ECC-45-365-REP-7-D

ENVIRONMENTAL SCOPING REPORT

PROPOSED CONSTRUCTION OF A BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE FOR PARATUS TELECOMMUNICATION (PTY) LTD ON ERF 361 IN BRAKWATER WITHIN THE KHOMAS REGION, NAMIBIA.

Prepared for

FEBRUARY 2022

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EXECUTIVE SUMMARY

Paratus Telecommunication (Pty) Ltd (herein referred to as Paratus or the proponent) is a multinational organisation and has established telecommunication services across Africa over 15 years. Paratus proposes to construct a Base Transceiver Station and associated infrastructure on Erf 361 in Brakwater which lies to the north of Windhoek within the Khomas Region. The proponent believes that owning its telecommunications infrastructure is crucial to the delivery of the quality of service that matches the demands of its customers. The proposed project will improve, develop, and promote effective information sharing by expanding network coverage, which will provide telecommunication services to the targeted society.

The proposed project triggers listed activities listed in the Environmental Management Act, No. 7 of 2007 and Environmental Impact Assessment (EIA) Regulations, No. 30 of 2012, thus it requires an EIA to be conducted to obtain an environmental clearance certificate. An environmental scoping report, environmental and social impact assessment (ESIA) report with Environmental Management Plan (EMP) will describe the detailed baseline conditions for reference, potential environmental and social impacts with assessment and permit conditions or commitments (EMP), which will be adhered to by the proponent. The reports will be submitted to the competent authority as part of the decision-making process. The ESIA was undertaken using a methodology developed by Environmental Compliance Consultancy (ECC) based on the International Finance Corporation (IFC) standard for environmental and social impact assessments and is fully aligned with Namibia legislation. Through the scoping process, a review of the site and surrounding environment was completed by undertaking desktop and literature reviews.

This assessment has evaluated the potential environmental and social impacts, that could possibly occur during the various phases of the proposed project. Through the process, it was determined that various of the potential impacts were not deemed significant due to the small magnitude of change from the baseline environment; the short duration of potential impacts; and the reversibility of effects once installation activities end. Activities with regards to employee's health and safety, visual disturbances and collision risks for avifauna have been identified as potentially significant impacts and should thus be carefully managed according to the EMP, national legislation and best practice methods to minimize and control these potential impacts as far as reasonably possible.

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ABBREVIATIONS

Abbreviation	Description
BTS	Base Transceiver Station
DEA	Directorate of Environmental Affairs
ECC	Environmental Compliance Consultancy
ECNS	Electronic Communications Network Service
ECS	Electronic Communications Service
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFC	International Finance Cooperation
I&APs	Interested and Affected Parties
MEFT	Ministry of Environment, Forestry and Tourism
MICT	Ministry of Information and Communication Technology
NCAA	Namibian Civil Aviation Authority
RF	Radio Frequency
WHO	World Health Organization

1 INTRODUCTION

1.1 BACKGROUND OF THE PROPOSED PROJECT

Paratus Telecommunication (Pty) Ltd, (herein referred to as Paratus or the proponent) is a multinational organization and has established telecommunication services across Africa over 15 years. Paratus is always prepared, and to meet the mobile services (voice and data) users' demand throughout Namibia, the proponent proposes to construct a Base Transceiver Station (BTS) and associated infrastructure on Erf 361 in Brakwater which lies to the north of Windhoek within the Khomas Region (Figure **1**). Paratus considers that installing, owning, and using its own infrastructure is crucial to the delivery of and compliance with the rigorous quality of service demands of its customers. The proposed project will improve, develop, and promote effective information sharing by expanding network coverage, which will provide telecommunication services to the targeted receptors/community. Furthermore, with the current population increase in urban areas the telecommunication service has experienced tremendous growth in terms of users, prompting advances in technology from 2G to 4G and LTE networks within the proposed area. 5G is not within the current scope and the potential future deployment will be dealt with as an independent project with its own applications for approvals. At this stage, Paratus has no intention to deploy 5G network in the short term.

Namibia is one of the African countries that fully support information and communication technology development; as such the government has encouraged the modernization of the global, market-related telecommunication service technology. In recent years, this led to Telecom Namibia constructing a fibre-based network to connect the central government to the administrative capitals of all regions in the country, in order to support the government efforts towards effective telecommunication service delivery to the wider public. There is substantial growth in the number of telecommunication service users, especially with mobile communication, which supports and improves the socio-economic growth in the country. For Paratus, the need to increase capacity and improve service with the installation of a new BTS designed to meet the growing mobile demand with fast and reliable network coverage is obvious.

The proposed project requires an Environmental Impact Assessment (EIA) to be conducted as stipulated in the Environmental Management Act, No. 7 of 2007 and its regulations, to obtain an environmental clearance certificate. As such, an environmental scoping report and EMP will describe the detailed potential environmental impact assessments and conditions or commitments, which will be adhered to by the proponent. The scoping report and EMP will be submitted to the competent authority as part of the decision-making process.

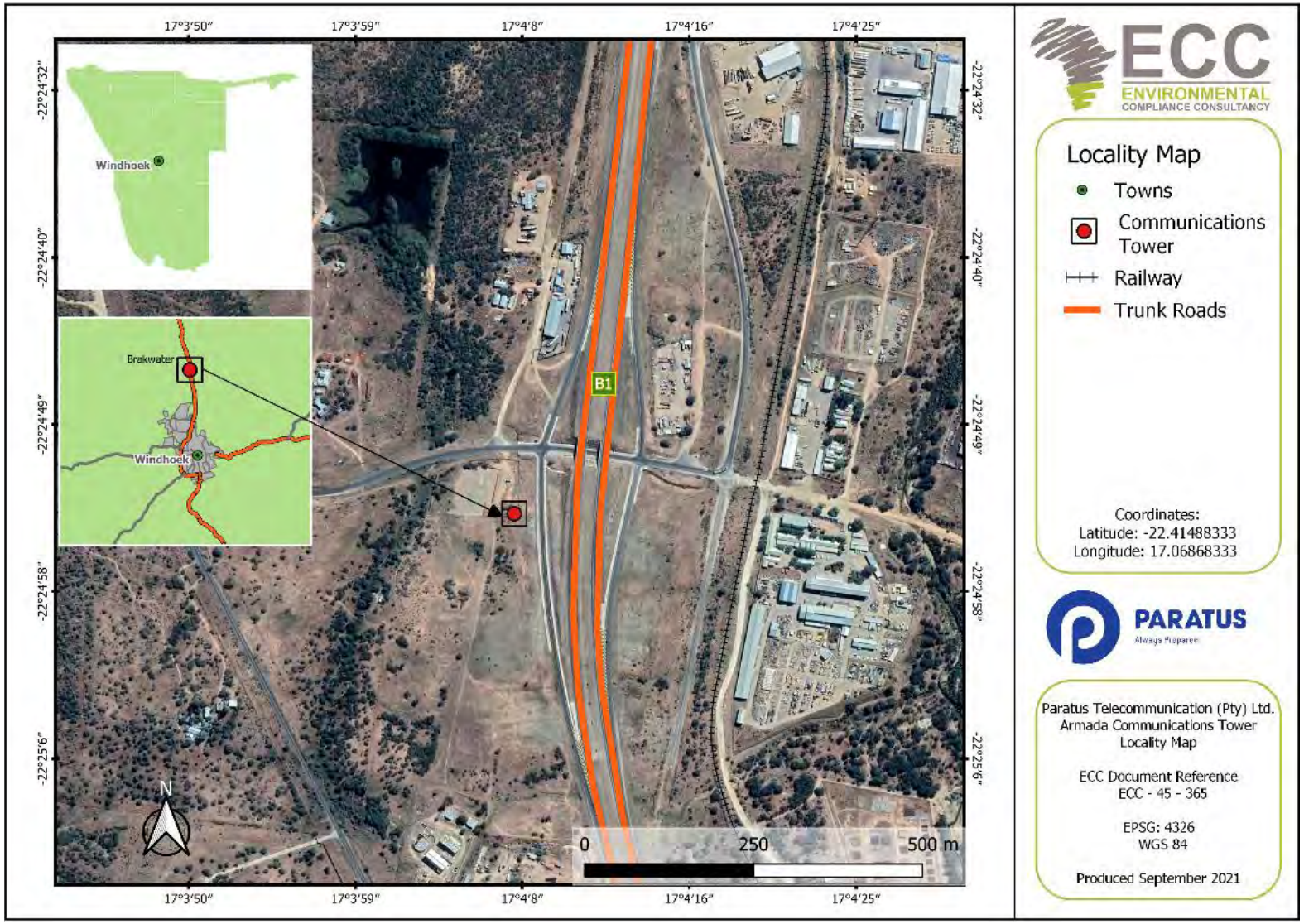

Figure 1: Showing the proposed location for the base transceiver station

1.2 PURPOSE OF THIS REPORT

Environmental Compliance Consultancy (ECC) has been appointed by Paratus Telecommunications (Pty) Ltd to undertake the ESIA for the proposed construction of the BTS and associated infrastructure. This report will present the findings of the ESIA for the proposed construction of the BTS and associated infrastructure. It has been undertaken in terms of the requirements of the Environmental Management Act, No. 7 of 2007 and the EIA Regulations (No. 30 of 2012). This scoping report, plus assessment and appendices will be submitted to the Ministry of Information and Communication Technology (MICT) and the Directorate of Environmental Affairs (DEA) at the Ministry of Environment, Forestry and Tourism (MEFT) for review as part of the application for an environmental clearance certificate.

This scoping report and EMP will address possible impacts, explore alternatives, develop technical recommendations and mitigation measures for the proposed construction of the BTS and its associated infrastructure.

ECC has identified potential environmental impacts through a project-specific environmental impact assessment, and suggested mitigation measures for the proposed project, as discussed within this report. To address these potential impacts, considering that the proposed site is located within an already disturbed footprint and Paratus will use previously assessed technology, further specialist studies were not deemed necessary. A desktop study was conducted to identify areas of potential concern and propose mitigation measures to prevent environmental harm.

1.3 ENVIRONMENTAL LEGAL REQUIREMENTS

The Environmental Management Act, No. 7 of 2007 stipulates that an environmental clearance certificate is required to undertake listed activities in terms of the Act and its regulations. Listed activities in the Act triggered by the proposed project are as follows (Table 1):

Table 1: Listed activities and relevance to the proposed project

LISTED ACTIVITY	ESIA SCREENING FINDING
INFRASTRUCTURE **10.1** The construction of: (g) Communication networks including towers, telecommunication, and marine telecommunication lines and cables. (j) masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission.	Construction of a base transceiver station and associated infrastructure. High-Performance Point-to-Point Microwave Antenna and Panel antenna will form part of the tower.

1.4 The Proponent of the Proposed Project

Paratus Telecommunication (Pty) Ltd was founded in 2005, as the first privately and 100% wholly owned Namibian telecommunications operator. Paratus holds both a Class Comprehensive Telecommunications Service License (Electronic Communications Service (ECS) and Electronic Communications Network Service (ECNS)) and a Broadcasting Service License for Signal Distribution, thus becoming the first telecommunications operator able to fully provide converged services in Namibia. The proponent can provide national telecommunication network services through aggregated partner networks to offer a full end-to-end service to its customers. In Namibia, currently, Paratus has various access technologies such as Fiber, Microwave, Fixed LTE and Mobile LTE for customers. As such, customers can be assured that the network is stable, reliable and has the ability to not only scale with capacity but also provide redundancy, disaster recovery and route diversity to ensure maximum uptime. The contact details for the proponent are listed in Table 2.

Table 2: Contact details of the proponent

CONTACT PERSON	POSTAL ADDRESS	EMAIL ADDRESS	TELEPHONE
Len Franken	PO Box 81588 Olympia, Windhoek	len.franken@paratus.africa	+264851276651

1.5 Environmental Consultancy

ECC, a Namibian consultancy (registration number Close Corporation 2013/11401), has prepared this scoping report and impact assessment on behalf of the proponent. ECC operates exclusively in the environmental, social, health and safety fields for clients across Southern Africa, in both the public and private sectors. ECC is independent of the proponent and has no vested or financial interest in the proposed project, except for fair remuneration for professional services rendered. All compliance and regulatory requirements regarding this ESIA report should be forwarded by email or posted to the following address:

Environmental Compliance Consultancy

P O BOX 91193
Klein Windhoek, Namibia
Tel: +264 81 6697608
Email: info@eccenvironmental.com

2 REGULATORY FRAMEWORK

This chapter outlines the regulatory framework applicable to the proposed project. Table 3 provides a list of applicable national legislation and its relevance to the project.

2.1 NATIONAL REGULATORY REGIME

Table 3: A list of applicable national legislation and the relevance to the project

NATIONAL REGULATORY REGIME	SUMMARY	APPLICABILITY TO THE PROJECT
Communications Act, No. 8 of 2009 and relevant regulations, subject to the Regulations Regarding Licence conditions for Telecommunications Service Licences as published in Government Gazette 5037, Notice No 308, 13 September 2012	The Act provides for the regulation of telecommunication services and networks; broadcasting, postal services and the use and allocation of radio spectrum; the establishment of an independent Communications Regulatory Authority of Namibia (CRAN); to make provision for its powers and functions; the granting of special rights to telecommunications licensees; the creation of an Association to manage the internet domain namespace; and for matters connected therewith.	Paratus and the proposed BTS should comply with the Act and relevant Regulations including license conditions for telecommunication service licenses.
Labour Act, No. 11 of 2007: Regulations relating to the Health and Safety of Employees at Work (GN 156/1997).	The Act provides for the regulation of employees' health and safety in the workplace.	Employees and contractors will be working at heights and be exposed to potentially dangerous occupational hazards (i.e., electrical wiring, construction etc.). Employees should also have access to an ergonomically friendly working environment. Chapter 6.A, Section 200 also refers to exposure to non-ionizing radiation.

NATIONAL REGULATORY REGIME	SUMMARY	APPLICABILITY TO THE PROJECT
The Aviation Act, No. 74 of 1962 and Namibian Civil Aviation Regulations Part 139; and **Subparts 11 of the Namibia Civil Aviation Regulations of 2001, as amended in 2018, and the Namibia Civil Aviation Technical Standards – Aerodromes and Heliports (NAMCATS -AH).**	Provides effect to certain International Aviation Conventions and makes provision for the control, regulation, and encouragement of flying within the Republic of Namibia and for other matters incidental thereto.	Provides the regulations for setting up cellular structures e.g., on obstacle limitation and marking such as no obstacle higher than 45 m above mean level of the landing area will be erected or be allowed to come into existence, within a distance of 15 km measured from the aerodrome reference point of any aerodrome, unless the plans for such erection or coming into existence have been approved by the executive director (Appendix D).
Local Authorities Act, No. 23 of 1992	To provide for the determination, for purposes of local government, of local authority councils; the establishment of such local authority councils; and to define the powers, duties and functions of local authority councils; and to provide for incidental matters.	City of Windhoek is the responsible Local Authority that should be consulted to ensure that the proposed project is compliant with the act, its regulations and its by-laws.
Environmental Management Act, No. 7 of 2007 and its regulations, including the Environmental Impact Assessment Regulations, No. 30 of 2012	The Act aims to promote sustainable management of the environment and the use of natural resources by establishing principles for decision-making on matters affecting the environment. It sets the principles of environmental management as well as the functions and powers of the Minister. The Act requires certain activities to obtain an environmental clearance certificate before project development. The act states an EIA may be undertaken and submitted as part of the environmental clearance certificate application. MEFT is responsible for the protection and management of Namibia's natural	This environmental scoping report plus assessment and EMP documents and the findings of the environmental assessment undertaken for the proposed project, which will form part of the environmental clearance application. The assessment and report have been undertaken in line with the requirements of this Act and associated regulations.

NATIONAL REGULATORY REGIME	SUMMARY	APPLICABILITY TO THE PROJECT
	environment. DEA - MEFT is responsible for the administration of the EIA process.	
Soil Conservation Act, No. 76 of 1969	Makes provision for the prevention and control of soil erosion and the protection, improvement, and conservation, and manner of use of the soil and vegetation.	There will be minimal soil disturbance during construction e.g., trenches.
National Heritage Act, No. 27 of 2004	The Act provides the provision of the protection and conservation of places and objects with heritage significance. Section 55 stipulates that exploration companies must report any archaeological findings to the National Heritage Council after which a heritage permit needs to be issued.	The initial desktop assessment did not identify any areas of potential concern with regards to heritage. However, if any heritage sites are discovered during the project phases a "chance finder procedure" will be used.
The Atomic Energy and Radiation Protection Act, No. 5 of 2005 & Non-Ionising Radiation Regulations No. 126 of 2020.	This Act provides for adequate protection of the environment and of people in current and future generations against the harmful effects of radiation by controlling and regulating the production, processing, handling, use, holding, storage, transport and disposal of radiation sources and radioactive materials, and controlling and regulating prescribed non-ionising radiation sources.	The Act ensures protection against non-ionising radiation. The proposed BTS has the potential of emitting Radio Frequency (RF) radiation (non-ionising). The Act should be adhered to ensure that RF radiation falls within the recommended exposure limits.

2.2 International Best Practice Methods

The following documents apply to this development:

- The World Health Organization (WHO) International Electromagnetic Fields (EMF) Project
  - The EMF project aim is to assess the scientific evidence of possible health effects of EMF in the frequency range from 0 to 300 GHz
- The International Commission on Non-Ionizing Radiation Protection (ICNIRP)
  - Published guidelines on limiting exposure to EMF, to protect against all known adverse health effects, and
  - This publication resulted from a thorough review of the scientific literature and assessed all health risks to both the general public and employees.
- ICNIRP: RF EMF Guidelines 2020
  - The ICNIRP Guidelines for Limiting Exposure to Electromagnetic Fields are for the protection of humans exposed to radiofrequency electromagnetic fields (RF) in the range 100 kHz to 300 GHz.

- The International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines for Telecommunications.
    - Published Environmental, Health, and Safety (EHS) Guidelines.

2.3 PERMITS AND LICENCES

Table 4 lists the permits and licenses that are required for the proposed project.

In addition to the permits and licences mentioned in Table 4, the following form(s) has been completed for erecting a permanent structure: FSS-AGA-FORM-032 (permanent structures). The form was submitted to Namibia Civil Aviation Authority (NCAA) and approval has been obtained from the executive director for the erection of the proposed tower (APPENDIX D – NCAA LETTER OF CONSENT).

Table 4: Permits and licences required by Paratus for this project

PERMIT/LICENCE	RELEVANT AUTHORITY	VALIDITY
Class Comprehensive Telecommunications Service License (ECS &ECNS)	Communications Regulatory Authority of Namibia	5 Years
Spectrum Use Licenses	Communications Regulatory Authority of Namibia	1 Year
Broadcasting Service License for Signal Distribution	Communications Regulatory Authority of Namibia	5 Years

3 METHODOLOGY AND APPROACH

3.1 PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The ESIA process in Namibia is governed and controlled by the Environmental Management Act, No. 7 of 2007 and the EIA Regulations, No. 30 of 2012, which is administered by the office of the environmental commissioner through the DEA of the MEFT.

The purpose of the ESIA is to identify, predict, evaluate and assess, and mitigate the potential impacts of a proposed project on the natural and human environment. The scoping and baseline investigation process, ESIA process, and subsequent reports such as EMP are designed to apply the principles of environmental management to the proposed activities; reduce the negative and increase the positive impacts arising from a project.

The EIA process is also to provide an opportunity for the public to consider the environmental impacts of a proposed project through meaningful consultation, and to present the findings of the assessment process to the public and competent authorities for decision making. Furthermore, the assessment process helps to determine the spatial and temporal scope; and identify the assessment methodology which is most applicable for the specific project.

The scope of the assessment was determined through undertaking a preliminary assessment of the proposed project against the receiving environment, completed using a high-level desktop review.

3.2 THE ASSESSMENT PROCESS

The ESIA methodology applied to this assessment has been developed using the IFC standards and models, in particular, Performance Standard 1: 'Assessment and management of environmental and social risks and impacts' which establishes the importance of (IFC, 2012):

- Integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects
- Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them, and
- The client's management of environmental and social performance throughout the life of the project.

The Namibian Draft Procedures and Guidance for ESIA and EMP (the Republic of Namibia, 2008), international and national best practice documents publicly available, and over 25 years of combined ESIA experience were also drawn upon in the assessment process.

This impact assessment is a formal process in which the effects of certain types of development on the biophysical, social and economic environments are identified, assessed

and reported so that the effects can be taken into account when considering whether to grant development consent or to provide financial support.

Final mitigation measures and recommendations are based on the cumulative experience of the consulting team and the client, taking into consideration the potential environmental and social impacts. The process followed by ECC for the basic assessment is illustrated in section 6 EVALUATION OF IDENTIFIED IMPACTS.

3.3 Methodology for the Impact Assessments

ECC's methodology for environmental impact assessments was used and is based on models for environmental and social impact assessments set out by the IFC Principal 1: 'Assessment and management of environmental and social risks and impacts. The impact assessment process used for the proposed project is fully aligned with Namibian legal requirements.

Desktop studies on the national database are undertaken as part of the scoping stage to get information about the current status of the receiving environment. This provides a baseline against which changes that can occur as a result of the proposed project can be measured.

3.4 Screening of the proposed project

The first stages in the ESIA process are to register the project with the DEA/MEFT and undertake a screening exercise to determine whether it is considered as a listed activity under the Environmental Management Act, No. 7 of 2007 and associated Regulations and if significant impacts may arise from the project. The location, scale and duration of project activities will be considered against the receiving environment.

It was concluded that an ESIA (e.g., scoping report and EMP) is required, as the proposed project is considered as a Listed Activity and there may be potential for significant impacts to occur.

3.5 Scoping of the environmental assessment

The purpose of the scoping stage in the ESIA process is to identify the scope of assessment; undertake a high-level assessment to identify potential impacts and to confirm if further investigation is required; assign the severity of potentially significant effects and allocate appropriate mitigation.

This report presents the findings of the scoping phase and high-level assessment, and it confirms that no further investigation is required. This conclusion is presented in Section 6.

3.6 Baseline studies

Baseline studies are undertaken as part of the scoping stage, which involves collecting all pertinent information from the current status of the receiving environment. This provides a baseline against which changes that occur as a result of the proposed project can be measured.

The environmental and social aspects or receptors that may be affected by the proposed project are described in this section. The baseline focuses on receptors that could be affected by the proposed project.

3.7 IMPACT PREDICTION AND EVALUATION

The key stage of the ESIA process is the impact prediction and evaluation stage. This stage is the process of bringing together project characteristics with the baseline environmental characteristics and ensuring all potentially significant environmental and social impacts are identified and assessed. Impact prediction and evaluation involve predicting the possible changes to the environment as a result of the proposed project. The robust methodology was applied to determine the magnitude of impact and whether or not the impact was considered significant and thus warrant further investigation. The assessment considers all stages of the project's life cycle that is scoped into the assessment and is presented in this report. It is an iterative process that commences at project inception and runs through to the final design and project implementation (construction and operations). The impact prediction and evaluation stage were undertaken in September – October 2021 and the findings of the assessment are presented in Section 7.

3.8 ESIA CONSULTATION

Public participation and consultation are requirements stipulated in Section 21 of the Environmental Management Act, No. 7 of 2007 and associated regulations for a project that needs an environmental clearance certificate. Consultation is a compulsory and critical component in the ESIA process in achieving transparent decision-making and can provide many benefits.

The objectives of the stakeholder engagement process are to:

- Provide information on the project: introduce the overall concept and plan;
- Clarify responsibility and regulating authorities;
- Listen to and understand community issues, concerns and questions;
- Explain the process of the ESIA and timeframes involved; and
- Establish a platform for ongoing consultation.

3.8.1 BACKGROUND INFORMATION DOCUMENT

The Background Information Document (BID) presents a high-level description of the proposed project; sets out the ESIA process and when and how consultation is undertaken and provides contact details for further project-specific inquiries to all registered Interested and Affected Parties (I&APs). The BID was distributed to registered I&APs and can be found in Appendix B.

3.8.2 Newspaper Advertisements

Notices regarding the proposed project and associated activities were circulated in three newspapers namely the 'Republikein', Allgemeine Zeitung' and the 'Sun" on the 1st of November and 8th of November 2021. The purpose of this was to commence the consultation process and enable I&APs to register an interest in the project. The adverts can be found in APPENDIX C – EVIDENCE OF PUBLIC CONSULTATION.

3.8.3 Site notices

A site notice ensures neighbouring properties and stakeholders are made aware of a proposed project. The notice was set up at the proposed site as illustrated in APPENDIX C – EVIDENCE OF PUBLIC CONSULTATION.

3.8.4 Summary of Issues Raised

The main concerns raised by I&APs was the impacts with regards to health and safety risks (RF radiation), visual disturbances to the businesses/residents surrounding the site, collision risk for avifauna as a result of the man-made earth-filled dams near the proposed site (dam in a river that holds water throughout/large part of the year) and safety and security during the construction phase of the proposed BTS. There are also concerns about the effects of RF radiation on biodiversity.

A table with the questions/concerns raised can be seen in APPENDIX C – EVIDENCE OF PUBLIC CONSULTATION.

All of the concerns have been discussed or elaborated on within scoping (plus impact assessment) and EMP reports.

