacts on wildlife and the environment.

With regards radar, 5G and millimetre waves, here is the issue of vegetation attenuation: https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.833-10-202109-I!!PDF-E.pdf Concerning exposures of trees and vegetation to sustained RFR A Dutch study has revealed "After a few months, trees exposed to the radiation displayed a "metallic lustre appearance, a discolouration of the leaves that appeared to result in the disappearance of the outer cell layer of the leaves". <https://www.siliconpublic.com/science/could-wi-fi-radiation-be-killing-trees>

Again, you will notice these are non-thermal effects from RFR, and these are of many kinds affecting humans and wildlife.

Scientists know RFR can have damaging effects on birds eggs, nesting, breeding, roosting. Smaller animals and humans are more vulnerable, in different ways as this article explains scientifically: <https://citizensfor5gawareness.org/2020/01/03/effects-of-wireless-radiation-on-birds-and-other-wildlife/>

RFR exposure studies show "**in birds, aggressive behavior, impaired reproduction and interference with migration** (Southern 1975, Larkin and Sutherland 1977, Balmori 2004, Balmori and Hallberg 2007, Everaert and Bauwens 2007, Fernie et al. 2010, Engels et al. 2015, Wiltschko et al. 2015). **In honey bees, aggressive behaviour, reduced learning, reduced productivity, swarming and abandoning hives** (Harst et al. 2006, Pattezhy 2009, Warnke 2009, Favre 2011, Kumar et al. 2011, Sahib 2011, Shepherd et al. 2019). In rodents, increased cancer risk in three long-term studies (Chou et al 1992, NTP 2018, Falcioni et al. 2019).

Non-thermal effects: Problem on a massive scale

To protect wildlife and the Highway environment from millimetre waves and other RFR, how they will be propagated, and how the propagations are being measured? What guarantees can National Highways give that our wildlife is being protected from excessive radiation that disrupts normal functioning of animals and fauna?

Insects are particularly vulnerable to RFR and pulsed electromagnetic fields that are produced by radar/millimetre waves: <https://www.nature.com/articles/s41598-018-22271-3> Such frequencies "lead to changes in insect behaviour, physiology, and morphology over time due to an increase in body temperatures, from dielectric heating. The studied insects that are smaller than 1 cm show a peak in absorption at frequencies (above 6 GHz)".

An extensive set of scientific literature on the effects of RFR on insects can be accessed from this article: <https://thepulse.one/2021/12/31/5g-other-wireless-radiation-is-destroying-bees/>

The non-thermal effects of pulsed RF are equally as important if not more so than measuring the thermal effects, and as such, no consensus about 5G being safe has been reached. 5G uses the 3.7 to 3.98 GHz band the same as aircraft radar systems, with which it can interfere. We are seeing a mixture of military technologies being ethically washed as safe and we need the facts about what people are being exposed to. National Highways cannot call radar and the interaction of multiple sources and emissions of RFR constituting a safe environment for all.

Do the benefits outweigh the risks?

The benefits of introducing radar and expanding 5G coverage on motorways do not outweigh the risks on a full inspection. A full risk assessment is necessary, made available for public perusal. If National Highways does not have a duty of care, as was suggested in recent legal action, how can it be trusted to keep people safe? Promoting radar and 5G and increasing millimetre waves on the highways represents a persisting health hazard unnecessarily endangering lives, and causing damage to the environment, and further, National Highways appears prepared to cut down trees to assist radar and signal propagation, which will result in birds, insects, and other animals being behaviourally affected, and assist in species decline.

It is not correct to say the roll out of either radar or 5G is safe. It is far from safe, and in light of the science, the precautionary principle is a necessary means for policy makers to intervene.

There is a full moral imperative to do so, and that should be clear, especially when the science is far from clear about the safety of 5G.

It is easy to make people "feel safe", as National Highways wants to do, but it is even more important that they are in fact safe.

I hope National Highways and contributions from MPs can answer questions I have raised and the UK government will make effective plans, in light of the irrefutable evidence that RFR is a contaminant and health hazard. Steps need to be urgently taken to truly make people and the local environment **safer for all**.

I hope I have presented my concerns clearly. If anything isn't clear I am happy to help or provide more information.

I have already written to the government about RFR issues arising from current policies and you can read that letter here for more information: <https://safetechinternational.org/open-letter-to-uk-parliament/>

I very much look forward to hearing your feedback on this matter,

Yours sincerely,

SEAN CARNEY