The scoping report and EMP have been submitted for public review from the 26th of January 2022 to the 9th of February 2022 (14 days) and comments received has been added and addressed in the table in Appendix C.

4 PROJECT DESCRIPTION

4.1 NEED FOR THE PROPOSED PROJECT

With the current population increase, the telecommunication service has experienced tremendous growth in terms of the number of users. As such, Paratus has identified the need to provide increased telecommunication services and hence improve customers' satisfaction in cellular networks, by constructing a BTS within the proposed site. Additionally, the proposed site has the preferred topography with no significant land-use problems which are unlikely to limit the network coverage optimization efforts. The BTS is the most important element in the network as they provide a physical connection to mobile devices.

4.2 ALTERNATIVES CONSIDERED

The tower was strategically selected to be constructed on the same property as the Paratus data centre on Erf 361 in Brakwater Khomas Region, Namibia. An alternative site along the airport road was considered for the data centre but was decided against because the power provision was not sufficient, no incoming A or B fibre lines and the land pricing being too high. Alternatives closer to the city was also not an option as land and power prices were found to be too high as well, thus those alternatives were deemed not feasible. The current proposed site was then selected for the data centre and was determined to also be the most feasible option for the communication tower.

4.2.1 NO-GO ALTERNATIVE

The option of not constructing a new BTS would mean that Paratus will not be able to supply telecommunication services to cater for the increased demand for network coverage around the proposed site. As a result, poor reception and/or no network access for mobile phone users would continue to occur. In that regard, the "no-go alternative" is not preferred, and as such, the project could positively contribute to economic growth and other development by providing market-related, fast, and reliable telecommunication services with minimal negative impacts.

4.3 PROPOSED ACTIVITIES

4.3.1 PROPOSED BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE

The proposed BTS will be constructed on Erf 361 in Brakwater to the north of Windhoek in the Khomas Region, Namibia. Figure 2 shows detailed design plans for the proposed BTS. The lattice tower will be 48 meters high and have a base length of 4.5 meters and a base area of 14m^2

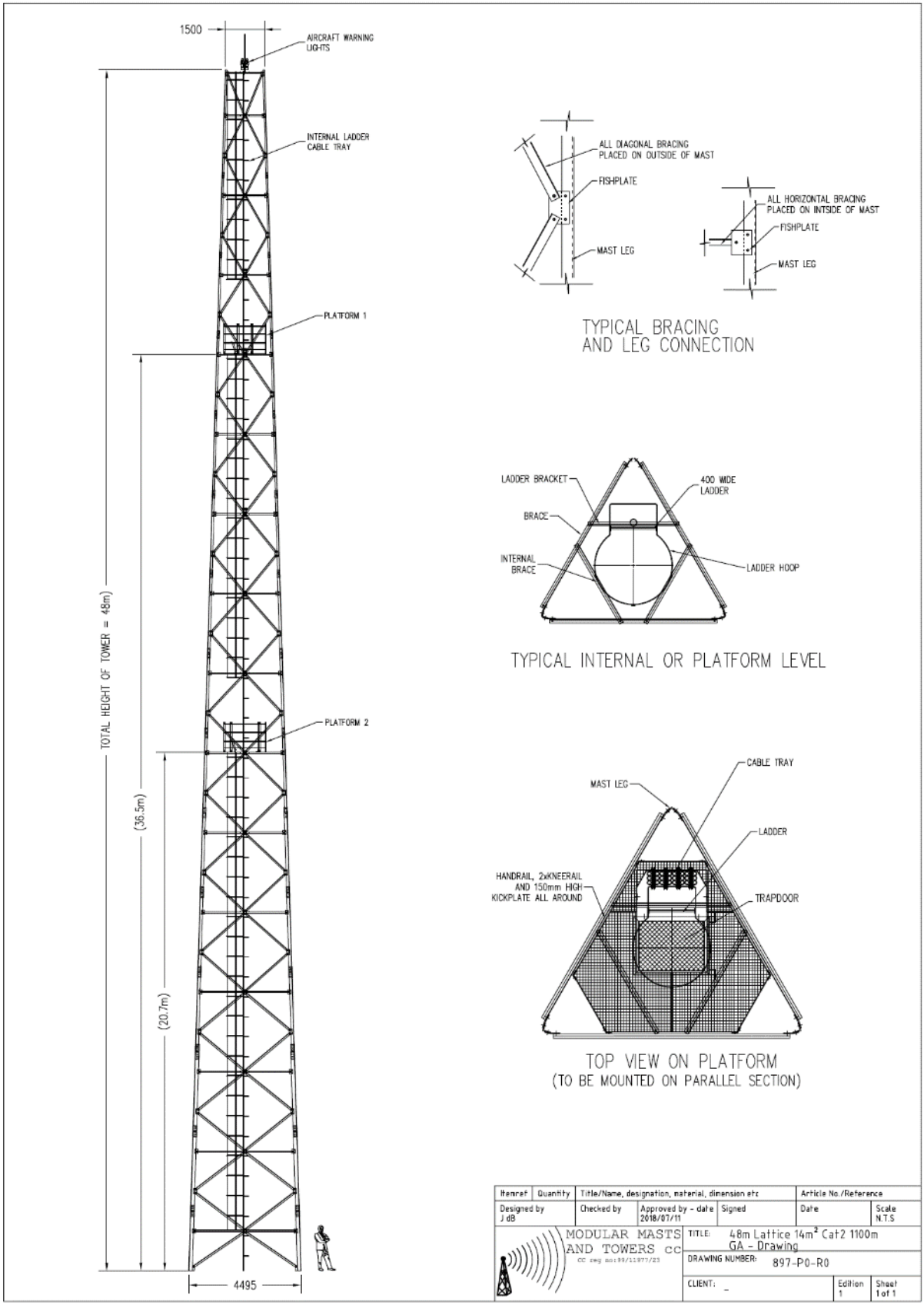

Figure 2: The communication towers specifications

4.3.2 Construction Phase

Construction of the proposed BTS is planned to start towards the end of 2022 (if the RoD is an approved ECC). The proposed construction phase will include low-impact and non-intrusive activities and will be completed within five to six weeks.

The following are envisaged during the proposed project:

- Storage and stockpiling of material for the construction of the tower;
- Construction of the tower;
- Installation of cables and wiring; and
- Commissioning of transmitters.

4.3.3 Equipment and material

Equipment and material will be stockpiled for construction in staging areas, which are located near the proposed site. The preferred BTS height will be 48 meters to provide 100% transmission and reception of telecommunication service signals. The typical BTS equipment would include 3G Access Power Solutions-APS6-400 Series, High-Performance Point-to-Point Microwave Antenna, FibeAir IP-20G Radio, Panel antenna and AirHarmony 4000/4200/4400. Delivery of construction material and equipment will require light-to-heavy transport vehicles, but no abnormal or hazardous loads will be used. Construction vehicles are to make use of the existing roads to transport equipment and material to the site.

4.3.4 Workers and accommodation

The construction work of the proposed BTS and associated infrastructure will be outsourced to local specialised contractors (Namibian registered and owned companies) with existing workforces. Five permanent employees from Paratus will also form part of the erection/construction and maintenance of the proposed BTS.

4.3.5 Resource use and waste management

All waste that will be generated on-site, including general household waste, timber (pallets, paints and electrical solvents from construction etc.) and plastics will be disposed of in the nearest appropriate dumping site i.e., Rent-A-Drum skip removal or similar companies in Windhoek. Waste will be disposed of at the Kupferberg landfill site. There are no hazardous materials or wastes expected as part of the project construction and operation.

No hazardous materials or hazardous waste will be generated/used during construction, operation or maintenance of the tower.

4.3.6 Operational Phase

During operation, the BTS and associated infrastructure will require minimal intervention and maintenance. However, periodic inspections (monthly and yearly) and general maintenance of the equipment, such as rust or corrosion management will be done by the proponent.

4.3.7 Decommissioning Phase

Should the proposed BTS and associated infrastructure no longer be required, all the equipment would be removed, followed by rehabilitation and/or reclamation of the area. Alternatively, and with the agreement of interested or identified stakeholders, the BTS and associated infrastructure could remain to be leased for future telecommunication service use.

5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 INTRODUCTION

The detailed environmental and socio-economic baseline assessment of the proposed project are provided in this report. Baseline studies are a critical part of a project assessment from which impacts can be identified and assessed, whether positive, negative or cumulative. Together these data and information provide input into the project designs, which can be advanced or refined to avoid, reduce, or mitigate the potentially adverse environmental and social risks. This section provides an overview of the existing biophysical environment through the analysis of the available baseline data regarding the receiving environment. Desktop studies, followed by site verification on the national database are undertaken as part of the scoping process to get information about the current status of the receiving environment. This provides a baseline against which changes that occur as a result of the proposed project can be measured.

5.2 PROJECT SITE LOCATION AND SURROUNDING ENVIRONMENT

The proposed project is located in Brakwater (north of Windhoek, Khomas Region) on a portion of land adjacent to the B1 (or new road name A1) highway (turning onto the D1473 road, by using the Dobra offramp) en route to Okahandja, (Figure 3). The capital city, Windhoek, is the economic centre of Namibia and good telecommunication service is thus of a high priority to always ensure efficient and effective communication.

The selected location for the proposed communication tower will be on Erf 361, where the Paratus data centre is also currently being constructed as seen in Figure 3. This site is owned by Paratus and classified as an industrial site according to the site plans as approved by the City of Windhoek (APPENDIX E – ERF 361 APPROVED SITE PLANS).

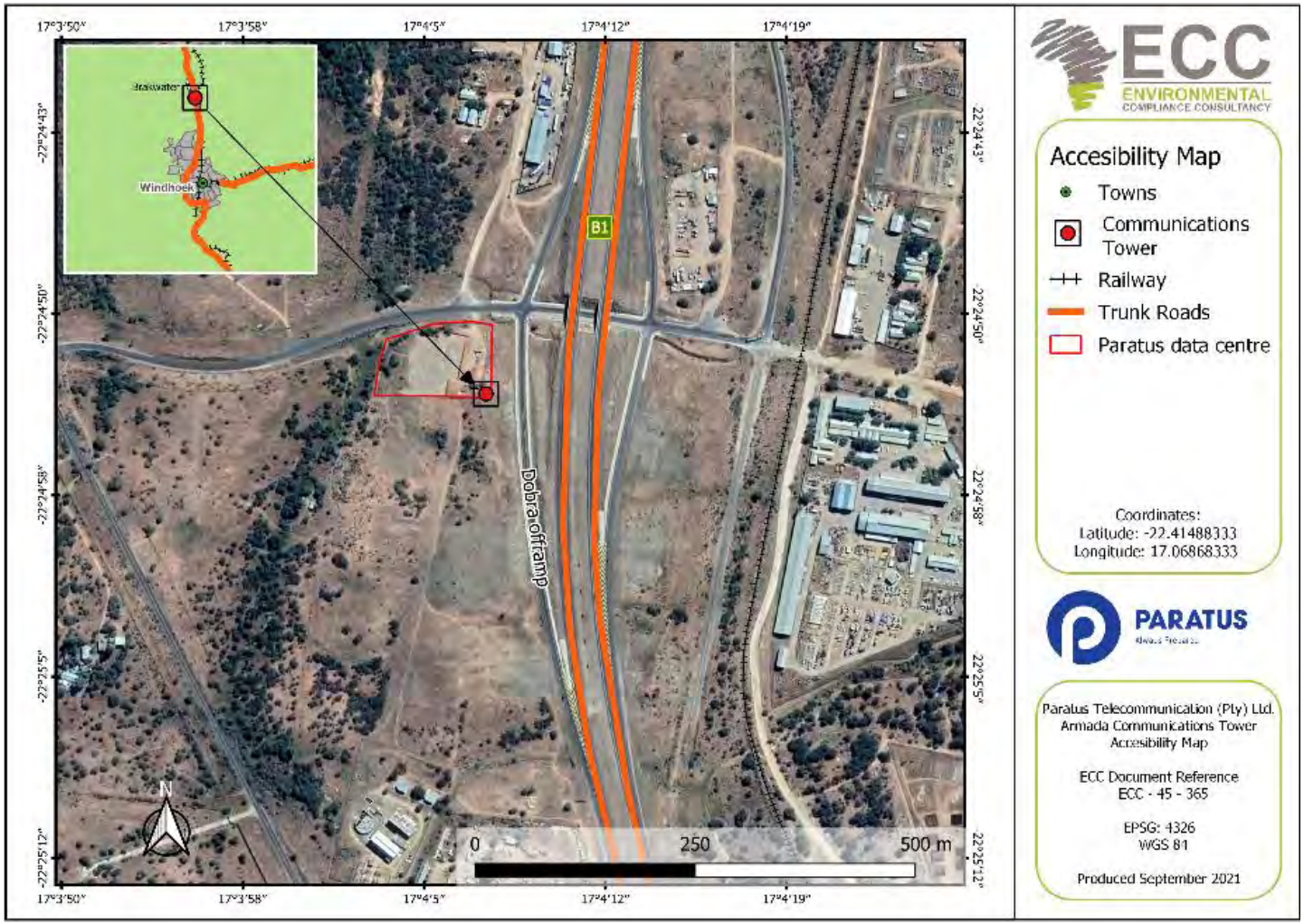

Figure 3: Shows the location of the proposed site and how it can be accessed

5.3 Environmental Baseline

5.3.1 Climate

The area where the communication tower is located has a climate that is characterised by mild summers and cool winters with the mean temperatures between 19˚C and 20˚C, with mean maximum temperatures ranging between 22˚C and 32˚C and mean minimum temperatures ranging between 5˚C to 19˚C. The hottest months of the year is between November and January and the coolest months are in June and July. The area where the proposed site is situated can receive frost during the winter months. (Bubenzer, 2002 & meteoblue, 2021).

With regards to the Relative Humidity (RH), the most humid month of the year is February at approximately 70% RH, and the driest month is June with approximately 10% RH. The average rainfall in this area during the year is between 300 to 350 mm and rainfall events are limited to the summer months, mainly between December and March. Potential evaporation is between 3000 and 3200 mm per year (Bubenzer, 2002).

Climate and Weather data for Brakwater have been used to give the most accurate data for the proposed site. The site has wind speeds between 0 and 38 km/h, where the months of August to October are known to have the strongest winds. Wind can occur any time of the day and the most predominant wind directions for this area are NE and ENE (Figure 5) (meteoblue, 2021).

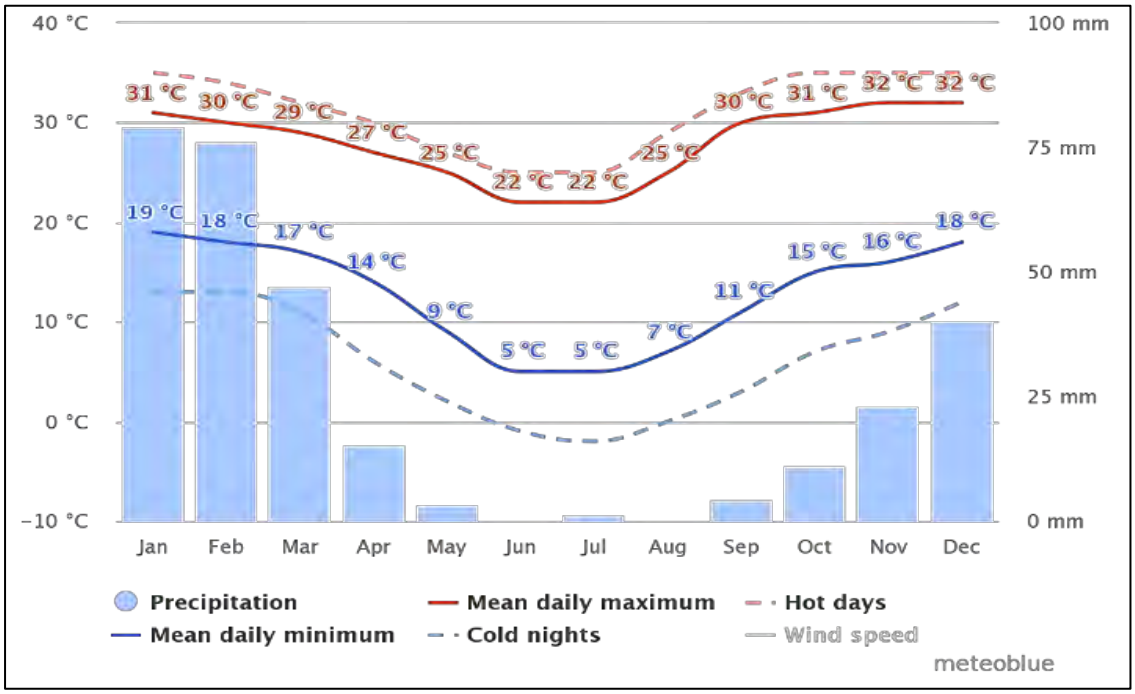

Figure 4: Brakwater's weather summary (meteoblue, 2021).

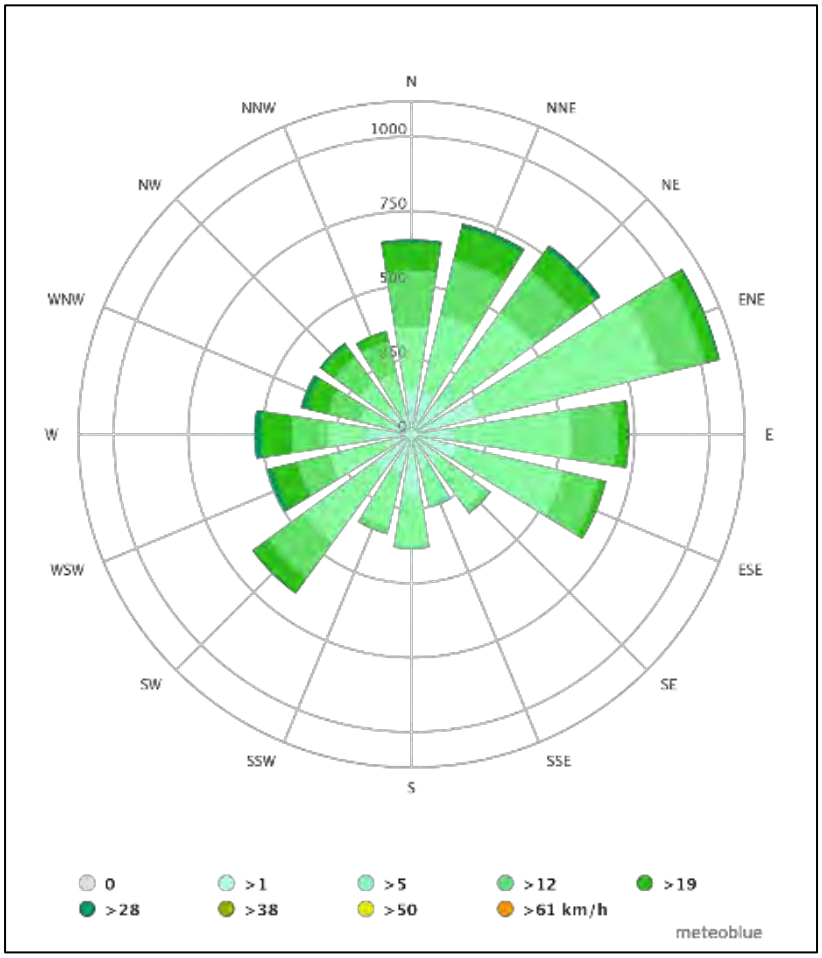

Figure 5: Brakwater's wind direction and wind speed summary (meteoblue, 2021).

5.3.2 Landscape, Geology and soils

Namibia can be divided into two broad geological provinces, one covering the western parts and the other in the east. The western parts consist of a variety of geological formations of different ages and compositions and formed under very diverse environmental conditions – some were formed in the depths of primaeval oceans, others as a result of the movement of the earth's crust or because of collisions or volcanic eruptions. Most of these formations are exposed in the west as rugged landscapes of mountains, hills, valleys and plains with sparse vegetation, providing an interesting insight into Namibia's geological past. In eastern Namibia, the formations are covered with deposits of a much more recent past (Mendelsohn et al., 2002). The deposits are loose, aeolian of origin, sandy and unconsolidated. On the surface the east of Namibia appears monotonous and uniform, covered with dense vegetation in the north and decreasing to the south. Most of the knowledge about these sediments has been derived from water abstraction boreholes, and rare outcrops and underlying formations exposed along drainage lines and around isolated pans.

The geology surrounding the proposed site consists of the Khomas Group. The main rock types of this area are metamorphic sedimentary rocks, primarily schist, locally quartzite and marble. The Khomas Group is part of the Damara Supergroup and Gariep Complex (Bubenzer, 2002).

The areas surrounding the proposed site is largely covered by lithic Leptosols soil (Bubenzer, 2002). Namibian soils vary a great deal, and variations occur both on a broad scale and at a local level. The lithic soil in the area is characterised as very thin or shallow soil. Leptosols are gravelly soils and prone to erosion and desiccation or cracking and with very low to negative pore water pressure (Mendelsohn et al., 2002).

5.3.3 Flora

The vegetation in Namibia is strongly influenced by rainfall. The plant diversity and tallest trees are most lush in the north-eastern parts of the country and contrast sparser and shorter to the west and south of the country. This gradient is not simple as other factors such as soil types and landscape may also influence the vegetation. The dominant vegetation type of the proposed site is thornbush shrubland and falls within the Savanna biome (Bubenzer, 2002 & Mendelsohn et al., 2002).

Erf 361 (a brownfield site) is situated in a part of Namibia with a high plant diversity of more than 500 plant species and moderate endemism (6-15 endemic species), but flora is affected by development, the city of Windhoek, nearby residential and commercial areas and activities, and the highway (Bubenzer, 2002 & Mendelsohn et al., 2002).

5.3.4 AviFauna

This brownfield site is expected to have a low biodiversity presence, due to it being situated in an area with various industrial sites and next to the B1/A1 highway; thus only avifauna is discussed in this section. There are approximately 220 bird species (>230 according to Bubenzer (2002) & Mendelsohn et al. (2002)) that could be found within these areas throughout the year, of which about 19 species are summer breeding birds (breed in southern Africa during summer months) and about 44 species are visitors that are found in southern Africa during the summer months and migrate to the northern hemisphere (Europe or Asia) to breed during southern Africa's winter months (IUCN 2021 & Oberprieler and Cillié 2008).

Most bird species in Namibia fall under Schedule 4: Protected Game within the Namibian Conservation Ordinance No. 4 of 1975, except for the following excluded species: Weavers, Sparrows, Mousebirds, Redheaded Quela, Bulbul, and Pied crow as well as 19 huntable game bird species identified in Schedule 6 of the Nature Conservation Ordinance (Nature Conservation Ordinance No. 4 of 1975).

Various bird species are highly migratory and might only pass through Namibia, thus some of the species might be very rare to encounter or see during the year, but they could potentially be found or spotted near the proposed site (IUCN 2021 & Oberprieler and Cillié 2008). Especially due to the ponded water behind man-made earth-filled dams near the proposed site, which attract various birds (either resident or migratory).

In this part of Namibia, there are approximately 95 bird species that are either additionally protected under the Regulations Relating to the Exploitation Of Marine Resources No. 241 of 2001, section 18 or listed within the CITES appendices, that might potentially be found or encountered near the proposed site during the year (depending on the season and migratory patterns); of these species six are Near-threatened, two are Vulnerable, seven are Endangered and one Critically Endangered (White-backed Vulture) according to the IUCN red list of threatened species (CITES 2019, IUCN 2021, Irish 2021 & Oberprieler and Cillié 2008 & Regulations Relating to the Exploitation Of Marine Resources No. 241).

5.4 Social Baseline

5.4.1 Radiation Background and Potential Health Effects

Radiation is the emission of energy as electromagnetic waves or as moving subatomic particles and it is part of our everyday environment (Clegg *et al.*, 2019). Radiation exposure can be from cosmic rays, as well as from radioactive materials found in the soil, water, food and air. There are two types of radiation namely, ionizing and non-ionizing radiation. Ionizing radiation is a type of energy released by atoms that travel in the form of electromagnetic waves such as gamma rays or x-rays or particles (e.g. neutrons, beta or alpha). Non-ionizing radiation is part of the electromagnetic spectrum where there is insufficient energy to cause ionization, such as in the case of electromagnetic fields, radio waves, microwaves and optical radiation (ITU-T, 2014).

Non-ionizing radiation encompasses both natural and human-made sources of electromagnetic fields, for example, electrical power supplies and appliances are the most common sources of low frequency electric and magnetic fields in our living environment (ITU-T, 2014). Everyday sources of radiofrequency electromagnetic fields include telecommunications, broadcasting antennas and microwave ovens. Humans have been exposed to natural electromagnetic fields throughout their lifetime; however, sources of electromagnetic fields have increased in the past century, especially with the development of technology and radio communications (Clegg *et al*., 2019).

The World Health Organisation (WHO)/International Agency for Research on Cancer (IARC) has classified RF radiation as possibly carcinogenic to humans (Group 2B) in 2011, based on an increased risk of a malignant type of brain cancer (glioma), associated with wireless phone use (OSHA, n.d.). There are various new applications for the reception and broadcasting of RF waves and the use of RF technologies (i.e., mobile phones). Thus, the

associated increased public exposure to RF radiation has resulted in concerns with regards to impacts on human health from the general public and scientists (WHO, 2010).

The International Commission on Non-Ionizing Radiation (ICNIRP) published the "Guidelines on Limiting Exposure to Electromagnetic Fields", which is for the protection of people exposed to RF electromagnetic fields within the 100 kHz to 300 GHz ranges. This guideline covers the following applications: WiFi, Bluetooth, Base stations, mobile phones and the new 5G technologies (ICNIRP, 2020).

WHO (2006) mentioned that "Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects."

5.4.2 Governance

Since independence in 1990, Namibia is led by a democratically elected and stable government to date. The country ranked top 5 out of 54 African countries in the Ibrahim Index of African Governance in 2015 for the indicators including the quality of governance and the government's ability to support human development; sustainable economic opportunity; rule of law and human rights; and development of smart information and communication technology to access information for socio-economic growth (National Planning Commission, 2017).

As a result of sound governance and stable macroeconomic management, Namibia has experienced rapid socio-economic development. Namibia has achieved the level of 'medium human development and ranks 125th on the Human Development Index out of 188 countries (National Planning Commission, 2017).

The Namibian constitution provides for the establishment of Local authorities by law under the Municipal Ordinance, 1963 (Ordinance 13 of 1963) and the Local Authorities Act, No. 23 of 1992. As such the Local Authorities have the power to pass by-laws for the effective administration of their Municipalities and Communities; therefore, Paratus will adhere to the City of Windhoek By-Laws and Regulations.

5.4.3 Economic Activities

In the Khomas Region, 74.5% of all households depend on salaries and wages as their main income source, only 0.2% of households depend on subsistence farming as the main income and 9.7% of all households get their main income from non-farming business activities (NSA, 2019).

In contrast to most of Namibia's other regions, agriculture is less prominent in the Khomas Region where the majority of people are urbanized. The figure for informal-employed people is also lower (55.6%) as people are employed in a wider range of secondary and tertiary economic sectors such as administration, services and manufacturing (NSA, 2019).

Since 2016, Namibia has recorded slow economic growth, registering an estimated growth of only 1.1% in 2016. The primary and secondary industries contracted by 2.0% and 7.8% respectively. During 2017 the economy contracted by 1.7%, 0.7% and 1.9% in the first, second and third quarters respectively (NSA, 2019). Despite the more positive expectations, the economy retracted to average growth of not more than 1% annually since 2017.

During the second quarter of 2020 the domestic economy contracted by 11.1%, which is the largest contraction since 2013; but, the Bank of Namibia (BoN) predicts that the Gross Domestic Product (GDP) could grow by 1.9% in 2021 and by 2.8% in 2022. The impact assessment also showed that 96.5% of tourism businesses have been affected by COVID-19 in 2020, the manufacturing and construction sectors contracted by 9.2% and 5.7% respectively and there was also a 2% to 3% decline in net export (United Nations Namibia 2020).

5.4.4 Socio-Economic

The Khomas Region is the central region of Namibia and is named after the Khomas Hochland, the prominent highland that surrounds Namibia's capital. In the west and northwest, the region is bordered by the Erongo Region, by the Otjozondjupa Region to the northeast, the Omaheke Region to the east and the Hardap Region to the south. Although the Khomas Region only occupies 4.5% of the land area of Namibia, it accommodates the largest percentage (18%) of the national population total in 2016 (NSA, 2017).

Namibia is one of the least densely populated countries in the world (2.8 people per km^2). Vast areas of Namibia are without people, in contrast to some dense concentrations, such as the central-north and along the Kavango River.

The population density in the Khomas Region is 4.2 times higher (12 persons per km2) than the national figure; the projected total population for the Khomas Region was 415,780 in 2016. In the Khomas region 95% of all people live in an urban area in 2016, Oshiwambo is the most spoken language (41% of all households), the average household size is 3.5 people and the literacy rate is 97% for people older than 15. Living in an urban environment implies better living conditions – in the Khomas Region 100% of all households have access to safe water, only 25% have no toilet facility, 64% have electricity for lighting and only 7% of the population depend on open fires to prepare food (NSA, 2017).

The urban population pyramid for Namibia shows a very clear dominance of the age group 20 – 35 as well as for infants (0 – 4 years of age) (Figure 6). As the majority of people in the Khomas Region are living in an urban area, the dominance of Windhoek is further apparent – the population of the Khomas Region is young, most of them within the child-bearing age range (NSA 2014).

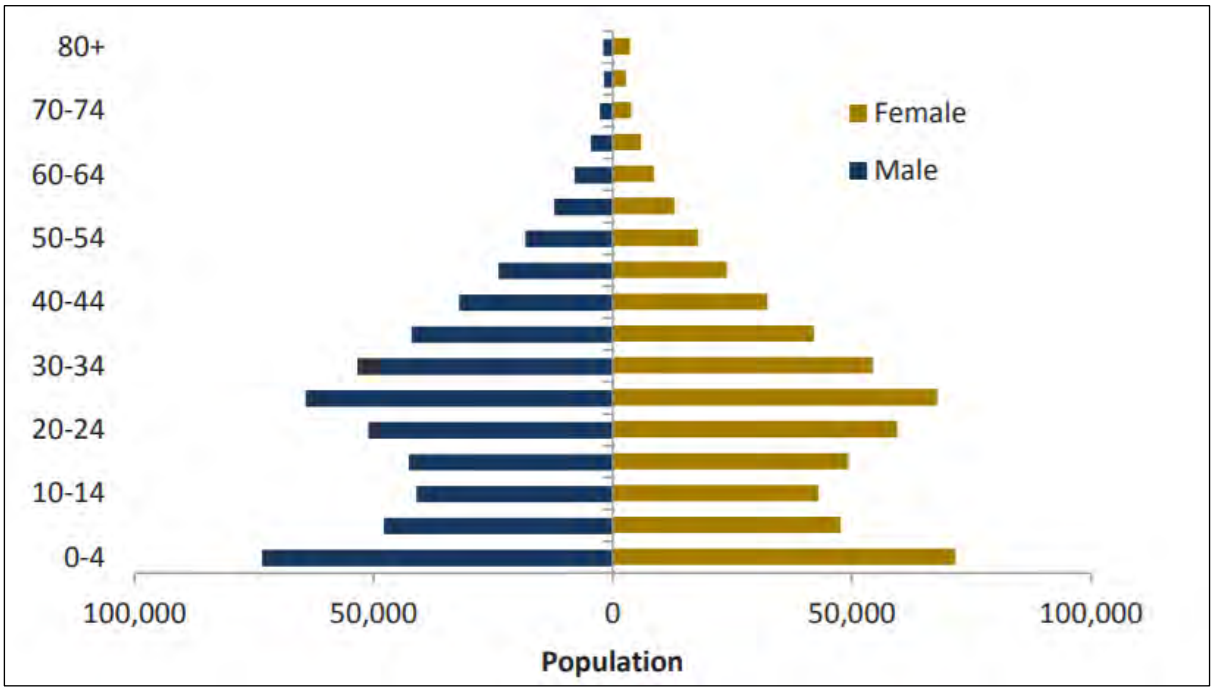

Figure 6: 2015 urban population pyramid of Namibia (NSA 2014)

Namibia is divided into 14 regions, subdivided into 121 constituencies. Khomas Region is divided into ten constituencies. Each region has a regional council, elected during regional elections per constituency. Towns are governed through local authorities, in the form of municipalities.

Windhoek is the national capital and also the capital of the Khomas Region. As the country's capital Windhoek hosts many of the national head offices as well as the head offices of the Khomas regional council. Windhoek is governed by a local authority in the form of a city council.

The dominance of Windhoek as a place of residence in the Khomas Region is apparent by its population, all other urban places in the Khomas Region are classified as settlements – the lowest order of governed populated places in Namibia. Places such as Baumgartsbrunn, Groot Aub, Seeis and Dordabis are managed directly by the central authority.

5.4.5 Employment

In 2018, 53.4% of all working Namibians were employed in the private sector and 21.5% by the state. State-owned enterprises employ 7.6% Namibians and private individuals 16.6%. Wages and salaries represented the main income source of 47.4% of households in Namibia. Agriculture (combined with forestry and fishing) as an economic sector has the most employees – 23% of all employed persons in Namibia work in this sector. Agriculture is also the sector that employs the most informal workers in Namibia, calculated at 87.6%. Wages of employees in the agriculture sector are lower than all other sectors except for workers in accommodation and food services and domestic work in private households (NSA, 2019).

Low education levels affect employability and prevent many households to earn a decent income. Of all people employed in Namibia, 63.5% are not higher qualified than junior secondary level (Grade 10 and lower). In total 11.8% of all people employed had no formal education. In total 29.1% of all people employed are within the category "elementary occupation" and 15.2% in the category "skilled agriculture" (NSA, 2019).

Overall, the rate for unemployment is estimated at 33.4% for Namibia, using the broad definition of unemployment. More than 60% of the population is over 15 years of age and about one-third of the total population can be regarded as part of the labour force. The unemployment rate in rural and urban areas is almost the same – 33.4% in urban areas and 33.5% in rural areas (NSA, 2019). The youth group also ranks high in unemployment levels, even though many Namibia youth complete post-secondary education. In 2018 the unemployment level was at 59.6% for those aged 15-19, 57% for those aged 20-24, and 42.3% for 25-29-year-olds (NSA, 2018).

According to the Socio-Economic impact Assessment of COVID-19 in Namibia by the United Nations Namibia (2020), there has been an estimated increase in unemployment from 33.4% to 34.5% and through a best-case scenario, it is also estimated that poverty will increase from 17.2% to 19.5% due to a drop in the domestic GDP (United Nations Namibia 2020).

5.4.6 Health

Since independence in 1990, the health status of Namibia has increased steadily with a remarkable improvement in access to primary health facilities and medical infrastructure. Despite the progress, the World Health Organization (WHO) in 2015 recommended strategic priorities of the health system in Namibia which include improved governance, an improved health information system, emergency preparedness, risk reduction and response, preventative health care and the combating of HIV/AIDS and TB (WHO, 2016).

HIV/AIDS remains a major reason for low life expectancy and is one of the leading causes of death in Namibia. There is a high HIV prevalence among the whole population, but since the peak in 2002 (15,000 new cases of HIV per year, and 10,000 yearly deaths due to AIDS) the epidemic started to stabilise (UNICEF, 2011). Although new infections, as well as fatalities, halved during the next decade, life expectancy for females returned to pre-independence levels but for males, it did not reach pre-independence levels yet. HIV/AIDS remains the leading cause of death and premature mortality for all ages, killing up to half of all males and females aged 40 - 44 years in 2013 (IHME, 2016).

Tuberculosis (TB) is a leading killer of people infected by HIV/AIDS, and Namibia has a high burden – in 2018, 35% of people notified with TB were infected with HIV. The country is included among the top 30 high-burden TB countries in the world, with an estimated

incidence rate of 423 per 100,000 people and 60 fatalities per 100,000 people in 2018 (retrieved from www.mhss.gov.na).

As of the beginning of 2020 the coronavirus disease (COVID-19), a communicable respiratory disease, causes illness in humans at a pandemic scale and has resulted in an increasing number of deaths worldwide. The viral outbreak is adversely affecting various socio-economic activities globally, and with reports of the increasing number of people testing positive, it is anticipated that this may have significant impacts on the operations of various economic sectors in Namibia too. The disease caused many countries to enter a state of emergency and lockdown mode, with dire economic consequences.

Furthermore, COVID-19 has also resulted in a loss of learning and socialising opportunities for children in Namibia and there was a lack of access to school feeding programs and parents had to provide or find alternative care for children. There has also been a 6% increase in health workers across Namibia as a result of the pandemic (United Nations Namibia 2020). By mid-November 2021, Namibia has had 3,319 deaths due to COVID-19 in 2021. There were a total of 205 deaths in 2020.

5.4.7 Cultural Heritage

The proposed tower will be constructed in the Brakwater on an industrial site, where the construction of the data centre has already started, the land area has already been cleared. The actual area where the tower is proposed to be constructed will cover a very small area to the south-eastern corner of Erf 361 (Figure 3). Thus it is not expected that there would be any heritage finds on-site.

5.4.8 Noise and Vibrations

Erf 361 is an industrial site and is also surrounded by various sites with industrial activities (to the north, east and south) and lies next to the B1/A1 highway (source of noise and vibration); therefore, the increase in noise would be minimal, and no vibrations are expected to result from the project. There would be a minimal temporary increase in localised noise generated during the construction activities of the BTS; however, the impact will be temporary and will occur during normal working hours (e.g., 7:00 am – 5:00 pm).

6 EVALUATION OF IDENTIFIED IMPACTS

6.1 THE ASSESSMENT PROCESS

The evaluation of the significance of the impacts will be determined using ECCs methodology (Figure 7) for environmental impact assessments is adopted and based on models for environmental and social impact assessments set out by the International Finance Corporation (IFC) Performance Standard 1 'Assessment and management of environmental and social risks and impacts'. Furthermore, the impact assessment methodology also follows Namibian legal requirements.

An impact assessment is a formal process in which the potential effects of the project on the biophysical, social, and economic environments are identified, assessed, and reported. The significance of potential impacts can be taken into account when considering whether to grant approval, consent or support for the proposed project. The process followed through the basic assessment is illustrated in Figure 8.

The methodology, consistent with globally recognized standards, will be applied to determine the magnitude of impacts and whether each one was considered significant and thus warrant further investigation. The assessment considers all stages of the project's life cycle. It is an iterative process that commences at project inception and runs through to the final design and project implementation (operations). The impact prediction and evaluation stages were undertaken in October 2021 and the findings of the assessment will be presented in this Scoping and Impact Assessment report.

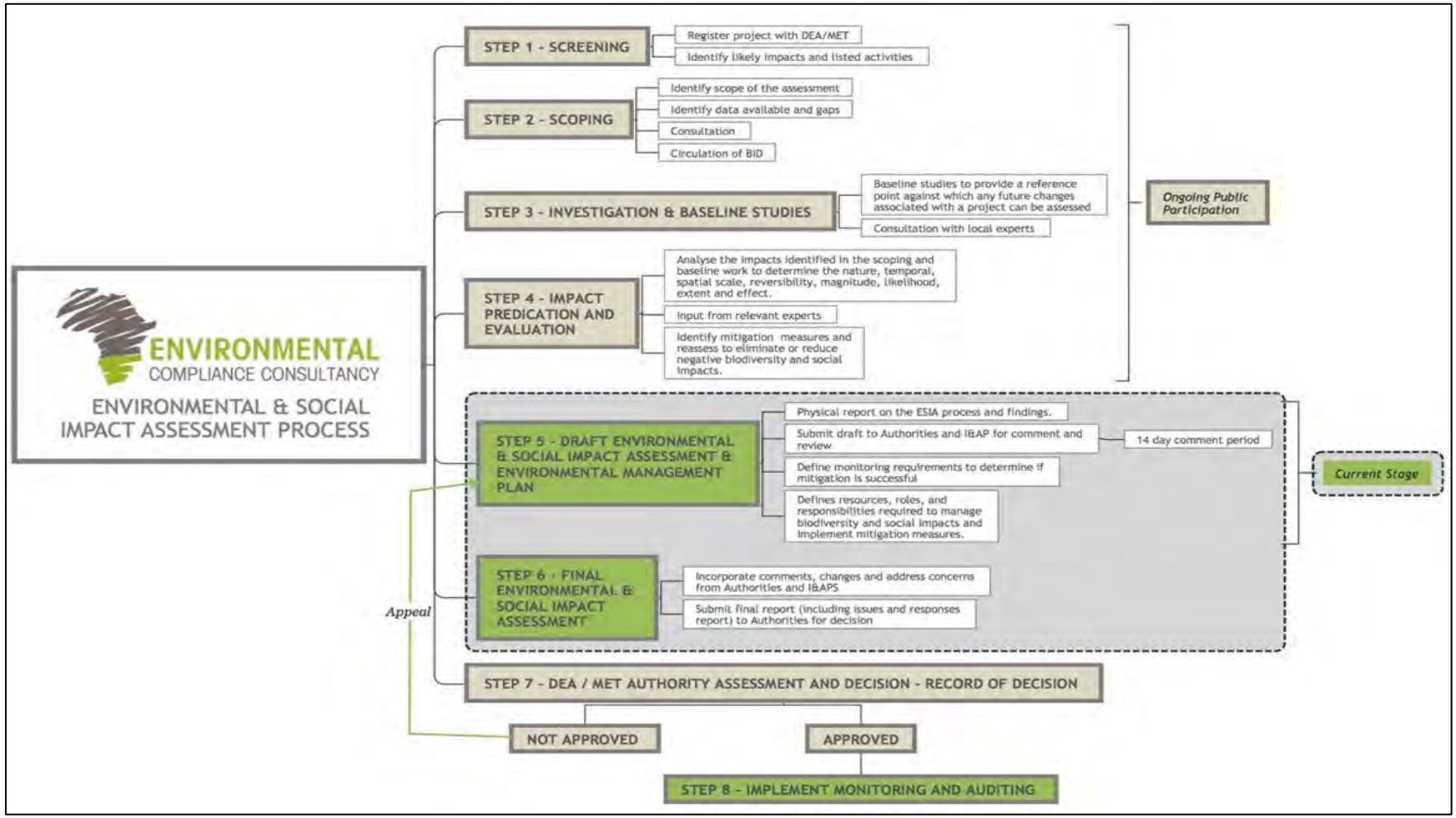

Figure 7: ECC ESIA method

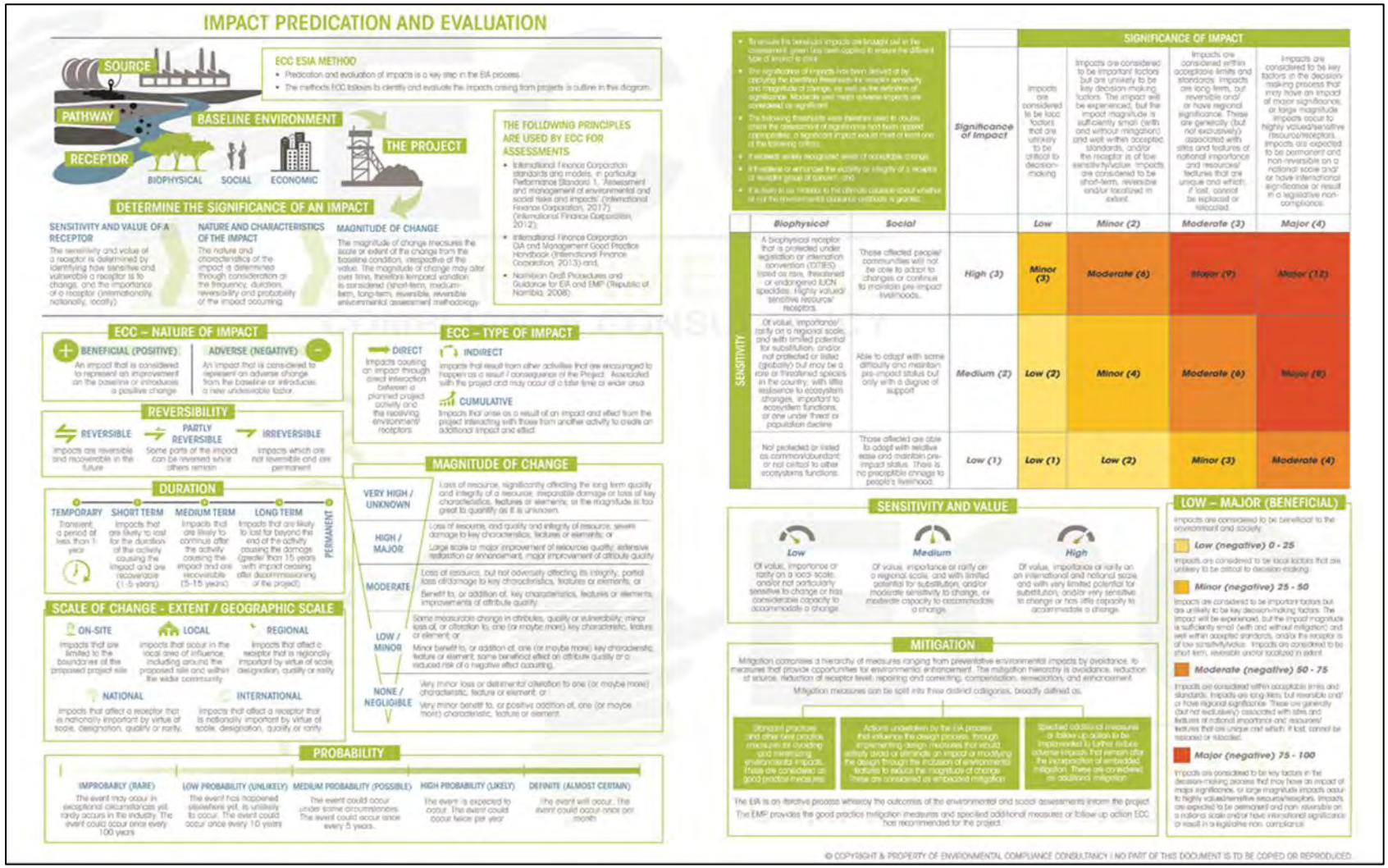

Figure 8: ECC's impact assessment methodology

7 IMPACT ASSESSMENT FINDINGS AND PROPOSED MITIGATION MANAGEMENT MEASURES

This chapter presents the findings of the ESIA for the proposed project as per the ESIA process, scope and methodology set out in Chapter 3 and Chapter 6. A range of potential impacts has been identified that may arise because of the proposed project. This ESIA reports aims to focus on the significant impacts that may arise because of the proposed project. This chapter mentions both the non-significant and significant impacts and/or those that may have specific interests to the community and stakeholders.

When undertaking the assessment exercise, the design of the proposed project and best practice measures were considered to ensure the likely significant effects and any required additional mitigation measures were identified.

The following topics were considered during the scoping phase:

- Visual impacts;
- Potential health and safety risks;
- Potential RF Radiation;
- Impacts on Biodiversity (especially birds); and
- Socioeconomics (employment).

For each potential significant or sensitive impact, a summary is provided which includes the activity that would cause an impact; the potential impacts; embedded or best practice mitigation (stated where required or available); the sensitivity of receptor that would be impacted; the severity, duration, and probability of impacts; the significance of impacts before mitigation and after mitigation measures are applied.

7.1 IMPACTS DEEMED NOT SIGNIFICANT

Impacts that have been identified as not being significant are summarized in Table 5. As a result of an iterative development process, mitigation has been incorporated and embedded into the project, thereby designing out potential environmental and social impacts or reducing the potential impact so that it is not significant. Best practice has also played a role in avoiding or reducing potential impacts. The EMP provides best practice measures, management, and monitoring for all impacts.

Table 5: Table of non-significant impacts

ENVIRONMENT OR SOCIAL TOPIC	POTENTIAL IMPACT	SUMMARY OF PRELIMINARY ASSESSMENT FINDINGS
Waste management	Waste generation during construction and operational phases.	Waste items and litter on the site and surrounding areas. The proponent will develop a waste management plan to counter the impact of waste dispersal on and surrounding the site.
Employment Creation	Beneficial impact through the creation of job opportunities.	Work relating to the erection/construction and maintenance of the tower will be outsourced to local specialized contractors (Namibia Registered and owned company) with existing workforces. Five full time Paratus employees will also form part of the project. The construction phase is expected to last between 5 -6 weeks.
Increased people/foot traffic in the immediate vicinity. (Construction phase only)	Increased footfall in the project area and surrounding vicinity.	The potential risk of negative social interactions to occur between the workforce and the public. An internal Health and Safety Management Plan will be developed by the client to address this topic and the mitigation measures provided.
Soil	Disturbance of the soil on Erf 361 during construction.	Construction of the BTS will involve minor ground preparation (trenches and levelling) of the site.
Increased Traffic	Potential increase in the number of trucks during the construction phase.	The potential negative impact to the traffic in Brakwater area, as well as potential for accidents at the, turn off to the site (Slow-moving vehicles turning).
Air Quality	The construction of the proposed project building will discharge dust which is considered a form of air pollution.	During construction, excavation activities will discharge some form of air pollution into the atmosphere (i.e., dust) and marginally affect the ambient air quality of the vicinity. The EMP should be closely followed to minimise air pollution.

ENVIRONMENT OR SOCIAL TOPIC	POTENTIAL IMPACT	SUMMARY OF PRELIMINARY ASSESSMENT FINDINGS
Noise	Noise from mechanical equipment/machinery on-site, as well as an increase in sound generation from larger slow-moving vehicles (Trucks).	During the construction phase, there is potential for increased noise levels, thus the possible noise pollution should be considered.
Impacts on Biodiversity	Biodiversity surrounding the proposed tower might potentially be exposed to RF radiation.	Due to the proposed BTS being planned in an area with industrial activities and with the B1 (A1) highway running approximately 76 meters next to the site (and carries heavy traffic each day), it is expected that there would be a lower wildlife presence in the surrounding area due to an already disturbed habitat. The highway might have various impacts on the biodiversity within this area, as it is a source of noise, vibration and causes habitat fragmentation (Barrientos, et al. 2019, Geneletti, 2003, Raboin and Elias, 2019 & Trombulak and Frissell, 2000). Some of the potential impacts to biodiversity might include: the disappearance of invertebrates, impacts on incubating bird eggs, impacts on bird navigation, impacts on reproductive success and development of insects, increased mortality rates of tadpoles and reduced milk yields and abnormal behaviours in cows (Balmorie, 2010, Balmorie, 2021, Bryan & Gildersleeve, 1998 and Loscher & Kas, 1998).

7.2 Significant Issues to be Addressed

Table 6: List of potential impacts scoped into the assessment

ENVIRONMENT OR SOCIAL TOPIC	POTENTIAL IMPACT	SUMMARY OF PRELIMINARY ASSESSMENT FINDINGS
Employee, contractors and community Health and Safety.	Risk of falling due to working at heights during the construction phase and during maintenance of the tower. Potential impacts from RF radiation for people working or living within 300 meters of the site.	The assessment should consider health and safety protocols and management thereof, to ensure that the correct PPE is used, and safety measures are followed. The proponent should develop a health and safety management plan which should be followed in addition to the mitigation and management measures in the EMP.
Visual Pollution	Potential visual impacts due to the construction of the 48-meter-high communication tower.	The assessment includes a viewshed (Figure 11) which shows the extent in red around the site from where the tower will be visible.
Impacts on Biodiversity	The height of the tower will be a potential collision risk for birds.	The mitigation and management measures mentioned in the EMP should be closely followed.

7.3 Scoping Assessment Findings

When undertaking the scoping exercise, the design of the project and best practice measures were considered to ensure the likely significant effects and any required additional mitigation measures were identified. A summary of the potential impacts and mitigation or control measures were discussed.

Notably, the proposed project site was found to be sensitive to receptors, such as nearest neighbours and tourists, due to the possible visual impacts and potential health risks. Paratus will comply with all the national and international regulatory frameworks and regulations as indicated in Section 2.

Table 7, Table 8, Table 9 and Table 10 set out the findings of the scoping assessment phase. Activities that could be the source of an impact have been listed, followed by receptors that could be affected. The pathway between the source and the receptor has been identified where both are present. Where an activity or receptor has not been identified, an impact is

unlikely, thus no further assessment or justification is provided. Where the activity, receptor and pathway have been identified, a justification has been provided documenting if further assessment is required or not required.

Due to the nature and localised scale of the construction and operational activities, and the environmental context of the site, the potential environmental and social effects are limited and unlikely to be significant. The only area where uncertainty remained during the scoping phase was the potential effects on human receptors with regards to health risks in the area, visual impacts (i.e., landowner or residents in the nearby houses or buildings) and potential collision risk for birds. Further consideration of the potential impacts was therefore undertaken and results are presented with some mitigation measures in tables sections 7.6 and 7.7.

7.4 MITIGATION

Mitigation measures will focus on reducing the effects of the potential impacts and ensure an acceptable measure of operation can be maintained when an impact cannot be avoided completely. An EMP will be developed in conjunction with the Scoping and Impact assessment report will set out the management and mitigation measures for the project.

7.5 LIMITATIONS AND UNCERTAINTIES

Limitations and uncertainty were identified during the ESIA process. In line with ESIA best practice, assumptions have been made based on realistic worst-case scenarios, thereby ensuring that the worst-case potential environmental impacts are identified and assessed. This Scoping report does not include a full list of measures for compliance with statutory occupational health and safety requirements. This will be provided in the safety management plan to be developed by the proponent independently.

There are minimal information or studies in Namibia and Southern Africa relating to impacts with regards to communication towers, thus various studies used in the EIA refer to other countries, but the risks are expected to be similar.

7.6 SOCIAL IMPACTS

7.6.1 OCCUPATIONAL HEALTH AND SAFETY

According to the Occupational Safety and Health Administration (OSHA), bad weather conditions, falling from heights, structural collapse, electrical hazards and equipment failure are potential hazards faced by communication tower employees and contractors. In the United States, a total of 33 communication tower-related deaths have been recorded between 2013 and 2016 (www.osha.gov.,2018).

The proponent will be responsible to develop a health and safety management plan that should be implemented on-site. Employees and contractors should always work under the supervision of occupational health and safety professionals.

The IFC Environmental, Health, and Safety Guidelines for Telecommunications should also be followed as a best practice method. According to these guidelines, the following occupational health and safety issues are mainly seen with telecommunications projects: Electrical safety, Electromagnetic fields (occupational), Optical fiber safety, Elevated and overhead work, Fall protection, Confined space entry and Motor vehicle safety (IFC, 2007).

Table 7: Impacts related to occupational health and safety

DESCRIPTION OF ACTIVITY	RECEPTOR	DESCRIPTION OF IMPACT	EFFECT/ DESCRIPTION OF MAGNITUDE	VALUE OF SENSITIVITY	MAGNITUDE OF CHANGE	SIGNIFICANCE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
Construction and maintenance of the proposed BTS	**Employees**	Potential of injuries, incidents or even death during construction and maintenance of the tower (i.e., working at heights).	Adverse Cumulative Irreversible Moderate Long Term Local Possible	High	Moderate	**Moderate (6)**	**Minor (3)**

Impact management/control measures may include but are not limited to the following:

- Health and Safety management plan should be developed and implemented on-site by the proponent;
- Appropriate PPE should be used for relevant tasks on-site (i.e., harnesses for working at heights);
- Workers should work under the supervision of a health and safety professional;
- Safety planning should be used before any climbing work commences;
    - This should include an emergency action plan and a Job Hazard Analysis;
- If weather is not favourable (i.e. strong winds, rain etc.) and pose a safety risk no climbing work should be allowed;
- If a worker's mental or physical health is impaired they should not be allowed to work at heights or be involved in any climbing activities (for example, some over the counter medicines might cause drowsiness);
- Workers that will be responsible for maintenance or involved in climbing activities should receive regular awareness and safety training; and
- All tools, machinery, PPE and climbing equipment should always be in good working condition (www.osha.gov.,2018).

7.6.2 RF Radiation Exposure

There are very few human studies that give substantiated evidence on health effects from RF radiation exposure, there are indeed a large number of questionnaire and lab-based studies that give some indication of potential health effects. Some of the questionnaire-based studies discuss the potential of RF radiation having an impact on the health of people that live near a BTS. The distance that the studies evaluated are up to 300 meters from the BTS; where, headaches, nausea, sleep disturbances, loss of appetite, depressive tendencies, fatigue, decreased libido and discomfort were some of the symptoms recorded during these studies (Santini et al. 2002, Santini et al. 2003, Kato & Johnsson 2012, Shahbazi-Gahrouei et al. 2013, Parsaei et al. 2017).

Then other studies showed several more serious symptoms/illnesses that could potentially be the result of RF radiation which included, neoplasia, heart and circulation disorders, cancer, neurobehavioural symptoms, DNA damage and effects on hormone levels (Richter et al. 2002, Eger et al. 2004, Wolf & Wolf 2004, Eşmekaya et al. 2010, Khurana & Joris 2010, Eger, H. & Jahn, M. 2010, Rodrigues et al. 2021, Zothansiama et al. 2017). But, according to the ICNIRP, the only validated adverse health effects with regards to RF radiation are impacts due to the rise in temperature, nerve stimulation and permeability of cell membranes (ICNRIP, 2020).

A communication tower has a shadow zone (approximately 0 to 46 meters) where there is less radiation and then between about 46 meters to 152 meters from the tower is where the radiation is the highest (Daniel, 2019). Figure 9 shows within what distance range RF radiation is the highest; the potential concern here is the data centre that lies between 37 meters (at the closest point to) to about 102 meters (at the furthest point of the building) from the proposed tower.

As seen in Figure 9 there is a zone above ground that also has minimal exposure. The higher RF radiation exposure will be higher above ground (closer to the source) and due to the proposed project not having any high buildings surrounding the proposed communication tower RF radiation exposure is expected to be minimal; it is thus unlikely that there would be adverse health risks for employees and the community surrounding the site.

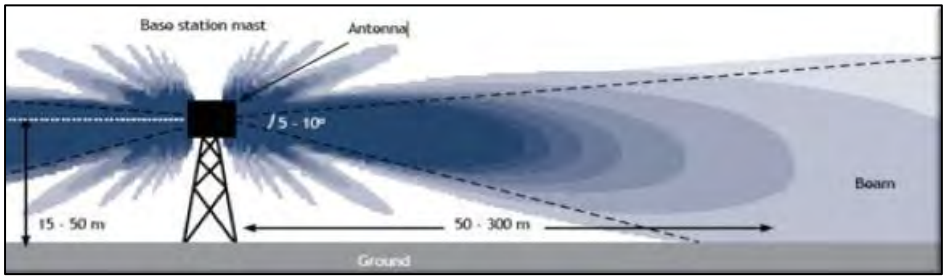

Figure 9: Shows the zone where radiation is the highest for towers with a height between 15-50 meters is between 50 and 300 meters from the tower (Challis et al. 2007).

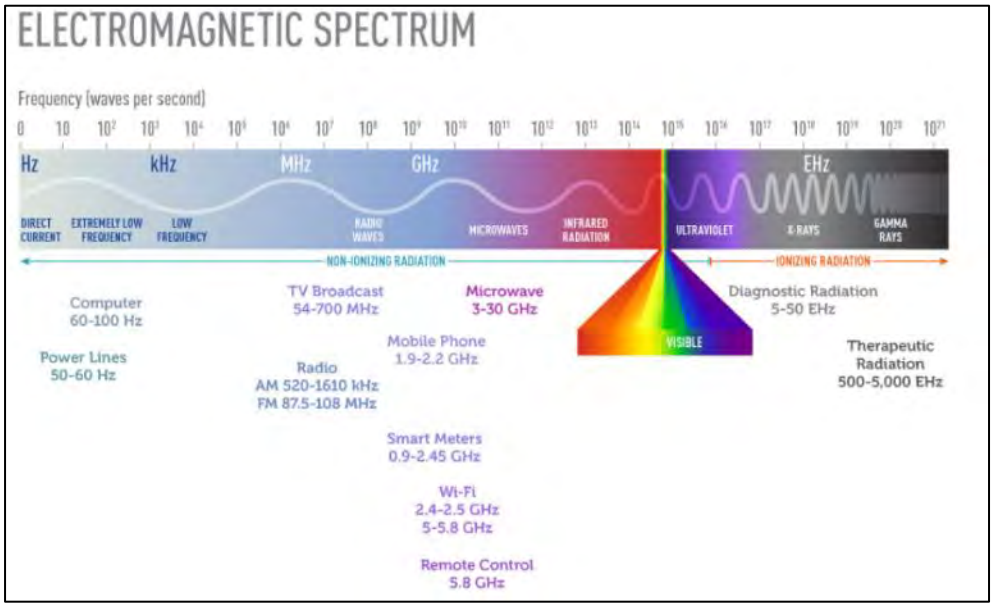

Figure 10: Shows the electromagnetic spectrum (cancer.org 2011).

The electromagnetic spectrum and the possible electromagnetic (EM) frequencies of EM energy are shown in Figure 10. These frequencies range from very low frequencies (i.e., power lines) to very high frequencies (i.e., gamma rays), this spectrum includes non-ionizing and ionizing radiation (Cancer.org 2011). RF radiation (microwave radiation) has longer wavelengths than infrared radiation (heat from the sun is a form of infrared radiation); the shorter the wavelengths become the more harmful the type of radiation is expected to be (i.e., X-rays and Gamma rays are very harmful).

The magnitude of change on the social environment is considered to be minor as a result of the built environment surrounding the site (no high buildings surrounding the site that might be exposed to the highest radiation levels). The sensitivity of the receptor is rated as medium because although the risk is minor, the health, safety and well being of employees and the community are essential.

Table 8: Impacts related to community and occupational health and safety.

DESCRIPTION OF ACTIVITY	RECEPTOR	DESCRIPTION OF IMPACT	EFFECT/ DESCRIPTION OF MAGNITUDE	VALUE OF SENSITIVITY	MAGNITUDE OF CHANGE	SIGNIFICANCE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
Daily activities of community and employees within approximately 300-meter distance of the proposed BTS.	**Community & Employees**	Potential health risks associated with the exposure Radio RF Radiation is also known as "microwave" radiation emitted from the communication tower.	Adverse Direct Partly reversible Minor Long Term Local Possible	Medium	Minor	**Minor (4)**	**Low (2)**

Impact management/control measures may include but are not limited to the following:

- The proponent will be responsible to develop and implement a Health and Safety management plan that covers all aspects related to Health and Safety with regards to the proposed communication tower;
- All occupational health-related complaints should be recorded;
- If any occupational health-related complaints are received and a risk assessment indicates that RF radiation may be a potential risk, EMF radiation should be measured and monitored by a registered occupational hygiene/health and safety monitoring body to determine whether the exposure is within recommended exposure limits;
- Shorter shifts could be implemented to reduce exposure time; and
- In partnership with relevant stakeholders, provide awareness campaigns about the effects of non-ionising electromagnetic fields on human health.

7.6.3 Visual Impacts

The proposed communication tower will be 48 meters high and due to the height of the tower, it will be visible from quite far away (i.e., landowners 5 km away will be able to see the tower) and will be a source of visual disturbance for various businesses, landowners, camps, lodges and residents surrounding the site. Figure 11 shows a viewshed map, which illustrates in red where the tower will be visible from. A height of 1.8 meters has been used as the potential receptor height since it represents the average height of a person, the modelling for which is shown as red in Figure 11.

Although this impact is listed under significant impacts, the proposed tower is confined to an area with various industrial sites that is already disturbed and might already have various sources of disturbances (i.e. visual, noise, vibration etc.). There is also another existing communication tower approximately 720 meters to the northeast of the proposed tower; which, will already be visible over a large area.

The magnitude of change on the social environment is considered to be moderate because it is still a visual change in the environment that might have an impact on some residents (especially camps/lodges or houses nearby). The sensitivity of the receptor is rated as low because although the magnitude of change is moderate, this is an area with various industrial sites that is already disturbed (i.e., powerlines and another communication tower).

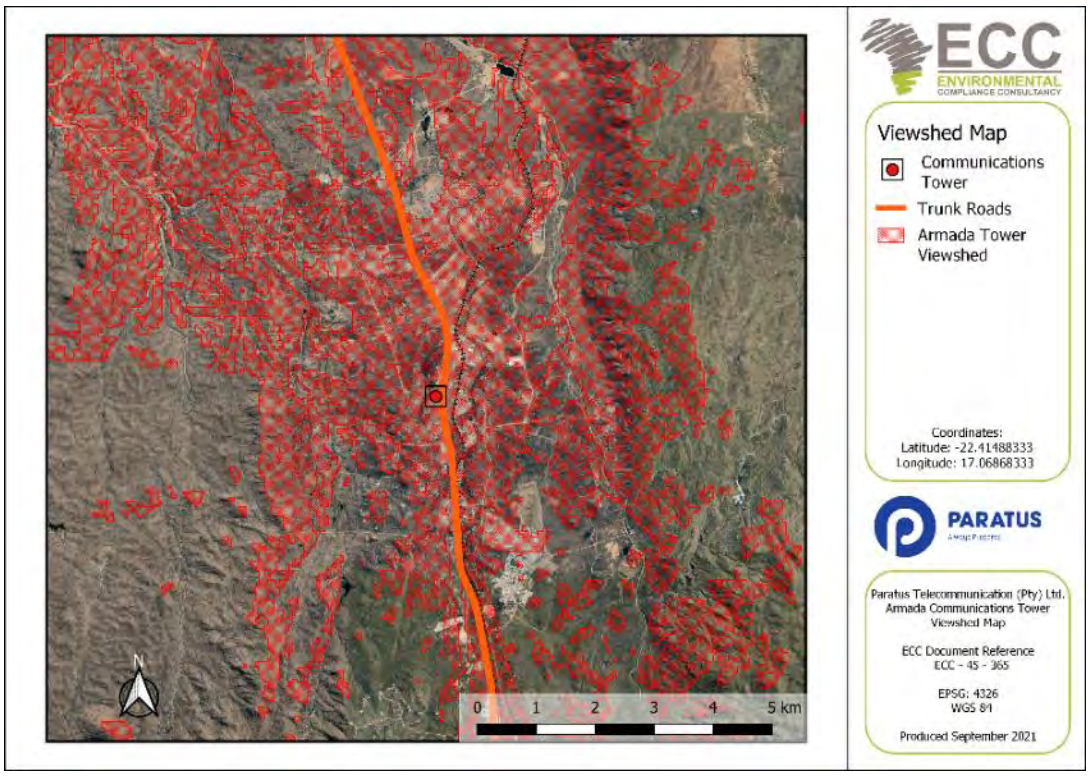

Figure 11: Viewshed map showing in red from where the communication tower will be visible

Table 9: Impacts related to visual impacts of the proposed tower

DESCRIPTION OF ACTIVITY	RECEPTOR	DESCRIPTION OF IMPACT	EFFECT/ DESCRIPTION OF MAGNITUDE	VALUE OF SENSITIVITY	MAGNITUDE OF CHANGE	SIGNIFICANCE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
The construction of the proposed 48 – meter high BTS and associated infrastructure.	**Community**	Visual disturbances to the area surrounding the site.	Adverse Direct Partly Reversible Low / Minor Permanent Local Almost Certain	Low	Moderate	**Minor (3)**	**Low (2)**

Impact management/control measures may include but are not limited to the following:

- Aircraft warning lights should be directed in the right directions and angles, to minimise disturbances to residents;
- No bright colours should be used on the tower (take into account the public perception about aesthetic issues); and
- Relevant stakeholders should be consulted before the construction of the BTS starts.

7.7 IMPACTS ON BIODIVERSITY

7.7.1 RISK OF COLLIDING WITH THE TOWER

Overall, the collision risk impact of the proposed communication tower on bird species will be low, because this is an area with various industrial sites and is thus already disturbed; but the impacts mentioned in this section might affect migrating bird species and avifauna found within the surrounding area.

Due to the height of some of the communication towers, there is the potential for birds to collide with it, this also includes nocturnal birds that might be on the hunt for insects or bats near the lights (i.e aeroplane warning lights) of the tower (Gehring et al., 2009).

A study by Martin (2011) indicated that birds live in different visual worlds which might result in them failing to see obstacles as they "may not predict constructions", this is possibly due to birds not being aware of or having knowledge of new buildings, power lines, wind turbines or towers on their migratory routes. The study also states that birds have a "restricted range of flight speeds that can be used to adjust their rate of gain of visual information as the sensory challenges of the environment change" (Martin, 2011). Thus any structures erected above the vegetation line might pose a collision risk for birds (especially migratory birds) due to a change in habitat unfamiliar to them.

Billions of birds die due to collisions with man-made infrastructure around the globe annually, in the United States alone it is estimated that 4-5 million birds collide with communication towers every year; This has a major impact on population viability and efforts with regards to the conservation of endangered bird species (Boycott et al. 2021 & Gehring et al., 2011).

Furthermore, a study also showed that some night-migratory birds (the study focused on songbirds, Suborder Passeri) might be disorientated or attracted by the "pilot navigational safety nighttime lighting system" of communications towers, especially during overcast nights, and might result in collisions with the towers (Gehring et al., 2009). The heights of the towers evaluated in this study were between 116 meters to more than 350 meters high, thus it is unlikely that the proposed BTS will have a significant impact on migratory birds as they fly high above the ground (up to 6000 meters above ground (Lindström 2021)). The collision risk can increase for birds (especially waterbirds) when they try to land in or near nearby man-made ground filled water dams. There are approximately 47 protected waterbird species that might be found within these areas during the year. Other birds might be at risk to collide with the tower when they are out hunting insects, birds, reptiles or small mammals surrounding the site.

This is an already disturbed area (i.e., powerlines and another communication tower) and the collision risk to avifauna is expected to be low, but there are a few factors and considerations that increased the significance rating of this potential impact, which are based on worst-case scenarios. Nearby is an earth-filled water dam (approximately 460

meters) to the north-north-west of the proposed BTS that will attract various birds throughout the year. The NARREC rehabilitation centre is also nearby the site, which also attracts vultures of which the critically endangered white-backed vultures are regular visitors.

Approximately 220 bird species could be found within these areas throughout the year, of which about 19 species are summer breeding birds (breed in southern Africa during summer months) and about 44 species are visitors that are found in Southern Africa during the summer months and migrate to the northern hemisphere (Europe or Asia) to breed during southern Africas winter months. Thus some of these birds are of international importance.

The magnitude of change on avifauna is considered to be moderate because of the dams near the site that might attract birds during the year and due to few endangered or threatened bird species that might be found within this part of Namibia; namely, *Aquila nipalensis* (endangered), *Aquila rapax* (vulnerable), *Ardeotis kori* (near threatened), *Calidris ferruginea* (near threatened), *Circus macrourus* (near threatened), *Circus maurus* (endangered), *Falco vespertinus* (near threatened), *Gyps africanus* (critically endangered), *Gyps coprotheres* (endangered), *Neotis ludwigii* (endangered), *Numenius arquata* (near threatened), *Oxyura maccoa* (vulnerable), *Phoeniconaias minor* (near threatened), *Polemaetus bellicosus* (endangered), *Sagittarius serpentarius* (endangered) and *Torgos tracheliotos* (endangered) (IUCN 2021). The sensitivity of the receptor is rated as medium because various of these bird species are protected in Namibia, some species are migratory which suggest they are important internationally, various raptors and vultures are listed under the CITES Appendices. The collision risk might be low but with the increase of tall man-made structures within natural habitats the collision risk will increase accordingly.

Table 10: Impacts related to collision risk of birds

DESCRIPTION OF ACTIVITY	RECEPTOR	DESCRIPTION OF IMPACT	EFFECT/ DESCRIPTION OF MAGNITUDE	VALUE OF SENSITIVITY	MAGNITUDE OF CHANGE	SIGNIFICANCE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
The construction of the 48 – meter high proposed BTS and associated infrastructure.	**Biodiversity**	Birds might potentially collide with the tower due to the height of the tower (change in habitat of birds use to this area).	Adverse Direct Irreversible Moderate Permanent Local Possible	Medium	Moderate	**Minor (4)**	**Low (2)**

- Could potentially add objects (i.e., "Flappers", which are reflective rotating devices) to the tower that will be able to divert birds away from the structures, especially areas where materials are thin and potentially difficult to see;
- Audible frequencies (4 to 6 kHz) could be broadcasted from the tower to divert birds from the tower (Boycott et al. 2021).
- Lighting on the tower should preferably be a colour that does not attract insects, to prevent nocturnal birds from flying into the structures; and
- The "Flappers" could also be glow in the dark to make it visible for birds at night (Miguel et al. 2020 & www.birdbusters.com n.d.).

8 ENVIRONMENTAL MANAGEMENT PLAN

The EMP for the proposed project is presented in Appendix A. It provides detailed environmental management options to ensure that the impacts of the proposed project are avoided, minimised or mitigated. An EMP is a tool used to take proactive action by addressing potential problems before they occur. This should limit the impacts on the environment and reduce the number of corrective measures needed during project execution.

The management measures should be adhered to during all stages of the project activities. All persons involved in the proposed activities should be made aware of the measures outlined in the EMP to ensure activities are conducted in an environmentally responsible manner.

The objectives of the EMP are:

- To include all components of the development and operations of the project
- To prescribe the best practicable control methods to lessen the environmental impacts associated with the project
- To monitor and audit the performance of operational personnel in applying such controls, and
- To ensure that appropriate environmental training is provided to responsible operational personnel.

9 CONCLUSIONS

ECC's ESIA methodology was used to undertake the environmental assessment for the proposed project to identify if there is potential for significant effects to occur as a result of the proposed project. Through the scoping process, it was determined that there was no potential environmental risk that requires further specialist studies and assessment. The identified impacts on the environment were found to be minor to moderate, due to the location of the proposed brownfield site.

The main impacts of concern are with regards to community and employee health and safety, visual disturbances and a potential collision risk for avifauna. Various mitigation measures have been identified and listed for implementation in the EMP to avoid and/or reduce impacts as far as reasonably practicable, as well as to ensure the environment is protected and unforeseen effects and environmental disturbances are avoided.

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APPENDIX A – EMP

APPENDIX B – BACKGROUND INFORMATION DOCUMENT

APPENDIX C – EVIDENCE OF PUBLIC CONSULTATION

NOTICE OF AN ENVIRONMENTAL ASSESSMENT & PUBLIC PARTICIPATION PROCESS FOR THE PROPOSED CONSTRUCTION OF A BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE FOR PARATUS TELECOMMUNICATIONS (PTY) LTD ON ERF 361 IN BRAKWATER, KHOMAS REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) hereby gives notice to the public that an application for an environmental clearance certificate in terms of the Environmental Management Act, No. 7 of 2007 will be made as per the following:

Applicant: **Paratus Telecommunications (Pty) Ltd**
Environmental Assessment Practitioner (EAP): **Environmental Compliance Consultancy**
Location: **Khomas Region, Namibia**

Project: The proposed communication tower involves the construction of a base transceiver station and associated infrastructure on Erf 361 in Brakwater to the north of Windhoek.

Location: All activities will take place on Erf 361, owned by Paratus Telecommunications (Pty) Ltd.

Proposed Activities: Paratus Telecommunications (Pty) Ltd proposes to construct a communication tower on Erf 361 in Brakwater to the north of Windhoek. The tower will consist of a base transceiver station and associated infrastructure. The preferred tower height will be 48 meters in order to provide adequate transmission and reception of telecommunication service signals.

Purpose of the review and registration period: The purpose of the review and registration period is to introduce the proposed project and to afford registered Interested and Affected Parties (I&APS) an opportunity to comment on the Background Information Document (BID) to ensure that all issues and concerns are brought forward, captured and considered further in the assessment.

The registration period is effective from the **1st of November 2021 to the 15th of November 2021**. I&APs and stakeholders are required to access the BID and register for the project at: www.eccenvironmental.com/projects/ or alternatively email ECC to register.

The team at ECC will then maintain contact with all registered I&APs to keep them informed and engaged as the ESIA process develops. ECC will also provide registered I&APs with all relevant documents (Scoping plus Impact Assessment Report and EMP) to review during the assessment process.

Environmental Compliance Consultancy
Registration Number: CC/2013/11404
Members: Mr JS Bezuidenhout or Mrs J Mooney
PO Box 91193, Klein Windhoek
Tel: +264 81 669 7608
E-mail: info@eccenvironmental.com
Website: http://www.eccenvironmental.com

Project ID: ECC-45-365-ADT-05-D

8 Republikeinse Sun Allgemeine Zeitung Market Watch MONDAY 8 NOVEMBER 20

032 Veilings Auctions

KAROO OCHSE SENTRAAL

VEILINGSDATUMS 2021

BEES VEILING
24 NOVEMBER 2021

Willy Beyer
061 249 3000 OF 062 - 523255

035 Regsbekendmakings Legal Notices

NOTICE OF APPLICATION IN TERMS OF THE CASINOS AND GAMBLING HOUSES ACT, 1994 (ACT 32 OF 1994) SECTION 16(3) FOR THE PERMANENT REMOVAL OF A GAMBLING HOUSE LICENSE NO. 040 Notice is hereby given of the application for the removal of a license of which the details are given below.
Any person who wishes to object to the application in terms of section 19(1) may submit his/her objection in the prescribed manner to the secretary not later than 21days after the publication of this notice.
Name of applicant: Parikia Konstantinos Zoganas
Type of license: Gambling house license
Name of accommodation establishment or retail liquor business: Tuhafeni Bottle Store, Rundu
Physical address of premises to which the license will be moved: Erf 1717, Markus Siwarenga Street, Rundu
DM0202100294d00

NOTICE OF APPLICATION TO A COMMITTEE IN TERMS OF THE LIQUOR ACT, 1998 (Regulation 14, 26 & 33)
Notice is given that an application in terms of the Liquor Act, 1998,particulars of which appear below, will be made to the Regional Liquor Licensing Committee, Khomas Region.
1. Name and postal address of applicant: KAPPS FARM LODGE CC, P O BOX 2301, WINDHOEK
2. Name of business or proposed business to which application relates: KAPPSFARM LODGE
3. Address/location of premises to which application relates: REMAINING EXTENT OF FARM KAPPS FARM NO 63, DISTRICT WINDHOEK
4. Nature and details of application: APPLICATION FOR A NEW SPECIAL LIQUORLICENCE
5. Clerk of the court with whom application will be lodged WINDHOEK
6. Date on which application will be lodged: 26 NOVEMBER 2021
7. Date of meeting of Committee at which application will be heard: 8 JANUARY 2022.
Any objection or written submission in terms of section 28 of the Act inrelation to the application must be sent or delivered to the Secretary of theCommittee to reach the Secretary not less than 21 days before the date of themeeting of the Committee at which the application will be heard.
DM0202100292200

NOTICE The First and Final Liquidation and Distribution Account in the Estate of the Late CAREL JACOBUS ENGELBRECHT (No E 1325/2021) will lie for inspection for 21 (twenty one) days at the offices of the Master of the High Court, Windhoek as from Friday, the 5th November 2021.
BRIAN VAN RENSBURG
Executor
c/o Kinghorn Associates
cliffordb@kinglaw.com.na
DM0202100294d07

035 Regsbekendmakings Legal Notices

APPLICATION TO GOBABIS TOWN COUNCIL Notice is hereby given in terms of Clause 7 of the Town Planning Scheme of the intention to apply to the Town Council of Gobabis for special permission in respect of Erf 37, Epako Proper, Gobabis, situated in Karurab Street, Gobabis, to carry on the undermentioned business on the premises: MSN Bar – Special Liquor Licence
Any person objecting to the erection and/or usage of the above mentioned buildings or against the use of land is entitled to lodge such objections in writing to the Town Council and the applicant within 14 days of the last publication of this notice.
DM0202100294d01

NOTICE Take notice that DU TOIT TOWN PLANNING CONSULTANTS, on behalf of the owner of the erf, Body Corporate of AM Weinberg Sectional Title Scheme (SS 30/2018), in terms of the stipulations of the Urban and Regional Planning Act, 2018 (Act No.5 of 2018), intends to apply to the Windhoek City Council and the Urban and Regional Planning Board for:
- Consent to use ±1190m² of Erf 1944, Jan Jonker Drive, Klein Windhoek for 'Office' purposes.
- Amendment of Table C1 of the Windhoek Town Planning Scheme to revise and include the above consent.
Erf 1944, Jan Jonker Drive, Klein Windhoek is a well-known landmark in Windhoek. It is a historical dwelling that has been incorporated in an upmarket development consisting of a hotel, a health and wellness centre, some restaurants and also dwelling units. The erf is zoned 'Special' and included in Table C1 of the Windhoek Town Planning Scheme to include the above functions(excluding office use).
The Body Corporate has been using part of the erf for 'Office' purposes among other uses for some time now. It has, however, been brought to their attention that the consent for offices does not reflect on Table C1 of the Windhoek Town Planning Scheme resulting in tenants/ purchasers being unable to obtain/ renew fitness certification from the City of Windhoek. It is on this background that they applied to the City to grant them consent to use ±1190m² for the office component as well as amend Table C1 to include the 'Office' in the allowable uses of Erf 1944, Klein Windhoek.
The intended application is in line with the Windhoek Structure plan and sufficient parking is provided for on-site as per the City of Windhoek requirements. It should be noted that the support for consent would not result in an increase in the bulk floor area already in use and neither will it change anything on the character of the development as it already accommodates some office floor area.
Further take notice that the locality plan of the erf lies for inspection on the Town Planning Notice Board in the Customer Care Centre, Municipal Offices, Rev. Michael Scott Street, Windhoek and at the offices of Du Toit Town Planning, 4 Dr. Kwame Nkrumah Avenue, Klein Windhoek.
Further take notice that any person objecting to the proposed use of land asset out above may lodge such objection together with the grounds thereof with the City Council (the Urban Planner-Town House, Fifth Floor, Room 516) and the applicant within 14 days of the last publication of this notice (final date for objections/comments is 29 November 2021).
Should you require additional information you are welcome to contact our office.
Applicant
DU TOIT TOWN PLANNING CONSULTANTS
P O Box 6811
AUSSPANNPLATZ
WINDHOEK
Tel: 061-248010
Email: planner@dutoitplan.com
DM0202100294d04

035 Regsbekendmakings Legal Notices

IN THE High Court of Namibia
Main Division
Case No: HC-MD-CIV-ACT-CON-2019/03179
In the matter between:
MIRANDA TYRE SERVICE (PTY) LTD, Execution Creditor
and
SIMEON NEUMBO, Execution Debtor
NOTICE OF SALE IN EXECUTION
TO: THE DEPUTYSHERIFF, TSUMEB
A sale in execution will be held by public auction on Thursday the 18th day of November 2021 at 12H00 at Advanced Refrigeration, Main Road, Otjikoto, Republic of Namibia, during which there will be sold in execution as a result of an attachment made on the 2nd day of September 2021 under a Writ of Execution issued on the 6th day of May 2020 by the abovenamed Simeon Neumbo (The Execution Debtor).
GOODS: 1x Deep Fridge, 1x Kitchen Unit, 1x Wood Cupboard, 1x Wood Table, 6x Chairs, 1x TV, 1x DSTV, 1x Scale, 1x Double Bed, 2x Single Bed, 5x Plastic Chairs, 4x Office Chairs, 1xLounge Suite, 1x Tea Table, 4x Chairs, 1x Table.
CONDITIONS OF SALE:
1. The sale will be held without reserve and goods will be sold to the highest bidder.
2. The goods will be sold "voetstoots".
3. Payment shall be made in cash or by bank guaranteed cheque.
Dated at Windhoek this day of September 2021.
KOEP & PARTNERS
LEGAL PRACTITIONERS FOR EXECUTION CREDITOR
39 SCHANZEN ROAD
WINDHOEK
(REF: CW/70600)
DM0202100294d06

NOTICE OF APPLICATION TO A COMMITTEE IN TERMS OF THE LIQUOR ACT (REGULATIONS 14, 26 & 33) : Notice is given that an application in terms of the Liquor Act, 1998, particulars of which appear below, will be made to the Regional Liquor Licensing Committee, Region Otjozondjupa.
1. Name and address of applicant: Lorna Paywali Mbwale, PO Box 4464, Windhoek.
2. Name of business or proposed business to which application relates to: Abenab Lodge and Tours CC.
3. Address/ location of premises to which application relates: Farm Abenab 70?, Grootfontein, 30 km from Grootfontein on D3017 Road.
4. Nature and details of application: Restaurant Liquor licence, Lodge of fourteen rooms.
5. Clerk of the Court with whom application will be lodged: Grootfontein Magistrate Court.
6. Date on which application will be lodged: 11 December 2021 - 29 December 2021.
7. Date of meeting of Committee at which application will be heard: 10 February 2022.
Any objection or written submission in terms of Section 28 of the Act in relation to the application must be sent or delivered to the Secretary of the Committee to reach the Secretary not less than 21 days before the date of the meeting of the Committee at which the application will be heard.
DM0202100294d02

LOSING CONTROL?

AA

ALCOHOLICS ANONYMOUS NAMIBIA
If you want to drink, that's your business. If you want to stop, that's ours.
WINDHOEK: 061-235644
WARMPLUNS: 081 242 3649
E-MAIL:
alcoholicsanonymousnam@yahoo.com

AL-ANON

Help for relatives of Alcoholics

AL-ANON Family groups offer help for friends and relatives of alcoholics. They provide assistance for people who live with alcoholics.

Mail: volmerdj@telecom.na
Dawnnam@gmail.com
Cell: 061 256 6229

VENUE:
cnr Lüderitz and Kasino Streets

DATE AND TIME:
Thursdays at 19H00

AL-ANON

The Gateway to Business Opportunities

City of Windhoek

Vision: To be a SMART and Caring City by 2022

PUBLIC NOTICE

RESCHEDULING OF THE INTERIM VALUATION COURT HEARING FOR THE MUNICIPAL COUNCIL OF WINDHOEK

21 October 2021

The Municipal Council of Windhoek hereby informs residents that a Valuation Court hearing which was scheduled for 7th October 2021 will now be held on 18th November 2021 at the Council Chambers, City of Windhoek Head office from 9h00.

Objectors or duly authorised legal representatives should be present at the Valuation Court hearing.

For any enquiries regarding the above, please contact our Valuation division on 061-2902195

Mujiwa G Mayumbelo
Acting Chief Executive Officer

Issued by: Office of the Chief Executive Officer
Corporate Communication, Marketing and Public Participation
E-mail: corpcommunication@windhoekcity.na

CAREER OPPORTUNITY

NAMIBIA MEDIA HOLDINGS

NAMIBIA MEDIA HOLDINGS (PTY) LTD an equal opportunity employer has the following vacancy for a dynamic and energetic person with Namibian Citizenship.

PRESENTER/ COMMENTATOR (SPORT)

Paterson Grade C1 | Duty Station: Windhoek

Key Performance Areas
- Convene regular sport planning meetings
- Plan and coordinate dissemination of sports news digitally and in print
- Executive, review sports coverage daily and provide feedback
- Initiate and innovate new ways to disseminate sport news
- Assisting all projects relating to the sport events involving studio input
- Commentate sport events & present programs when presenters are unavailable/unable
- Ensure project deadlines are strictly adhered to

Interested candidates who qualify for the above position can forward their CV with certified copies of qualifications and relevant documentation to:

The Human Resources Department
E-mail: vacancies@nmh.com.na. Please write "Presenter/ Commentator (Sport) - Paterson Grade C1" in the subject line. For further details on job requirements and competencies visit http://nmh.com.na/vacancies

Only shortlisted candidates will be contacted. No documents will be returned.

Covid-19 vaccination required. Appointments will be granted to suitable vaccinated candidates.

Closing date: 19 November 2021 | Interviews: 22 November 2021

Republikeinse | Allgemeine Zeitung | Sun | NBC 247 | Love 247

Divisions of

NAMIBIA MEDIA HOLDINGS

NOTICE OF AN ENVIRONMENTAL ASSESSMENT & PUBLIC PARTICIPATION PROCESS FOR THE PROPOSED CONSTRUCTION OF A BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE FOR PARATUS TELECOMMUNICATIONS (PTY) LTD ON ERF 543 IN OKAHANDJA, KHOMAS REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) hereby gives notice to the public that an application for an environmental clearance certificate in terms of the Environmental Management Act, No. 7 of 2007 will be made as per the following:

Applicant: Paratus Telecommunications (Pty) Ltd
Environmental Assessment Practitioner (EAP): Environmental Compliance Consultancy
Location: Okahandja Region, Namibia

Project: The proposed telecommunication tower involves the construction of a base transceiver station and associated infrastructure on Erf 543 in Okahandja to the north of Windhoek.

Location: All activities will take place on Erf 543, owned by Paratus Telecommunications (Pty) Ltd.

Proposed Activities: Paratus Telecommunications (Pty) Ltd proposes to construct a communication tower on Erf 543 in Okahandja to the north of Windhoek. The tower will consist of a base transceiver station and associated infrastructure. The proposed tower height will be 40 meters in order to provide adequate transmission and reception of telecommunication service signals.

Purpose of the notice and registration period: The purpose of the notice and registration period is to inform about the proposed project and to afford registered Interested and Affected Parties (I&APs) an opportunity to comment on the Background Information Document (BID) to ensure that all issues and concerns are brought forward, captured and considered further in the assessment.

The registration period is effective from the 1st of November 2021 to the 30th of November 2021. I&APs and stakeholders are required to access the BID and register for the project at www.environmentalcompliance.net or alternatively email ECC to register.

We have as ECC will then maintain contact with all registered I&APs to keep them informed and engaged in the EIA process develop. ECC will also provide registered I&APs with all relevant documents (including plus report Assessment Report and EMP) to review during the assessment process.

ECC

2 Republikein Sun AZ Allgemeine Zeitung Market Watch MONDAY 1 NOVEMBER 2021

Over poor services

SA's ANC faces tough municipal vote

Potholed roads, blocked drains, water shortages and power cuts are some of the daily realities for poor South Africans.

ALEXANDER WINNING AND SIYABONGA SISHI

In a township in South Africa's industrial heartland, raw sewage flows through the streets and into people's homes.

Dilapidated infrastructure and poor services in areas that have traditionally been strongholds of the governing African National Congress (ANC) could hurt it in municipal elections.

The former liberation movement is hoping to win back metropolitan voters it lost to opposition-led coalitions in 2016, when it suffered its worst election outcome since sweeping to power under Nelson Mandela in 1994.

But analysts are predicting a continued slide in the ANC's national support, possibly dipping below 50% for the first time from 54% five years ago.

"There is no respect for human dignity," said Motsamai Matsabu, a pensioner in Evaton, a township of concrete and brick houses near major steel works south of the commercial hub Johannesburg, a pool of grey sewage festering in his yard.

"It makes me wonder whether our existence is worthwhile," he added, declining to say how he will vote on Monday.

Potholed roads, blocked drains, water shortages and power cuts are some of the daily realities for poor South Africans in parts of South Africa's steel belt near the Vaal River that have historically voted ANC. Broken pipes and wastewater treatment plants, and the accompanying smell, are a reminder that 27-year-old promises of a better life for all after white minority rule ended remain unfulfilled for many.

> *It makes me wonder whether our existence is worthwhile.*
>
> **Motsamai Matsabu**
> **Pensioner: Evaton**

ANC President Cyril Ramaphosa. PHOTO NAMPA/REUTERS

Housing

"For many years I was still making my 'X' for ANC, but I want another party. I think ANC doesn't have that feeling for us," Mamkiti Mbhele, a hair salon owner in the Sebokeng township whose house floods in heavy rain, told Reuters.

ANC officials say it was always going to be difficult undoing decades of apartheid-era neglect. Lesego Makhubela, spokesman for the ANC caucus in the provincial legislature of Gauteng, which includes Johannesburg and surrounding areas, said hundreds of newly built houses showed efforts to improve lives were bearing fruit.

ANC leader President Cyril Ramaphosa said on the campaign trail that the party had learned from its mistakes and would ensure municipalities are well-run. It is also mired in corruption scandals and faces criticism over extreme inequality and unemployment.

Gilberto Martins, an administrator appointed to help run the municipality that includes Evaton and Sebokeng, said the rotting infrastructure was worsened by vandalism and theft. Transformers had been sabotaged, and power cables and manholes stolen.

Residents have, meanwhile, formed a movement to field candidates in Monday's elections, capitalising on dissatisfaction with the ANC.

"We are now enjoying democracy in a dump," Ernest Nkopane, one of the New Horizon Movement's candidates, said. Analysts say getting less than 50% of the municipal vote would be a psychological blow for the ANC.

– Nampa/Reuters

Unemployment and inequality is rising in South Africa. PHOTO NAMPA/REUTERS

CEGEOR

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

INVITATION TO COMMENT

ARK INDUSTRIES NAMIBIA (PTY) LIMITED HAS APPLIED TO ECB FOR A GENERATION OF POWER USING A COMBINE CYCLE TURNINE (CCGT) USING ANEROBIC -DIGESTER /BIOGAS AND COMBINED HEAT AND POWER (CHP) PLANT AT ONDANGWA IN NAMIBIA.

Venue: Protea Hotel By Marriott Ondangwa ,Main street

Date: 5th November 2021

Time: 10:00 am to 12: 00 pm

CENTRE FOR GEOSCIENCES RESEARCH cc has been appointed to undertake an Environmental Impact Assessment (EIA) in accordance with the Namibian Environmental Management Act (2007) and it Regulations (2012).

Background Information can be requested from CENTRE FOR GEOSCIENCES RESEARCH cc. All Interested and Affected Parties are invited to register with CEGEOR to receive the BID so as to raise there concerns related to the project. Furthermore, Interested and Affected Parties are requested to register with the consultant before 2nd November 2021.

All comments and concerns should be submitted to CENTRE FOR GEOSCIENCES RESEARCH cc by 2nd November 2021. For further information regarding the project, and/or registration as an Interested and Affected Party, please contact:

Mr Mulife Siyambango (EAP)
CENTRE FOR GEOSCIENCES RESEARCH cc
P.O. Box 31423, Pioneerspark
Windhoek, Namibia, 12RA Bach Street
Cel 0856419511
Fax: 061-307156
Email: cegeornam@gmail.com

NOTICE OF AN ENVIRONMENTAL ASSESSMENT & PUBLIC PARTICIPATION PROCESS FOR THE PROPOSED CONSTRUCTION OF A BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE FOR PARATUS TELECOMMUNICATIONS (PTY) LTD ON ERF 361 IN BRAKWATER, KHOMAS REGION, NAMIBIA.

Environmental Compliance Consultancy CC (ECC) hereby gives notice to the public that an application for an environmental clearance certificate in terms of the Environmental Management Act, No. 7 of 2007 will be made as per the following:

Applicant: Paratus Telecommunications (Pty) Ltd
Environmental Assessment Practitioner (EAP): Environmental Compliance Consultancy
Location: Khomas Region, Namibia

Project: The proposed communication tower involves the construction of a base transceiver station and associated infrastructure on Erf 361 in Brakwater to the north of Windhoek.

Location: All activities will take place on Erf 361, owned by Paratus Telecommunications (Pty) Ltd.

Proposed Activities: Paratus Telecommunications (Pty) Ltd proposes to construct a communication tower on Erf 361 in Brakwater to the north of Windhoek. The tower will consist of a base transceiver station and associated infrastructure. The preferred tower height will be 40 meters in order to provide adequate transmission and reception of telecommunication service signals.

Purpose of the review and registration period: The purpose of the review and registration period is to introduce the proposed project and to afford registered interested and Affected Parties (I&APs) an opportunity to comment on the Background Information Document (BID) to ensure that all issues and concerns are brought forward, captured and considered further in the assessment.

The registration period is effective from the 1st of November 2021 to the 15th of November 2021. I&APs and stakeholders are required to access the BID and register for the project at: www.environmental.com/projects/ or alternatively email ECC to register.

The team at ECC will then maintain contact with all registered I&APs to keep them informed and engaged as the EIA process develops. ECC will also provide registered I&APs with all relevant documents (Scoping plus Impact Assessment Report and EMP) to review during the assessment process.

Environmental Compliance Consultancy
Registration Number: CC/2013/13488
Member: Mr. Jo-Boaldi Brink or Mrs / Mevrouw
PO Box 91183, Klein Windhoek
Tel: +264 61 249 2909
E-mails: info@environmental.com
Website: http://www.environmental.com

ECC

INTERCAPE
Safe • Dependable • Affordable

Windhoek Depot:
Professional Coach Drivers

Requirements:

- Namibian Citizen
- Minimum Grade 10 education
- Valid Code CE Licence, PDP - G.P.
- Police Clearance
- 3-5 years' long distance coach driving experience
- Good communication skills
- Reliable and trustworthy
- Discipline orientated
- Own transport essential

Closing date: 12 November 2021

Send CVs to **rudi@intercape.co.za**

Always state clearly in your CV your long distance experience when applying for the position.

For any queries contact the depot directly on 044 695 1641.

Coordinates: -22.414100, 17.068094

Coordinates: -22.414031, 17.068495

+264 81 669 7608
info@eccenvironmental.com
www.eccenvironmental.com

ECC Ref: ECC-45-365-LET-04-D
27 October 2021

Identified Stakeholder and Potentially Interested Party for:
Paratus Telecommunications (Pty) Ltd proposed the construction of a 48-meter high communication tower.

Dear Sir or Madam:

RE: NOTIFICATION OF AN ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF A BASE TRANSCEIVER STATION AND ASSOCIATED INFRASTRUCTURE FOR PARATUS TELECOMMUNICATIONS (PTY) LTD ON ERF 361 IN BRAKWATER, KHOMAS REGION, NAMIBIA.

Environmental Compliance Consultancy (ECC) has been engaged by Paratus Telecommunications (Pty) Ltd (the Proponent) to act on their behalf for the environmental clearance certificate application in terms of the Environmental Management Act, No. 7 of 2007 for the proposed construction of the communication tower.

This letter is intended to engage potentially Interested and Affected Parties (I&APs) for the project and provides a communication channel to ECC whilst the ESIA is ongoing. You have been identified as an interested or affected party and therefore ECC wishes to inform you of how you can interact with the ESIA.

The proponent proposes to construct a communication tower on Erf 361 in Brakwater to the north of Windhoek. The tower will consist of a base transceiver station and associated infrastructure. The preferred tower height will be 48 meters in order to provide adequate transmission and reception of telecommunication radio signals.

Public participation is an important part of the ESIA process, as it allows the I&APs to obtain information about the proposed project and provide feedback. Communication with the I&APs occurs at various stages throughout a project lifecycle including:

- Advertising in newspapers; public notice boards (already done);
- Distributing a Background Information Document (BID) to identified I&APs; available online at (https://eccenvironmental.com/projects/)
- Registered I&APs will also be informed of the available draft scoping report for a review period, during this period I&APs will have the opportunity to review the draft document and raise any issues or concerns, and
- I&APs who wish to register as such must do so on the ECC website as per the link provided below: https://eccenvironmental.com/projects/

If you are unable to complete the registration form online, please contact us via email for assistance. info@eccenvironmental.com
ECC values community input and participation in our projects and we look forward to working with you as the project develops.

Should you have any questions or require additional information please do not hesitate to contact either of us.

ENVIRONMENTAL COMPLIANCE CONSULTANCY CC
PO BOX 91193 WINDHOEK, NAMIBIA
MEMBERS: J L MOONEY & JS BEZUIDENHOUT
REGISTRATION NUMBER: CC/2013/11404

Yours sincerely,

Stephan Bezuidenhout
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MEMBERS: J L MOONEY & JS BEZUIDENHOUT
REGISTRATION NUMBER: CC/2013/11404

NO.	I&AP / STAKEHOLDER COMMENT RECEIVED	STAKEHOLDER DETAILS	RESPONSE / CLARIFICATION
1.	Thank you for your email and informing us of this development. We would like to be registered as an I&AP and be kept informed of the proposed construction of a telecommunication tower. We have a few concerns. 1. Please could you elaborate on the potential health and safety risk that is indicated in section 2.7.1 2. We will be in direct line of sight of this tower, could you please give us an image of the visual impact it will have. 3. We have a dam on our property that has water all year round and thus attracts many bird species including many waterbirds and most likely birds of conservation concern. Please could you notify the avifauna specialist of this important waterbody for birds. 4. How long do you anticipate the construction phase to last? It will also possibly increase risk of crime in the area during this period as there will be new and more construction personnel on site. Has this been considered?	Nicole & Manu BASSINE-DEHALLEUX Plot 31 Brakwater 081 1240944 brassine@iway.na	Yes, you have already been added as an I&AP for the project. We have indeed considered most of your concerns and they will be incorporated into the scoping report. Below are more specific responses to your concerns. Thank you for your email and for informing us of this development. We would like to be registered as an I&AP and be kept informed of the proposed construction of a telecommunication tower. We have a few concerns. 1. Please could you elaborate on the potential health and safety risk that is indicated in section 2.7.1 – This will be discussed in detail in the scoping report and once done, will also be made public for review. Public comments will be incorporated into the scoping report before submission to the MEFT takes place. 2. We will be in direct line of sight of this tower, could you please give us an image of the visual impact it will have. – The viewshed map of the tower will be added to the scoping report. 3. We have a dam on our property that has water all year round and thus attracts many bird species including many waterbirds and most likely birds of conservation concern. Please could

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			you notify the avifauna specialist of this important waterbody for birds. – We have included the potential collision risk to avifauna within our assessment. The findings of which will be contained in the scoping report and relevant mitigation measures included in the environmental management plan. 4. How long do you anticipate the construction phase to last? It will also possibly increase risk of crime in the area during this period as there will be new and more construction personnel on-site. Has this been considered? – Safety and security risks and related potential impacts has been considered in the assessment. Corresponding mitigation measures to avoid the impact at source level will be encapsulated in the environmental management plan. The actual construction timeframe including duration, has not yet been finalised. Please do not hesitate to contact us if there are any additional concerns.
2	Dear Mr Bezuidenhout, I cannot find the above mentioned project on https://eccenvironmental.com/projects/.	upb@protonmail.com myxy@protonmail.com	Good morning Dr. Beiler, Thank you for your email and for letting us know, we look forward to receiving your comments or

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	Kindly register us (Beiler : plot 115 Brakwater) as interested and affected parties. Regards, Dear Ms Hoffman, thank you for your reply. Attached please find comments on the application for a tower on plot 361, Brakwater by Paratus to be included in your report. Kind regards, Michael **"Comment on Environmental Clearance Application for Proposed Base** **Transceiver Station by Paratus Telecom** **on Portion 361 in Brakwater, Windhoek** The following document includes concerns, comments and an objection to the application for an environmental clearance certificate for the planned	Plot 115 Dr Michael Beiler	concerns. The background information document for the proposed project can be downloaded by following this link: https://eccenvironmental.com/download/proposed-construction-of-a-base-transceiver-station-and-associated-infrastructure/ You have hereby been registered as an I&AP and will receive the relevant information as the process progresses as well as the chance to review the final deliverables before submission to the Ministry of Environment, Forestry and Tourism. The registration period was effective from the 1st of November till the 15th of November 2021 as seen in the advert attached that appeared in the newspapers, but you can still submit your comments and concerns and we will incorporate it into the Scoping report. We look forward to hearing from you. Please let us know if you have any additional questions. Kind regards, **Concerns addressed:** • **zoning:** APPENDIX E – ERF 361

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	base transceiver station by Paratus Telecom. The objection is divided into two parts. The first indirectly concerns the environmental clearance application and explains the flawed industrial rezoning which paved the way for the construction of a data centre and the proposed industrial telecommunications base station in the first place. The process evolved gradually and neighbours were not informed on any previous or planned developments. This leads to the second part, which concerns environmental and human impacts of the proposed project. The comment can be summarized as follows: Part 1: Flawed Procedure in Obtaining Industrial/Communication Rights and Environmental Clearance • The comment provides the background to this disputed development. • Environmental assessment and clearance was not performed prior to the project • The rezoning process did not follow the guidelines. We as neighbours were not informed about the rezoning process. This does not meet the requirements. • Rezoning reportedly happened in 1998 but no		APPROVED SITE PLANS • **public consultation:** APPENDIX C – EVIDENCE OF PUBLIC CONSULTATION • **community health and safety:** section 7.6.2 RF Radiation Exposure • **biodiversity:** 7.1 IMPACTS DEEMED NOT SIGNIFICANT and 7.7.1Risk of colliding with the Tower. • **5g:** At this stage, Paratus has no intention to deploy 5G network in the short term. • **visual:** 7.6.3 Visual Impacts

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	evidence can be provided by the authority. Part 2: Environmental Clearance • Neighbours were not informed about the intention to erect a base transceiver station, emitting radio frequency radiation (RFR) at the start of the project. The municipality could not provide plans when requested. • Base stations impact the natural and human environment. A large number of sources shows the harmful effect of electromagnetic field exposure and radio frequency radiations on the environment. • A large number of independent scientists have concluded that regulatory radio frequency radiation thresholds are unsafe, even in countries with high standards such as Japan and U.S, and that radio frequency radiation needs to be **reduced** from current levels. • A 48m tower is undesirable in a residential neighbourhood for several reasons, including the visual impact.		

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	• The impact on birdlife will likely be substantial." **1. Flawed Procedure in Obtaining Industrial/Communication Rights and** **Environmental Clearance for Plot 361** In 1970 our family purchased smallholding portion 115 of 25ha in Brakwater, adjacent to the new subdivision 361. Plot 115 was subdivided by a service road (D1491) in 1976 into an eastern and western portion. Plot 361 is located to the east of plot 115, which is the matter of comment. Between 1990 to 2000 the Brakwater area was transferred from Rural Development to the Windhoek municipality. Brakwater area was a residential zone. The municipality appointed consultants to advise on development of Brakwater. Community meetings were held and it was proposed to introduce industry to the west of the Windhoek-Okahandja road B1, including the eastern portion of our plot. Residents objected and requested industry not to be introduced to the west of the B1. This was acknowledged by the consultant at that time. However, the municipality proceeded with its plan to introduce industry to this area and presented new development plans. More community meetings followed. Residents were informed, but requests were not included in the planning. Planners did not involve residents in their		

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	planning. At a meeting at Umti Lodge municipality planners confirmed that essential and required environmental impact assessment studies of the whole Brakwater region will be performed prior to further development. This never happened. The proposed plans include industrial core zones to the east of our plot, which includes Plot 361. Realizing that disruptive bulk industry will eventually be introduced into Brakwater and since developers started purchasing land, the only option we had to maintain reasonable environmental conditions was to object to further rezoning of residential to industrial usage for the neighbouring plots. At the end of 2020 and at the start of the holiday season the natural environment on the adjacent subdivison 361 was destroyed for a new industrial development. As direct neighbours we were alarmed as we were unaware of an application for rezoning to industrial or an environmental impact assessment, as no notice boards of rezoning were put up and we were not consulted. Therefore, we started an enquiry at the municipality. In January 2021 the official at the municipality confirmed that no buildings or industrial development had been approved according to records. We inquired at the head of planning in writing. Mr van Rensburg confirmed that he could not establish whether or how the plot had acquired		

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	industrial rights and announced a formal investigation to be launched. On 10 February 2021 the section planner of the municipality, Mr Rust, requested a site visit with us to identify the correct plots (another dispute concerned a plot 505 and not discussed here) as plot numbers on various maps were inconsistent. In the meantime we inquired at the Deeds Office for more information. Plot 361 had actually been transferred to Paratus Telecom in September 2020 for N$8.2 million. No reference to industrial usage was noted. Thus we visited the planning office at City of Windhoek to find out about any zoning information, but the information did not reveal the required information. We were given a general Zonal Planning Policy Map. We followed up the at Namibia Planning Bureau (Nampab) on 15 February 2021 to find out if any industrial zoning was granted but were informed that no maps and information are available, but that consultants have this information. The consultant Stubenrauch and Partners, however, referred us back to the City of Windhoek. Subsequently, Mr Rust sent an email referring to a Council Resolution 119/05 of 1998, which states that Portion 26 was subdivided into 5 Portions and		

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	rezoning of portions to industrial bulk of 0.5 ha had already been granted in 1998. This was a surprise as this rezoning was to our knowledge never advertised or consulted with neighbours before. We asked for clarification but municipality reported that it had lost any proof of the rezoning for plot 361. The rezoning to industrial rights plot 361 is therefore unacceptable as it did not follow the correct procedure, were not disclosed to neighbours and did not request their consent to such a significant transformation. 60% of property transfer value needs to be paid as betterment fees on rezoning applications. N$0 has been paid. Other inconsistencies occur, such as incorrect statements in the applications, road side clearance requirements for plot 361 being ignored and accepted, etc. In February 2021 we contacted City of Windhoek (Mr Rust and van Rensburg) to clarify whether - a formal process was followed and why neighbours have not been consulted - why our concerns and requests and view have consistently been ignored and the construction be halted until the results are available. Construction at plot 361 came to a halt. We awaited the reply, but when construction resumed in June 2021, I asked Mr van Rensburg and Mr Rust on June		

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	10th, 2021 when the response will be provided. Mr van Rensburg responded that he believed all concerns had been responded to. Mr Rust then acknowledged that a response was not ready yet. Eventually a reply followed on June 14th. In a nutshell, the response did not show that a formal rezoning process for plot 361 was followed. The application and procedure is considered unacceptable and inadequate. According to environmental legislation an environmental assessment is required for land use and transformation developments before any part of the environment is being destroyed. Municipality did not confirm whether a clearance certificate was issued for plot 361, though the environment was practically wiped out. An environmental assessment and clearance makes only sense if it is done before the environment is irreversibly damaged. In conclusion, the rezoning process was unacceptable. Neighbours were not involved. Raised concerns were ignored. No impartial party oversaw the process. City of Windhoek claims the correct rezoning procedure was followed and neighbours gave consent, but did not show evidence five months after construction started. Instead they allowed the construction to proceed. We are not aware of any public notice and were not consulted for industrial		

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	rezoning and City of Windhoek claims relevant documentation cannot be traced. An environmental impact assessment and environmental clearance is useless if it is not done prior to the construction of the project and involving all affected parties. No assessments were performed at the onset although the development destroyed the environment. The background document states that the location has now been identified, because the applicant now has a data centre at that site. This cannot be a justification if the first project does not meet all standards and requirements. **Part 2: Environmental Impact** The owner now, after the disputed first development, publicises his intention to construct a base transceiver station and associated infrastructure. Neighbours have not been contacted or consulted. We spotted a notice of the environmental application at the perimeter of the site. The consequences of a tower is of concern. This section deals with environmental impact, health impact, EMF, RFR and more. ***Environmental and Health Impact:*** Many scientific studies have indicated the devastating effects on humans and the environment		

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	of RFR, as emitted from the base transceiver stations. Environmental effects include the following: 1. A huge number of peer-reviewed, published scientific studies indicate that exposures to wireless radiation can cause cancer, alter brain development and adversely impact insects and mammals. Cell tower radiation is also associated with headaches, hormone changes, memory problems and sleep problems. [Published Scientific Research on 5G, 4G Small Cells, Wireless Radiation and Health - https://ehtrust.org/scientific-research-on-5g-and-health/] 2. Radiofrequency radiations (RFRs) emitted by mobile phone base stations cause DNA damage and impact antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations. [https://pubmed.ncbi.nlm.nih.gov/28777669/] 3. Inhabitants living nearby mobile phone base stations are at risk of developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition. [https://pubmed.ncbi.nlm.nih.gov/16962663/]		

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	4. Research shows that higher rates of illnesses and cancers occur not only in those living near mobile masts and base stations, but also in those living well beyond 300m away from the tower. Figure 1: Electromagnetic field strength of base station beam A study by Zothansiama et al, 2017, demonstrated that both staying near the mobile base stations and continuously using mobile phones damage the DNA, and it may have an adverse effect in the long run. The persistence of DNA damage leads to genomic instability which may lead to several health disorders including the induction of cancer. [https://www.researchgate.net/publication/318916428_Impact_of_radiofrequency_radiation_on_DNA_damage_and_antioxidants_in_peripheral_blood_lymphocytes_of_humans_residing_in_the_vicinity_of_mobile_phone_base_stations] 5. Studies have shown that mitochondrial damage can occur after EMF radiation exposure, and the mutations are inherited by the next generations. While there is a lack of studies on 5G, because it is such a new technology, there is already plenty of evidence linking 2G, 3G and 4G to several types of cancer, including brain cancer. [Radio frequency radiation-related cancer: assessing causation in the		

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	occupational/military setting, https://pubmed.ncbi.nlm.nih.gov/29433020/] [Martin Hall, 5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them, Washington State University, 2018] Figure 2: Study of the health of people living in the vicinity of mobile phone base stations [Pathol Biol 2002; 50 : 369-73, 2002 Editions scientifiques et medicales Elsevier SAS. Tous droits reserves S0369-8114(02)00311-5/FLA] Proof and references to scientific studies of the great harm caused by EMF is summarized in a comprehensive review compiled by Professor Martin Hall of Washington State University. Instead of including the information here, the document has been attached in the Annex. Given the considerable health risks and effects on the environment shown in referenced studies, this is a valid reason to reject the base transceiver station on our neighbouring plot 361. ***Location:*** The location is unsuitable because it is in a populated area and population density increases rapidly in the area. The background information states that "the project is needed at this location to increase		

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	network coverage in Brakwater, which will accelerate the use and development of information technology in the proposed area and Namibia at large." Firstly, it is not clear exactly how the country and not the local area will benefit from the mast. Secondly, negative impacts of EMR on all biological systems, including humans, will be relevant here. Thirdly, MTC and Telecom Namiba already provide excellent network coverage and bandwidth to most of Brakwater, Elisenheim, Emmerentia, Nubuamis and other areas, even exceeding the quality of service compared to Windhoek central. Hence it is unclear why it is stated that additional coverage is needed, which would justify a huge 48m mast. ***Visual Impact:*** Apart from the health risk, a 48m high tower will visually impact the surrounding area. Communication companies usually camouflage communication masts in order to overcome this problem. Here a 48m tower cannot be disguised and will be an eyesore at the doorstep of the neighbourhood. ***Impact on Birdlife:*** High masts have an impact on birdlife. There is a high risk of avian collisions with a tower at this location. This has been shown by numerous studies. For example, every year an estimated 4–5 million migratory birds collide with communication towers in the United States. [Ghering		

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	et al., The Role of Tower Height and Guy Wires on Avian Collisions With Communication Towers, Michigan State University, 2011]. The proposed location is unsuitable for a 48m high mast. Many birds cross and bird migration routes follow the valley between the mountains to the east and west. Large birds, including storks, herons, egrets, vultures, pelicans, eagles and other large bird species cross the area. ***Impact on Wildlife:*** Not only humans but wildlife living in the area of masts suffer consequences due to radiation. Phone masts are irradiating continuously and some species of wildlife living in the area suffer long-term effects, such as reduction of their natural defenses and health, decline in reproduction capability and reduction of their useful territory through habitat deterioration. Electromagnetic radiation can exert an aversive behavioral response in some species. Microwave and radiofrequency pollution constitutes a potential cause for the decline of animal populations and deterioration of health of plants living near phone masts. [A. Balmori, Electromagnetic pollution from phone masts. Effects on wildlife, 2009] "A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)" published in Environment International reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and		

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	plants in 70% of the studies (S. Cucurachi et al., A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF),2013). Development and reproduction in birds and insects were the most strongly affected. Figure 2: Normalized Electric Filed strength (dB) in a mid-transverse cross section of ahoney bee as a function of frequency for a single plane wave incident. ***Impact on Trees:*** Research has also found high levels of damage to trees from cell antenna radiation. For example, a field monitoring study, "Radiofrequency radiation injures trees around mobile phone base stations" published in the Science of The Total Environment –spanning 9 years, involving over 100 trees–found trees sustained more damage on the side of the tree facing the antenna (Waldmann-Selsam et al., Radiofrequency radiation injures trees around mobile phone base stations, 2016). ***Noise pollution:*** from telecommunication and related equipment and machinery may exceed expected sound emission limits at night and have a negative effect on the surrounding neighbourhood. This needs to be addressed.		

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	Unsafe RFR limits: A study by the New Hampshire Legislative Commission of 2020 looks into the environmental impact of RFR. The report provides a list of recommendations, included as Annex 2. "It is to be noted that the only country with higher radiation thresholds than the U.S. is Japan, and a large number of independent scientists have concluded that the thresholds for Japan and the U.S. are unsafe." This landmark report shows the need for **RF radiation reductions** to protect people and nature from increasing exposure to RF radiation. The list of negative consequences mentioned here include a few salient concerns, but the list is not complete. The application for a mast on plot 361 needs to be rejected as all the studies and evidence indicate the negative impact on the environment. Dr. M. Beiler Brakwater, 2 December 2021		
Comments received during the public review period.			
	Objection to Environmental Clearance Application for Proposed Base Transceiver Station by Paratus Telecom on Portion 361 in Brakwater Dear Sirs, as neighbours and as directly affected party, we object to the proposed base station, Environmental Scoping Report (ESR) and Environmental Management Plan (EMP) due to shortcomings regarding both factual as well as administrative issues. The project is rejected primarily due to 1. harmful effect of a mast on biodiversity,	upb@protonmail.com myxy@protonmail.com Plot 115 Dr Michael Beiler	Good morning Dr. Beiler, Thank you we received your email and we will add and incorporate your comments to the scoping report and EMP. Have a good week. Kind regards, Diaan Hoffman

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	avifauna and nature 2. the mast exposing residents and environment to harmful microwave radiation 3. scientific proof of the harmful effects of microwave radiation on humans and environment in the vicinity of a base station 4. unacceptable and unwanted invasion of industry in a biodiverse and residential area 5. unacceptable environmental impacts and unacceptable visual impact of a 48m mast 6. two existing telecommunication masts in the area and excellent network coverage available, meaning an additional mast is redundant. Specific comments to ESR: 1. The ESR states the site was selected because Paratus chose the cheapest option regarding land and power and rejected sites to the airport road and closer to Windhoek (p20), while the application states "The proposed project is needed to increase the network coverage in Brakwater, which will accelerate the use and development of information communication technology in the proposed area and Namibia at large." (BID p3) If the site was selected for pricing it is wrong to state that the project is needed for network coverage in Brakwater. 2. As already mentioned in our previous comment, a cellphone mast from the competition, located only 700m away form Portion 361 behind the highway, as well as a second mast from Telecom on a close mountain at Elisenheim to the east, provide excellent		**Comments addressed:** **It is important to note that this ESIA report is only for the BTS and not for the data centre. The EMP thus only includes mitigation measures for the BTS.** **Paratus expansion:** a Purpose for an organization like Paratus is to expand and compete with other similar organizations, while supporting economic development and sustainability. Refer to targets/objectives set for the ICT development in

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	network coverage, exceeding bandwidth quality provided in Windhoek. There is no need to increase network coverage, but Paratus intends to compete with MTC and Telecom in the area. (p10). 3. p20: The option of not constructing a new BTS would mean that Paratus will not be able to supply telecommunication services to cater for the increased demand for network coverage around the proposed site. As a result, poor reception and/or no network access for mobile phone users would continue to occur. This is untrue as Telecom and MTC provide excellent network coverage. 4. A national data centre is constructed on the site. The BID document states "the proposed project will accelerate development … in … Namibia at large." (BID p3). If this implies that the mast is required to connect the data centre to the national communication network, the application needs to explicitly point this out. 5. If the mast is intended to be used to connect the data centre to the national network, fiber optic cable is not mentioned as an alternative. 6. The desktop study provides general Information on local avifauna, fauna, insects, but information is not site specific. (p28). For example large groups of low flying migrating birds are observed in the morning and evening, storks, pelicans and other water birds are attracted to the area due to perennial rivers, man-		Namibia. "One of the objects of the Communications Act is to ensure fair competition within the market. So since there are towers of competitors in the area, there are absolutely no grounds to object against Paratus erecting a tower". Not within the scope of the proposed project. "Fibre infrastructure will be implemented but not as part of the BTS project. Fibre infrastructure will be deployed as the primary Transmission medium to service Armada Data and its customers. The objective of the new BTS to enhance network resilience as an alternative medium in case of disruption/damage/failure if fibre infrastructure. Offering services to customers by means of wireless technologies is part Paratus business which based on customer demand. The BTS tower will so service customers within it area of coverage". "The communication mediums and technologies(wireless and optical) are deployed in the industry due to its own unique characteristics making each suitable for different applications".

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	made dams and waterholes, vultures visiting different feeding stations in the area, eagles etc. Studies have shown that insects are harmed by RF radiation while it is has not been mentioned that neighbours farm with honey bees, which will be affected. The study mentions disappearance of biodiversity in Table 5, p40, but rejects this important fact as insignificant impact. This is wrong and unacceptable. Specialist input and studies are required. 7. The ESR concludes that RF radiation is safe because a 2006 reference to the WHO, mentioned that there was no convincing evidence that RF signals cause adverse health effects. (p30) Firstly, the ESR does not acknowledge a number of references to scientific and peer reviewed studies we provided and which indeed showed the adverse health effects that have been observed near cell towers. Reference to another extensive study from Levitt and Lai1 of 2010 is included, which also shows the problem with base tower radiofrequency and power densities. The following excerpt is relevant: Lilienfield recorded exposures for continuous-wave, broad-band, modulated RFR in the frequency ranges between 0.6 and 9.5 GHz. The exposures were long-term and low-level at 6 to 8 h per day, 5 days per week, with the average length of exposure time per individual between 2 to 4 years. Modulation information contained phase, amplitude, and pulse variations with modulated signals being transmitted for 48 h or less at a time. Radiofrequency power density was between 2 and 28 mW/cm 2 — levels comparable to recent		The construction of the data centre has already started on-site and this is not a completely untouched area thus it was deemed unnecessary to include specialist studies for the proposed BTS. **Biodiversity concerns RF radiation:** Potential impacts are mentioned in Table 5 section 7.1 impacts deemed not significant, because this is not a completely untouched area and the highway and increased movement in the area will influence the biodiversity presence in the area, this is why the impact has been deemed as not significant. Please refer to **Figure 1** which shows the extent of the disturbed environment. **Human RF radiation Impact:** This has been discussed in section 7.6.2 RF Radiation Exposure, and all cases were taken into consideration and potential adverse effects have been discussed: Then other studies showed several more serious symptoms/illnesses that could potentially be the result of RF radiation which included, neoplasia, heart and circulation disorders, cancer, neurobehavioural symptoms, DNA damage and effects on hormone levels (Richter et al. 2002, Eger et al. 2004, Wolf & Wolf 2004, Eşmekaya et al. 2010, Khurana & Joris 2010, Eger, H. & Jahn, M. 2010, Rodrigues et al. 2021, Zothansiama et al. 2017). But, according to the ICNIRP, the only validated adverse health effects with regards to RF radiation are impacts due to the rise in temperature, nerve stimulation and permeability of cell membranes (ICNRIP, 2020).

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	studies cited in this paper. The symptoms that Lilienfield found included four that fit the Soviet description for dermographism — eczema, psoriasis, allergic, and inflammatory reactions. Also found were neurological problems with diseases of peripheral nerves and ganglia in males; reproductive problems in females during pregnancy, childbearing, and the period immediately after delivery (puerperium); tumor increases (malignant in females, benign in males); hematological alterations; and effects on mood and well-being including irritability, depression, loss of appetite, concentration, and eye problems. This description of symptoms in the early literature is nearly identical to the Santini, Abdel-Rassoul, and Narvarro studies cited earlier. Secondly, the WHO recommendation of 2006 has been disputed and is considered inadequate: The WHO adopted the International Agency for Research on Cancer (IARC) classification of extremely low frequency electromagnetic field (ELF EMF) in 2002 and radiofrequency radiation (RFR) in 2011. This classification states that EMF is a possible human carcinogen (Group 2B). Despite both IARC findings, the WHO continues to maintain that there is insufficient evidence to justify lowering these quantitative exposure limits. Based upon peer-reviewed, published research, a group of scientists engaged in the study of biological and health effects of non-ionizing electromagnetic fields (EMF) 2 concluded the serious concerns regarding the exposure to EMF generated by electric and wireless devices, including base stations, and indicated the		A communication tower has a shadow zone (approximately 0 to 46 meters) where there is less radiation and then between about 46 meters to 152 meters from the tower is where the radiation is the highest (Daniel, 2019). Figure 9 shows within what distance range RF radiation is the highest; the potential concern here is the data centre that lies between 37 meters (at the closest point to) to about 102 meters (at the furthest point of the building) from the proposed tower. As seen in Figure 9 there is a zone above ground that also has minimal exposure. The higher RF radiation exposure will be higher above ground (closer to the source) and due to the proposed project not having any high buildings surrounding the proposed communication tower RF radiation exposure is expected to be minimal; it is thus unlikely that there would be adverse health risks for employees and the community surrounding the site. This sentence has been taken from the Levett study: “Their findings coincide with Abdel-Rassoul et al. (2007) who found field strengths to be less in the building directly underneath antennas, with reported health complaints higher in inhabitants of the building across the street”(Levitt, B. and Lai, H. 2010). This refers to buildings and as mentioned in section

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	shortcomings in the WHO guide. 1 Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays 2 https://www.researchgate.net/publication/298533689_International_Appeal_Scientists_call_for_protection_from_non-ionizing_electromagnetic_field_exposure Two further ecological studies of cancer in the vicinity of base stations report both a strong increase of incidence within a radius of 350 and 400m, respectively.3 The ESR refers only to the disputed WHO reference. The topic is not even included in the list of potential impacts (Table 6), but listed as non-significant impact (Table 5) and is being ignored. It is mentioned once more under social impacts, but discarded as a minor impact not worth considering (p 47). This is misleading and unacceptable. Figure 9, taken from the previously provided list of references, is discussed out of context and the conclusion (it is thus unlikely that there would be adverse health risks for employees and the community surrounding the site and zone above ground has minimal exposure) is incorrect. The exposure is not minimal at ground level. Refer to the Levitt and Lai study quoted earlier. The ESR ignores findings of studies that base stations radiate at frequency and power density that are harmful within an area 500 meters. According to 17 references considered by the State of New Hampshire Commission report, the set-back for all new cell towers should be 500 meters. The microwave radiation is high and the risk of exposure is unacceptable to residents and workers. Expert		7.6.2 and as seen from Google Earth satellite images there are no high buildings next to the proposed site that might potentially be exposed to the higher exposure limits. The following information from Cancer.org. (2020) also states that RF radiation weakens further from the source and is weaker at ground level: "Base station antennas use higher power levels than other types of land-mobile antennas, but much lower levels than those from radio and television broadcast stations. The amount of energy from RF waves decreases rapidly as the distance from the antenna increases. As a result, the level of exposure to RF waves at ground level is much lower than the level close to the antenna. At ground level near typical cellular base stations, the amount of energy from RF waves is hundreds to thousands of times less than the limits for safe exposure set by the US Federal Communication Commission (FCC) and other regulatory authorities. It is very unlikely that a person could be exposed to RF levels in excess of these limits just by being near a cell phone tower."

NO.	I&AP / STAKEHOLDER COMMENT RECEIVED	STAKEHOLDER DETAILS	RESPONSE / CLARIFICATION
	findings need to replace the flawed discussion provided in this report. 8. Plot 115 to the west is a residential plot and people reside on plot 115 within the 500 meter range. This is not even mentioned in the study. 9. Masts impact migration route of birds. Birds migrate through the valley and close to the water sources in the area, often daily. The significance of the impact is classified as minor (p52). This is not a minor issue, given the status and vulnerability of avifauna occurring. 10. The ESR argues that Due to the proposed BTS being planned in an area with industrial activities and with the highway running approximately next to the site (and carries heavy traffic each day), it is expected that there would be a lower wildlife presence in the surrounding area due to an already disturbed habitat (p40) and Erf 361 is an industrial site and is also surrounded by various sites with industrial activities (to the north, east and south) (p34). The argument is then used to motivate the introduction of the industry. This is a biased presentation of reality which facilitates biodiversity destruction in the area. The following is a more accurate description: The base station is currently developed in a biodiverse area and a land of pristine nature. The area is completely uprooted for the development. The highway borders the site to the east. Vacant land is located behind the highway. Warehouses and storage sites are located		RF radiation exposure weakens as it moves away from the source and various studies indicate that exposure is already weak between 300 and 500 meters from the BTS (i.e, Figure 9). The closest surface infrastructure is about 280 - 300 meters away from the BTS and there are no high buildings. There are mitigations in the EMP to minimize these impacts Potential collisions risks are thoroughly discussed in 7.7.1 **Risk of colliding with the Tower.** Erf 361 does not represent a pristine/undisturbed habitat/ environment, please refer to Figure 1 which shows the extent of buildings and cleared areas surrounding the proposed site.

NO.	I&AP / STAKEHOLDER COMMENT RECEIVED	STAKEHOLDER DETAILS	RESPONSE / CLARIFICATION
	behind that vacant land (Nampower). No industry is located close to the site to the west of the highway and close to this site. A truck business operates from a plot to the north. The land to the south has been cleared many years ago and is vacant and undeveloped. A woodcutting business operates from the plot to the north east. The portion to the west and northwest is undeveloped as well and used only for residential, agricultural and woodcutting purposes. A Namwater pumpstation to the south frequently releases water, which fills a man-made lake located a few hundred meters to the northwest and holding water throughout the year, which attracts birds, waterbirds and fauna. The surrounding is a relatively untouched area. Currently traffic noise is a disturbance. Continuous noise pollution from the Bokomo mill about 2km to the south became a problem. 3 Mobile phone base stations - effects on wellbeing and health, 2009, https://pubmed.ncbi.nlm.nih.gov/19261451/		
	11. Noise emission during operation of the station will be a environmental disturbance. This needs to be addressed. Noise from operations of the station will be unacceptable, especially for operation during the night. Noise emission of operation has not been stated and no specific limits have been specified (p40).		The BTS will not be a source of noise disturbance during the operational phase, and the construction phase (that might have some level of increased noise) will be short (within 5 – 6 weeks) and take place within normal working hours. Section 4.3.2. outlines the construction phase. Mitigation measures are also covered in the EMP.
	12. Visual impact of a mast right infront of our doorstep and light pollution at night are significant and unacceptable. At least one more neighbour also		

NO.	I&AP / STAKEHOLDER COMMENT RECEIVED	STAKEHOLDER DETAILS	RESPONSE / CLARIFICATION
	objects to the visual impact. Affected residents were not consulted for opinion, while the study incorrectly concludes that this is a minor impact (p48-49).		There are mitigations in the EMP to minimize these impacts
	13. The significance of impact on biodiversity has been classified as minor and the residual impact as low (p52). Given the biodiversity and list of vulnerable species crossing the area, acknowledged on p 51, the classification is wrong and biased.		Section 7.7.1 and Table 10: Impacts related to collision risk of birds**,** provide a detailed overview of the birds in the area and justification of why the impact is expected to be minor.
	14. Comments have been submitted earlier but the ESR only comments that at this stage Paratus has no intention to deploy 5G in the short term (p72). While workers on site may indeed only be affected by a short term impact, neighbours are concerned about the long term. If 5G may be added at a later stage, this needs to be included in the application. The entire microwave frequency spectrum and the power density to be utilized needs to be specified. Specific comments EMP:		The implementation of 5G is a proposed future stage and all the relevant steps will be followed once Paratus is ready to deploy 5G.
	15. The ESR did not mention a 36000 liter diesel tank to be located permanently on site, but the EMP discusses consequences of diesel spillage. The ESR does not mention the purpose of the diesel. It appears diesel may be used for power generation as it is stated that power prices are too high for Paratus (p20). The ESR study needs to address diesel storage and its impact on the downstream water reservoir, power generation and noise emission during operation.		**It is important to note that this ESIA report is only for the BTS and not for the data centre.** The diesel tank is part of the data centre development and has been mentioned as such in the EMP and not discussed **"There is a 36 000 Liter diesel tank that will be constructed as part of the Armada Data Centre (the proponent is in the process of applying for a consumer installation certificate from MME)".** A separate internal EMP has been prepared for the

NO.	I&AP / STAKEHOLDER COMMENT RECEIVED	STAKEHOLDER DETAILS	RESPONSE / CLARIFICATION
	16. The EMP falls short on addressing significant environmental impact challenges and issues raised in the ESR and above but concludes that there was no potential environmental risk that requires further specialist studies and assessment. Specialist input would have been justified to address the significant environmental impacts discussed above. 17. The correct procedures have not been followed for this development, as pointed out in previous comment. Rezoning, plans to erect a national data centre and base station should have been disclosed to neighbours at the start. The ESR should have preceded the development. An official complaint will be submitted. Yours faithfully M. Beiler Brakwater, 9 February2022		Data centre as best practice and more detailed mitigations with regards to the Diesel tank has been incorporated. The EMP includes all relevant mitigation measures for the BTS. And due to it not being a greenfield site, it was deemed unnecessary for specialist studies. Please refer to the approved site plans from the city of Windhoek: **APPENDIX E – ERF 361 APPROVED SITE PLANS**

APPENDIX D – NCAA LETTER OF CONSENT

NCAA
NAMIBIA CIVIL AVIATION AUTHORITY

Private Bag 12003 Windhoek Namibia | (Tel) +264 83 235 2100 | (Web) http://www.ncaa.com.na

REF:NCAA:AGA:05/2021
Enquiries: Marx Shikongo
shikongom@ncaa.na
+264 83 235 2368

18 January 2022

Mr. Stephan Bezuidenhout
Director and Principle Environmental Practitioner
Environmental Compliance Consultancy CC
PO Box 91193
Windhoek

Dear Mr. Bezuidenhout,

SUBJECT: APPLICATION FOR THE ERECTION OF A PERMANENT STRUCTURE WITHIN THE VICINITY OF EROS AERODROME

I refer to your application dated 13 January 2022 for the erection of a permanent structure within the vicinity of Eros Aerodrome.

Pursuant to NAMCARs 139.11.6, the NCAA has no objection to the erection and operation of a **Base Transceiver Station** 22 km north of Eros Aerodrome at location **22°24'53.58"S, 17°04'7.26"E**. We further wish to inform you that, the review of your application concluded that, the proposed erection of the above-mentioned structure does not infringe the Obstacle Limitation Surfaces for the **Eros Aerodrome**.

Paratus Telecommunications (Pty)(Ltd) must ensure that all equipment used during construction and permanent structures remain within the limits specified in the application and ensure that they are marked and/or lighted as per the requirements.

Finally, the Namibia Civil Aviation Authority reserves the authority to initiate the removal of any obstruction within the vicinity of an aerodrome where it is in the interest of aviation safety (NAMCARs 139.11.7).

Your cooperation is highly appreciated.

Yours sincerely,

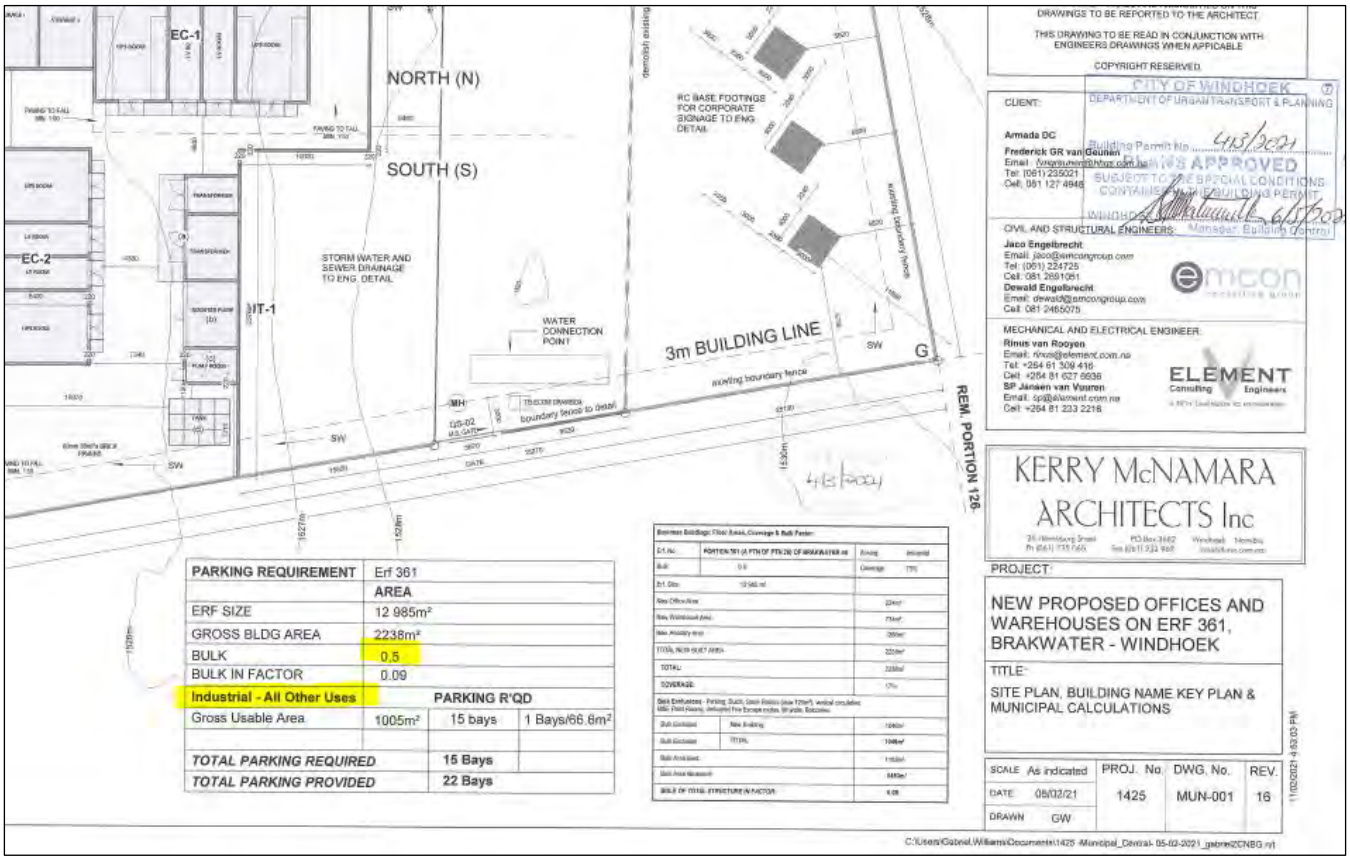
18/01/2022

Mr. Ericsson M. Nengola
Interim Executive Director of Civil Aviation

Cc: Mr. Bisey /Uirab: Chief Executive Officer of Namibia Airports Company

Board Members: Mr. Bethuel T. Mujetenga (Chairperson), Mrs. Kadiva D. Hamutumwa (Deputy Chairperson), Ms. Josephine N. Amukwa, Ms. Martha N. Hitenanye, Mr. Fernando Somaeb, Mr. Melkisedek Uupindi, Mr. Gordon Elliott (Interim Executive Director)

APPENDIX E – ERF 361 APPROVED SITE PLANS



PARKING REQUIREMENT	Erf 361		
	AREA		
ERF SIZE	12 985m²		
GROSS BLDG AREA	2238m²		
BULK	0.5		
BULK IN FACTOR	0.09		
Industrial - All Other Uses	PARKING R'QD		
Gross Usable Area	1005m²	15 bays	1 Bays/66.8m²
TOTAL PARKING REQUIRED		15 Bays	
TOTAL PARKING PROVIDED		22 Bays	

APPENDIX F – ECC CVs

CURRICULUM VITAE

STEPHAN BEZUIDENHOUT

Name of Consultant:	Stephan Bezuidenhout
Position / Profession:	Managing Member & Senior Environmental Practitioner
Date of Birth:	11 April 1989
Nationality:	Namibian
Professional Memberships:	EAPAN, FSC Environmental Chamber, NCE, NCA, N-BiG
Email:	stephan@eccenvironmental.com
Website:	www.eccenvironmental.com
Contact:	+264 81 262 7872

QUALIFICATIONS:

University of Pretoria:	**2011 – 2012**	Postgraduate Degree in Environmental Management and Analysis
University of Stellenbosch:	**2007 – 2010**	Bachelor of Applied Science

PROFILE:

ECC's proudly Namibian Principal leads the ECC team as the lead Environmental Practitioner with a strong and dedicated environmental background. Mr Bezuidenhout has leading practical experience in Identifying and applying legislative requirements to proposed projects. Identifying impacts and mitigations for projects within different sectors, including mining, energy, agriculture and construction.

KEY AREAS OF EXPERTISE:

Agriculture and Ecology	-	Aftercare, rehabilitation & restoration methodology & implementation Forest Stewardship Counsil (FSC) implementation and compliance
Environmental (and social) Impact Assessments (EIAs) (ESIAs) & Environmental Management	-	Compiling EIA Reports and EMPs Coordinate and review specialist studies Review EIA reports Environmental Management Systems (EMS) Public Participation & Stakeholder Management
Project Management	-	Management of teams through Southern Africa for various projects

LANGUAGES:

	Read	Write	Speak
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

SUMMARY OF EXPERIENCE AND CAPABILITY:

Since 2010, Stephan has been working as an environmental assessment practitioner. Stephan has a strong ecological background and has gained more than ten years' experience in the environmental industry. As a lead practitioner, Stephan has successfully driven environmental impact assessments and compliance assessments within Southern Africa. His hands on and practical experience and knowledge of international standards, such as FSC, IFC and World Bank standards allows Stephan to advise his clients and teams constructively and effectively.

PROJECT EXPERIENCE

PROJECT	DATE	ROLE
Best Practice Guide: Environmental Principles for Mining in Namibia	2017 - 2019	Team member
The FSC National Forest Stewardship Standard of Namibia	(2018-2020)	Part of the working group who compiled the National Standard for Forest Stewardship Council (FSC) in Namibia allowing for a higher rate of certification and improved compliance.
Jumbo Charcoal FSC Group Scheme Management	2015 - 2020	Jumbo Charcoal FSC Group Scheme Management
Biophysical Rehabilitation Plan for ML 42, 43, 44 and 45 as well as an overarching 5-year Biophysical Rehabilitation Plan for Namdeb	2018 - 2019	Part of the ECC team who completed the reporting and aided in the implementation of the Biophysical Rehabilitation Plans for Namdeb.
ESIA amendment for B2Gold Namibia Mining Licence (ML 169) to developed underground working for the Otjikoto (gold mine)	2018 - 2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
Kunene Regional Counsel sustainable water supply Pipeline and Ancillary works	2017 - 2018	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
ESIA application for B2Gold Namibia 10.8 megawatt PV solar upgrade to the B2Gold Power Plant	2017 - 2018	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
ESIA application for Otjiwarongo Wastewater Treatment and Bulk Water Supply	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
ESIA for the Wastewater Treatment facilities for Gondwanan Collection	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
MAWF permit application for Water Abstraction and Discharge for Gondwanan Collection	2019	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).
EIA application for various exploration activities for Votorantim Metals Namibia Pty Ltd	2018 - Present	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP and report review).

Abengoa Solar SA, Kaxu Solar One 100MW Concentrating Solar Plants (CSP) Trough	2015 - 2017	Environmental Control Officer during commissioning and rehabilitation phases
Konkoonsies II PV Solar Energy Facility, On-site substation and a 132kV power line Northern Cape, South Africa	2015 - 2017	Environmental Assessment Practitioner during EIA process
Abengoa Solar SA Paulputs CSP (Pty) Ltd. 150 MW CSP Trough Northern Cape, South Africa	2015 - 2017	Environmental Assessment Practitioner during EIA Process
Abengoa Solar SA, Xina Solar One 200 MW CSP Trough Northern Cape, South Africa	2015 - 2017	Environmental Control Officer during construction phase
Soil Remediation and Commissioning report of NGALA Camp for Isondlo Project Support (IPS) (Pty) Ltd Gauteng, South Africa	2015	Lead consultant and project manager.
375 km 26-inch natural gas installation for SASOL & ROMPCO Mozambique representing Worley Parsons (Pty) LTD. South Africa	2013 - 2015	Environmental Coordinator and Manager
Department of Water Engineering (working on a catchment management project for the Municipality of Stellenbosch)	2011 - 2012	Intern at Aurecon South Africa
Other projects	2011-2020	Stephan has successfully completed various other projects in the sectors of Agriculture, Mining, Energy and Tourism where he acted as the Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement, PPP, and report review).

PUBLICATIONS

N.S., et al., Some ecological side-effects of chemical and physical bush clearing in a southern African rangeland ecosystem, Southern African Journal of Botany (2015), http://dx.doi.org/10.1016/j.sajb.2015.07.012

The FSC National Forest Stewardship Standard of Namibia (Draft V 4). Co-authored by S Bezuidenhout, P Cunningham, A Ashby, F Detering, W Enslin & D Honsbein

CERTIFICATION:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and experience.

DATE: 21 / 10 / 20 20

FULL NAME OF CONSULTANT

Jacobus Stephanus Bezuidenhout

CURRICULUM VITAE

Diaan Hoffman

Name of Consultant:	Diaan Hoffman
Position / Profession:	Junior Ecologist and emerging Environmental Practitioner
Date of Birth:	19 May 1996
Nationality:	Namibian
Professional Memberships:	EAPAN No. 213
Email:	diaan@eccenvironmental.com
Website:	www.eccenvironmental.com
Contact:	+264 81 467 4294

QUALIFICATIONS:

University of Stellenbosch:	**2015 – 2018**	BSc Conservation Ecology

PROFILE:

Highly accomplished professional with experience as an environmental consultant. An out-the-box thinker, passionate about high-quality service in fast-paced environments. Excellent planning and execution ability, able to lead and collaborate with teams to deliver beyond expectations.

KEY AREAS OF EXPERTISE:

Environmental (and social) Impact Assessments (EIAs) (ESIAs)	-	Compiling EIA Reports and EMPs Public Participation & Stakeholder Management
Conservation		Small mammal sampling and parasite analysis. In-depth knowledge of biodiversity and Ecology.

LANGUAGES:

	Read	Write	Speak
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

SUMMARY OF EXPERIENCE AND CAPABILITY:

Since 2019, Diaan has been working as an environmental assessment practitioner. In 2021 he started working as a junior ecologist assisting with the rangeland management and the FSC standard in Namibia. Diaan has a good biodiversity and ecology background.

PROJECT EXPERIENCE

PROJECT	DATE	ROLE
ENAEX EIA: Assisting with application for Environmental Clearance Certificate (ECC)	2019 - 2020	Team member
Bulk Mining Explosives: Updating EMP and application for renewal of ECC.	2019-2020	Team member
Sand Miners Association: Assisting with the writing of the EIA, EMP and creating of Maps	2019 - 2020	Team member
Okapana (TOTAL) Service Station CC: Conducting and assisting with the whole EIA process.	2019 - 2020	Team member
Walvis Bay Salt Refiners: Measuring Environmental Noise and assisting with the report writing.	2019-2020	Team member
Jumbo Charcoal FSC Group Scheme management.	2021	Team member
Jumbo Charcoal: writing of EMP	2021	Team member
EMCON: Creating Maps and Baseline sections for ESIA	2021	Team member
Nexus Charcoal: Conducting and assisting with the whole ESIA process.	2021	Team member
Etosha Charcoal: writing of EMP	2021	Team member
FSC Mapping and rangeland management	2021	Team member
GIS Mapping: Using QGIS to produce maps for various projects.	2021	Team member
Uis Afrititn EPLs: Conducting and assisting with the whole ESIA process.	2021	Team member
Paratus ESIA: Conducting and assisting with the whole ESIA process.	2021	Team member
Gmundner ESIA: Conducting and assisting with the whole ESIA process.	2021 -Present	Team member
!Uris Amendment: Conducting and assisting with the Amendment	2021 -Present	Team member

CERTIFICATION:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and experience.

DATE: 19/08/2021

Diaan Philip Hoffman

CURRICULUM VITAE

LESTER HARKER

Name of Consultant:	Lester Harker
Position / Profession:	Environmental Assessment Practitioner
Date of Birth:	26 February 1988
Nationality:	Namibian
Email:	lester@eccenvironmental.com
Website:	www.eccenvironmental.com
Contact:	+264 81 602 2082

TERTIARY EDUCATION:

University of Stellenbosch:	**2006 – 2010**	Bachelor of Arts (Environment and Development - attended)

PROFILE:

Lester works as an Environmental Assessment Practitioner with a diverse environmental background. Mr Harker has leading practice experience in fields of construction, exploration, monitoring and audit compliance and consultancy obtained from leading professionals.

KEY AREAS OF EXPERTISE:

Environmental Management	-	Project Management
Environmental (and social) Impact Assessments (EIAs)	-	Conducting and managing various small to large scale EIAs Compiling EIA Reports and EMPs Coordinate and review specialist studies
Environmental & Social Compliance reporting	-	Environmental and Social compliance audits in the construction industry

LANGUAGES:

	Read	Write	Speak
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent

SUMMARY OF EXPERIENCE AND CAPABILITY:

Has over 9 years of work experience. His first three years were as a junior environmental assessment practitioner, but already became involved with the holistic management of EIA

projects. The following 5 years he has worked in the environmental management field with experience in Environmental Impact Assessments (EIAs), compliance monitoring and auditing in Namibia, the DRC and Equatorial Guinea. Has above average experience in successful client relations.

PROJECT EXPERIENCE

PROJECT	DATE	ROLE
Collaborated with the British CRIDF donor organisation to conduct a high level environmental investigation to determine the feasibility of treating and reusing the Rehoboth Wastewater facility for agricultural purposes	2015	Environmental Assessment Practitioner
Environmental scoping and impact assessment for exploration activities for Westrine Mining & Exploration Company (Pty) Ltd	2016	Environmental Assessment Practitioner.
Conducted an Environmental Scoping and Impact Assessment for the construction of a cement mining and processing facility in Equatorial Guinea, North Africa, for N.B.L.E Sa.	2016	Environmental Assessment Practitioner.
Conducted an environmental impact assessment for the Dauremas Mineral Development Company for exploration and proposed mining activities, Kunene Region.	2015-2017	Environmental Assessment Practitioner.
Conducted an Environmental Impact Assessment for a terrestrial diamond exploration project south of Aus, Karas Region for Hallie Investment Number 14.	2017	Environmental Assessment Practitioner.
Conducted an environmental performance audit in collaboration with a British firm for a copper and cobalt processing facility for the Somika Sarl Group of Companies operating in the DRC to fund the expansion of their processing facility.	2018	Environmental Assessment Practitioner
Projects Completed while at ECC		
Environmental impact assessment for a pilot sustainable water supply project by means of desalination, powered by solar to supplement water supply for Walvis Bay Erongo Region, Namibia	2020	Environmental Assessment Practitioner
Amendment application for the Palmwag Lodge, Gondwana Namibia.	2020	Environmental Assessment Practitioner
Environmental Assessment for the proposed development of residential, retail including tourism activities on Erf 4747, Swakopmund Namibia.	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP.
Environmental scoping and impact assessment for the proposed exploration activities on 19 EPLs in the Omaheke and Khomas regions for Kuiseb Copper Company (Pty)Ld	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP.
Environmental assessment for proposed exploration activities on EPL 7769 for Jin Peng	2020	Lead Environmental Assessment Practitioner managing the EIA process

Investments (Pty) Ltd		(including stakeholder engagement and PPP.
Environmental assessment for the proposed exploration activities on EPL 7688	2020	Lead Environmental Assessment Practitioner managing the EIA process (including stakeholder engagement and PPP.
Environmental and social compliance audit for 21 sites across Namibia under the Education, Training and Quality Improvement Project funded by the African Development Bank	2020	Site audits and development of an audit report and corrective action plan
Environmental Management Plant for an existing charcoal production and storage plant in Outjo, Namibia	2020	Environmental Assessment Practitioner
Environmental and social impact assessment for the proposed biomass processing (Retort System), storage and packaging plant on farm Gai//Khaisa no. 159, Otjozondjupa Region, Namibia.	2020	Environmental Assessment Practitioner
Environmental Management Plan for the proposed mechanised bush thinning operations on farm Gai//Khaisa no. 159, Otjozondjupa Region, Namibia	2020	Environmental Assessment Practitioner
Environmental and social impact assessment for the proposed quarrying activities for dimension stones on mining claims 72236, 72237, 72238, 72239 and 72240, Hardap Region, Namibia	2021	Environmental Assessment Practitioner
Environmental and social impact assessment for the proposed exploration activities on EPLs 7212, 7789, 7964, 7970, 7971, 7972 and 7994 in the Kunene, Otjozondjupa and Khomas regions	2021	Environmental Assessment Practitioner
Environmental and social impact assessment for the airborne electromagnetic surveys across portions within several EPLs in the Omaheke and Khomas regions for Kuiseb Copper Company (Pty) Ltd	2021	Environmental Assessment Practitioner

5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them

Written and Compiled by Martin L. Pall, PhD
Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University
Address: 638 NE 41st Ave., Portland OR 97232 USA
martin_pall@wsu.edu 503-232-3883 May 17, 2018

Summary:

We know that there is a massive literature, providing a high level of scientific certainty, for each of eight pathophysiological effects caused by non-thermal microwave frequency EMF exposures. This is shown in from 12 to 35 reviews on each specific effect, with each review listed in Chapter 1, providing a substantial body of evidence on the existence of each effect. Such EMFs:

1. Attack our nervous systems including our brains leading to widespread neurological/neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in essentially all chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce cancer and also mutations in germ line cells which produce mutations in future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lower sex hormones, lower libido and increased levels of spontaneous abortion and, as already stated, attack the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and excessive calcium signaling.
8. Attack the cells of our bodies to cause cancer. Such attacks are thought to act via 15 different mechanisms during cancer causation.

There is also a substantial literature showing that EMFs also cause other effects including life threatening cardiac effects (Chapter 3). In addition substantial evidence suggests EMF causation of very early onset dementias, including Alzheimer's, digital and other types of dementias (Chapter 3); and there is evidence that EMF exposures in utero and shortly after birth can cause ADHD and autism (Chapter 5).

Each of these effects is produced via the main mechanism of action of microwave/lower frequency EMFs, activation of voltage-gated calcium channels (VGCCs) (Chapter 2). Each of them is produced via what are called downstream effects of VGCC activation. It follows from this that we have a good understanding not only that these effects occur, but also how they can occur. The extraordinary sensitivity of the VGCC voltage sensor to the forces of the EMFs tells us that the current safety guidelines allow us to be exposed to EMF levels that are something like

7.2 million times too high. That sensitivity is predicted by the physics. Therefore, the physics and the biology are each pointing to the same mechanism of action of non-thermal EMFs.

The different effects produced are obviously very deep concerns. They become much deeper and become existential threats when one considers that several of these effects are both cumulative and eventually irreversible. There is substantial evidence for the cumulative nature and eventual irreversibility of the neurological/neuropsychiatric effects, of the reproductive effects, the mutational DNA effects, the cardiac effects, of some but not other of the hormonal effects (Chapter 3); any causation of ADHD and autism may add additional concerns (here the cumulative nature is probably limited to the perinatal period). When we know that sperm counts have dropped by more than 50% throughout the technologically advanced countries on earth, it is difficult to avoid the conclusion that the vast majority of the population in those countries is already substantially impacted. The same conclusion can be made based on the widespread nature of the neuropsychiatric effects in those countries. Both of those effects will get much much worse even with no increase in current exposures, due to the cumulative nature and irreversibility of these effects. I expect we will see crash in human reproduction almost to zero as happened in the Magras and Xenos mouse study which I estimate to occur within about 5 years, without any increases in our exposures. Obviously 4G and 5G will make the situation much worse. Similarly I expect that the deterioration in brain function that we are already seeing will seal our fate if we fail to act rapidly and vigorously. Our collective brain function may become completely incapable of dealing with such a mega-crisis situation.

Now it can be argued that some of these may not develop as I expect, although those expectations are based on the best available evidence. One may even be able to argue this for all of those expectations. However, when we have substantial risk of multiple existential threats to every single technologically advanced country on earth, failure to act vigorously means there is a very high probability of complete destruction of these societies. And the chaos which would inevitably ensue, in a world that still has nuclear weapons, may well lead to extinction. In the face of these types or risk, the only reasonable course is to move with great vigor to stop new exposures and lower current exposures. One can still access the internet, using wired connections. And we can lower cell phone tower and cell phone radiation substantially. Smart meters, if needed, can work via wired connections.

Over 60% of this document (Chapters 5 & 6), is focused on the failures of statements from SCENIHR, the telecommunications industry, the U.S. FCC and the U.S. FDA to reflect the science. Their statements repeatedly omit much, often all of the most important science. Their statements are rife not only with omissions, but also with easily demonstrable falsehoods and with false logic. These have often occurred at times where we know that they knew better. These have occurred along with vigorous efforts by the telecommunications industry to corrupt the science by attacking individual scientists whose only fault is that they have obtained important findings that the industry does not like. These attacks have occurred along with vigorous efforts to corrupt two agencies that have important regulatory roles.

There are also possible concerns about individual industry-linked research studies. All wireless communication devices put out polarized EMFs that carry information via pulsations. Both the pulsations and the polarization make these EMFs much more biologically active. There are three other factors that also influence the production of effects. Several industry-linked studies may have used these factors, along with using very tiny numbers of individual animals in their studies, to produce studies which may have been designed to fail (Chapter 5). It is not clear at this point whether this type of concern is quite limited or whether it is very broad.

The European Commission has done nothing to protect European citizens from any of these very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect American citizens. The U.S. FCC has been much worse than that, acting vigorously with wanton disregard for our health.

Preface

The document that follows was, in its original form, sent to many of the authorities of the European Union, in conjunction with other documents sent to the same people by a group of European scientists. It was in response two documents that were, in turn, written by Mr. Ryan and Dr. Vinciūnas responding to a large group of European and other international scientists expressing great concern about the safety of 5G. I was asked by the leaders of the group of scientists to write my own response to those two documents. Mr. Ryan made the statement that "There is consistent evidence presented by national and international bodies (International Commission on Non Ionising Radiation Protection - ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) that exposure to electromagnetic fields does not represent a health risk, if it remains below the limits set by Council Recommendation 1999/519/EC1." In fact, that is not either the ICNIRP or SCENIHR position – their position, and similar positions have been taken by the U.S. FCC, FDA and the National Cancer Institute, is that the evidence is inconsistent or conflicting and therefore, in their view, no conclusions can be drawn. Some of these organization have also stated that there is no known mechanism by which effects can be produced. What is shown below is that there is a vast amount of evidence in the independent scientific literature that conflicts with both the conclusion about lack of demonstrated effects and the conclusion about lack of mechanism.

The European Commission, according to the Ryan and Vinciūnas documents and the U.S. National Cancer Institute, according to their web site, are each depending on the SCENIHR 2015 document to make judgments about EMF effects. Consequently, the reliability of SCENIHR 2015 is an essential element in determining the reliability of both of their assessments.

The document that is presented below, differs from the document that was emailed to EU authorities in three different ways: 1. The original document was sent as an email with multiple attachments. In this document attachments are simply provided as citations. The current document is a stand-alone document. 2. Some material is inserted to discuss positions taken by the U.S. FCC, FDA and National Cancer Institute, so as to be particularly relevant to the U.S. situation. 3. Substantial additional evidence is also provided.

The revised document contains seven chapters followed by a citation list for the entire document:

Chapter 1: Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects, pp. 4-17

Chapter 2: How Each Such EMF Effect Is Directly Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects, pp. 17-23

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects pp. 23-27

Chapter 4. EMFs Including Wi-Fi May Be Particularly Damaging to Young People pp. 27,28

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document pp. 28-58

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies? pp. 58-78

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know pp. 78-82

Chapter 1. Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects

Both the earlier Ryan document and the more recent Arūnas document each fail to pay any attention to the extensive scientific literature that has been accumulated on non-thermal electromagnetic field (EMF) effects. The scientific consensus of independent scientists based on information accumulated over the last 7 decades is just the opposite of what each of them states. I am copying into this document, at the end of Chapter 1, a series of 8 extremely well-documented effects of such EMF exposure, together with a list of review articles, most of them being peer reviewed articles published in well respected journals in the PubMed database, *that have each reviewed a body of evidence demonstrating the existence of each such effect*.

What are the effects produced by non-thermal exposures to microwave frequency EMFs, where we have an extensive scientific literature? Each of the following effects has been documented in from 12 to 34 reviews, listed at the end of Chapter 1.

1. Three types of cellular DNA attacks, producing single strand breaks in the cellular DNA, double strand breaks in cellular DNA and oxidized bases in cellular DNA. Each of these DNA changes have roles in cancer causation and in producing the most important mutational changes in humans and diverse animals. Double stranded DNA breaks produce chromosomal breaks, rearrangements, deletions and duplications and copy number mutations; they also produce gene amplification, an important mechanism in cancer causation. Single strand breaks in cellular DNA cause aberrant recombination events leading to copy number mutations. Oxidized bases cause point mutations. When these occur in somatic cells, they can each have roles in causing cancer. When these occur in germ line cells (and they have be shown to occur in sperm following EMF exposures), they cause the three most important types of mutations in future generations, chromosomal mutations, copy number mutations and point mutations. (21 different reviews documenting these types of cellular DNA damage)
2. A wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido (18 reviews). Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world [1]. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception. These include every EU country, the U.S., Canada, Japan, South Korea, Taiwan, Singapore, Australia and New Zealand. Reproduction averages, in these countries, about 73% of replacement levels according to 2015 or 2016 data. A study on mouse reproduction [2] showed that radio/microwave frequency EMF exposure at doses well within our current safety guidelines produced substantial dose-dependent decreases in reproduction within

the first set of litters; further exposure produced dose-dependent complete or almost complete sterility that was found to be largely irreversible. When we have a technology that is universally present in these technologically advanced countries, that we know impacts reproduction, and reproduction has already dropped well below replacement levels, and we may be facing a catastrophic and irreversible decline in reproduction and there are more and more plans to expose us still further, don't you think that we should take note of the science? Mr. Ryan and Dr. Vinciūnas seem to be saying not at all. (Please note that the U.S. FCC and FDA also completely ignore this existential threat)

3. Neurological/neuropsychiatric effects (25 reviews). My own paper on this [3] and two earlier reviews cited in it found that there are whole series of repeatedly found EMF effects which have also become extremely widespread complaints in our technologically advanced societies, namely: sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability. These findings are not just based on epidemiological findings but are also based on profound impacts of EMFs, at levels well within our safety guidelines, on brain structure and function and also on the mechanism of non-thermal EMF action discussed below. When we have these neuropsychiatric effects becoming more and more common in technologically advanced societies all over the world, and *we know each of these is caused EMF exposures*, shouldn't we take note of this relationship?
4. Apoptosis/cell death (13 reviews). The two most important consequences of large increases in apoptosis (programmed cell death) are in causation of the neurodegenerative diseases and lowered reproduction although there are others.
5. Oxidative stress/free radical damage (19 reviews). Oxidative stress has roles in all or almost all chronic diseases. It is reported to have essential roles in producing the reproductive effects and the attacks on cellular DNA and may also have roles in producing the neurological effects and some of the cancer-causing effects shown to be produced here by EMF exposures.
6. Widespread endocrine (that is hormonal) effects (12 reviews). The steroid hormone levels drop with EMF exposure, whereas other hormone levels increase with initial exposure. The neuroendocrine hormones and insulin levels often drop with prolonged EMF exposure, possibly due to endocrine exhaustion.
7. Increases in intracellular calcium ([Ca2+]i) levels following EMF exposure (15 reviews). Calcium signaling also increases following EMF exposure.
8. Cancer causation (35 reviews). Brain cancer, salivary cancer, acoustic neuromas and two other types of cancer go up with cell phone use. People living near cell phone towers have increased cancer rates. Other types of EMFs are each implicated. Short wave radio, radio ham operators and people exposed to radar all are reported to have increased cancer incidence. Perhaps most telling, heavy-long term cell phone users have the highest incidence of brain cancer and have predominantly cancer increases on the ipsilateral side of the head (the side they use their cell phones), as opposed to the contralateral side. I have a paper [7], focused not on whether EMFs cause cancer but rather on ***how*** they can cause cancer. The paper shows that "downstream effects" of the main target of the EMFs in the cells of our bodies, can cause cancer in 15 different ways, including increases in cancer initiation, promotion and progression. Progression effects include both tissue invasion and metastasis. Each of these cancer causation effects are caused via mechanisms produced by downstream effects of the main non-thermal EMF mechanism, as discussed in Chapter 2.
9. Therapeutic effects of such EMFs. Such EMFs when focused on a specific region of the body where there is some dysfunction and when used at specific intensities, can have therapeutic effects. In my 2013 paper [4], I cited 12 different reviews where EMF

stimulation of bone growth was used therapeutically. There are something like 4000 papers on various therapeutic effects. Strangely, the telecommunications industry does not acknowledge these therapeutic effects, preferring rather to maintain the fiction that there are no non-thermal effects.

There is another set of reviews, 13 in this case, with each showing that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is particularly important because all wireless communication devices communicate via pulsations, making them potentially much more dangerous. It follows from this that if you wish to study the effects of Wi-Fi, cell phones, cordless phones, cell phone towers, smart meters or 5G, you had better study the real thing or at least something that pulses very much like the real thing. There are many studies that don't do this, but falsely claim to be genuine Wi-Fi, cell phone or cordless phone studies. Other factors that influence the occurrence of non-thermal EMF effects include the frequency being used, the polarization of the EMFs and the cell type being studied [4,5,8-11]. Furthermore there are intensity "windows" that produce maximum biological effects, such that both lower and higher intensities produce much less effect [5,8,9]. These window effect studies clearly show that dose-response curves are both non-linear and non-monotone, such that it is difficult or impossible to predict effects based on relative intensity even when all other factors are the same. The role of each of these factors is completely ignored by ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute as well as by many other industry-friendly groups. When each of these organizations concludes that "results are inconsistent" they are comparing studies based on superficial similarities but not on these demonstrated causal factors. What is being observed, therefore, is genuine biological heterogeneity, not inconsistency. It has been known since the beginning of modern science in the 16th century that how you do your studies is important in determining what results are obtained. How is it possible that ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute have forgotten this important fact?

The primary literature studies demonstrating roles of pulsation, frequency, polarization, cell type and intensity windows in determining biological effects are entirely dependent on having genuine effects to study. None of these studies could have been done without an effect to study. Consequently, the claims that there are no well-documented EMF effects are nonsense, based not only on the eight extremely well-documented effects summarized above, but also on the entire literature demonstrating the role of pulsation, frequency, polarization, cell type and intensity windows.

Now I haven't said anything about how these non-thermal EMF effects are produced. I am taking much of Chapter 2 from a recent paper [11].

Reviews each showing important health-related non-thermal effects of microwave frequency electromagnetic fields (EMFs).

These review lists were prepared by Dr. Martin L. Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University. martin_pall@wsu.edu
BA degree in Physics, Phi Beta Kappa, with honors, Johns Hopkins University; PhD in Biochemistry & Genetics, Caltech.

Specific effects and reviews each reporting the effect in multiple primary literature studies:

Cellular DNA damage: Single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
3. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
6. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
7. Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
8. Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.
9. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
10. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
11. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
12. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
13. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
14. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
17. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
18. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

19. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 163-184.
20. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
21. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
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9. La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. 2014 Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. Environ Int 70:106-112.
13. Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, Zhang S. 2014 Association between mobile phone use and semen quality: a systematic review and meta-analysis. Andrology 2:491-501.

14. K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276
17. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
18. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Neurological/neuropsychiatric effects:

1. Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11). http://www.dtic.mil/docs/citations/AD0642029 (accessed March 12, 2018)
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23. Lai H. 2018. A Summary of Recent Literature (2007–2017) on Neurological Effects of Radio Frequency Radiation. Chapter 8 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 185-220.
24. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
25. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
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Pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs. This is important because all wireless communication devices communicate via pulsations and because the "smarter" the devices are, the more they pulse because the pulsations convey the information. What should be obvious is that you cannot study such pulsation roles if there were no biological effects produced by such EMFs. *The pulsation studies alone tell us that there are many such EMF effects.*

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Each of these reviews, typically cite from 5 to over 100 primary literature citations, each showing that non-thermal EMF exposures produce the effect under which they are listed. It follows from this, that there are not only 11 or more reviews documenting each of these effects, but there is also a massive primary literature documenting these effects as well. It follows from this that the ICNIRP, FCC and International Safety Guidelines, which are entirely based only on thermal effects are inadequate and there have been petitions and other statements of international groups of scientists expressing great concern about this. *It follows that the ICNIRP, FCC and International safety guidelines are completely unscientific and cannot be relied upon to protect our safety.*

Chapter 2: How Each Such EMF Effect Is Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects

The Pall, 2013 [4] study showed that in 24 different studies (there are now a total of 26 [5]), effects of low-intensity EMFs, both microwave frequency and also lower frequency EMFs, could be blocked by calcium channel blockers, drugs that are specific for blocking voltage-gated calcium channels (VGCCs). There were 5 different types of calcium channel blockers used in these studies each thought to be highly specific, each structurally distinct and each binding to a different site on the VGCCs. *In studies where multiple effects were studied, all studied effects were blocked or greatly lowered by calcium channel blockers*. These studies show that EMFs produce diverse non-thermal effects via VGCC activation in many human and animal cells and even in plant cells where some similar calcium channels are involved [6]. Furthermore, many different effects shown to be produced in repeated studies by EMF exposures, including the effects discussed above, can each be produced by downstream effects of VGCC activation, via increased intracellular calcium [Ca2+]i, as discussed below.

Various EMFs act via VGCC activation, as shown by calcium channel blocker studies. These include microwave frequency EMFs, nanosecond pulse EMFs, intermediate frequency EMFs, extremely low frequency EMFs and even static electrical fields and static magnetic fields.

It is important to discuss why the VGCCs are so sensitive to activation by these low-intensity EMFs. Each of the VGCCs have a voltage sensor which is made up of 4 alpha helixes, each designated as an S4 helix, in the plasma membrane. Each of these S4 helixes has 5 positive charges on it, for a total of 20 positive charges making up the VGCC voltage sensor [5,8]. Each of these charges is within the lipid bilayer part of the plasma membrane. The electrical forces on the voltage sensor are extraordinarily high for three distinct reasons [5,8]. 1. The 20 charges on the voltage sensor make the forces on voltage sensor 20 times higher than the forces on a single charge. 2. Because these charges are within the lipid bilayer section of the membrane where the dielectric constant is about $1/120^{th}$ of the dielectric constant of the aqueous parts of the cell, the law of physics called Coulomb's law, predicts that the forces will be approximately 120 times higher than the forces on charges in the aqueous parts of the cell. 3. Because the plasma membrane has a high electrical resistance whereas the aqueous parts of the cell are highly

conductive, the electrical gradient across the plasma membrane is estimated to be concentrated about 3000-fold. The combination of these factors means that comparing the forces on the voltage sensor with the forces on singly charged groups in the aqueous parts of the cell, the forces on the voltage sensor are approximately 20 X 120 X 3000 = 7.2 million times higher [5,8]. The physics predicts, therefore, extraordinarily strong forces activating the VGCCs via the voltage sensor. It follows that the biology tells us that the VGCCs are the main target of the EMFs and the physics tells us why they are the main target. *Thus the physics and biology are pointing in exactly the same direction*.

We have, then, very strong arguments that the EMFs act directly on the voltage-sensor to activate the VGCCs. There are several other types of evidence, each providing important evidence supporting this view:

1. In a study published by Pilla [12], it was found that pulsed EMFs produced an "instantaneous" increase in calcium/calmodulin-dependent nitric oxide synthesis in cells in culture. What this study [12] showed was that following EMF exposure, the cells in culture, must have produced a large increase in [Ca2+]i, this in turn produced a large increase in nitric oxide synthesis, the nitric oxide diffused out of the cells and out of the aqueous medium above the cells into the gas phase, where the nitric oxide was detected by a nitric oxide electrode. This entire sequence occurred in less than 5 seconds. This eliminates almost any conceivable indirect effect, except possibly via plasma membrane depolarization. Therefore, it is likely that the pulsed EMFs are acting directly on the voltage sensors of the VGCCs and possibly the voltage-gated sodium channels, to produce the [Ca2+]i increase.

2. There are also additional findings pointing to the voltage sensor as the direct target of the EMFs. In addition to the VGCCs, there are also voltage-gated sodium, potassium and chloride channels, with each of these having a voltage sensor similar to those found in the VGCCs. Lu et al [13] reported that voltage gated sodium channels, in addition to the VGCCs were activated by EMFs. Tabor et al [14] found that Mauthner cells, specialized neurons with special roles in triggering rapid escape mechanisms in fish, were almost instantaneously activated by electrical pulses, which acted via voltage-gated sodium channel activation to subsequently produce large [Ca2+]i increases. Zhang et al [15] reported that in addition to the VGCCs, potassium and chloride channels were each activated by EMFs, although these other voltage-gated ion channels had relatively modest roles, compared with the VGCCs, in producing biological effects. Each of these three studies [13-15] used specific blockers for these other voltage-gated ion channels to determine their roles. The Tabor et al [14] study also used genetic probing to determine the role of the voltage-gated sodium channels. Lu et al [13] also used whole cell patch clamp measurements to measure the rapid influx of both sodium and calcium into the cell via the voltage-gated channels following EMF exposure. Sodium influx, particularly in electrically active cells, acts in the normal physiology to depolarize the plasma membrane, leading to VGCC activation such that the voltage-gated sodium channels may act primarily via indirect activation of the VGCCs. In summary then, we have evidence that in animal including human cells, seven distinct classes of voltage-gated ion channels are each activated by EMF exposures: From Ref. [4], four classes of voltage-gated ion channels were shown from calcium channel blocker studies, to be activated by EMFs, L-type, T-type, N-type and P/Q –type VGCCs. In this paragraph we have evidence that three other channels are also activated, voltage-gated sodium channels, voltage-gated potassium channels and voltage-gated chloride channels. Furthermore the plant studies strongly suggest that the so called TPC channels, which contain a similar voltage sensor, are activated in plants allowing calcium influx into plants to produce similar EMF-induced responses [6]. In summary, then we have evidence for eight different ion channels being activated by EMF exposure, four classes of VGCCs, one class each of voltage-gated sodium,

potassium and chloride channels and also one class of plant channel, with each of these channels having a similar voltage-sensor regulating its opening. One can put those observations together with the powerful findings from the physics, that the electrical forces on the voltage-sensor are stunningly strong, something like 7.2 million times stronger than the forces on the singly charged groups in the aqueous phases of the cell. Now you have a stunningly powerful argument that the voltage sensor is the predominant direct target of the EMFs.

3. The most important study on this subject, was published by Tekieh et al [16]. It showed that microwave frequency EMFs directly activate the VGCCs in isolated membranes. A variety of microwave frequencies were used in these studies and each such frequency produced VGCC activation in a completely cell-free system. This study clearly shows that the EMF activation of the VGCCs is direct and not due to some indirect regulatory effect.

How then does the estimated sensitivity of the voltage-sensor, about 7.2 million times greater forces than the forces on singly charged groups, compare with previous estimates of levels of EMF exposure needed to produce biological effects? The ICNIRP 2009 [17] safety guidelines allowed for 2 to 10 W/m^2 exposure, depending upon frequency. In contrast, the Bioinitiative Working Group 2007 [18] proposed a precautionary target level of 3 to 6 $\mu W/m^2$ or about a million-fold lower, using a safety factor of 10. If one uses a more commonly used safety factor of 50 to 100, then the 7.2 million-fold sensitivity of the voltage-sensor, predicted by the physics, falls right in the middle of the Bioinitiative Working Group 2007 calculations. So again, it can be argued that the physics and the biology are pointing in the same direction, in this case pointing to the same approximate range of sensitivity.

You may be wondering why I am spending so much time and space going through each of these studies. The answer is that a well over a trillion dollar (or trillion euro) set of industries, the telecommunications industry, has been putting out propaganda for over two decades, arguing that there cannot be a mechanism of action of these non-thermal EMFs to produce biological effects; and that these EMFs are too weak to do anything and that only thermal effects are documented. It is essential to dot every **i** and cross every **t** with regard to the main mechanism of action of non-thermal effects. That is exactly what has been done here.

<u>How Can the Diverse Effects of Such EMF Exposures Be Produced by VGCC Activation?</u>

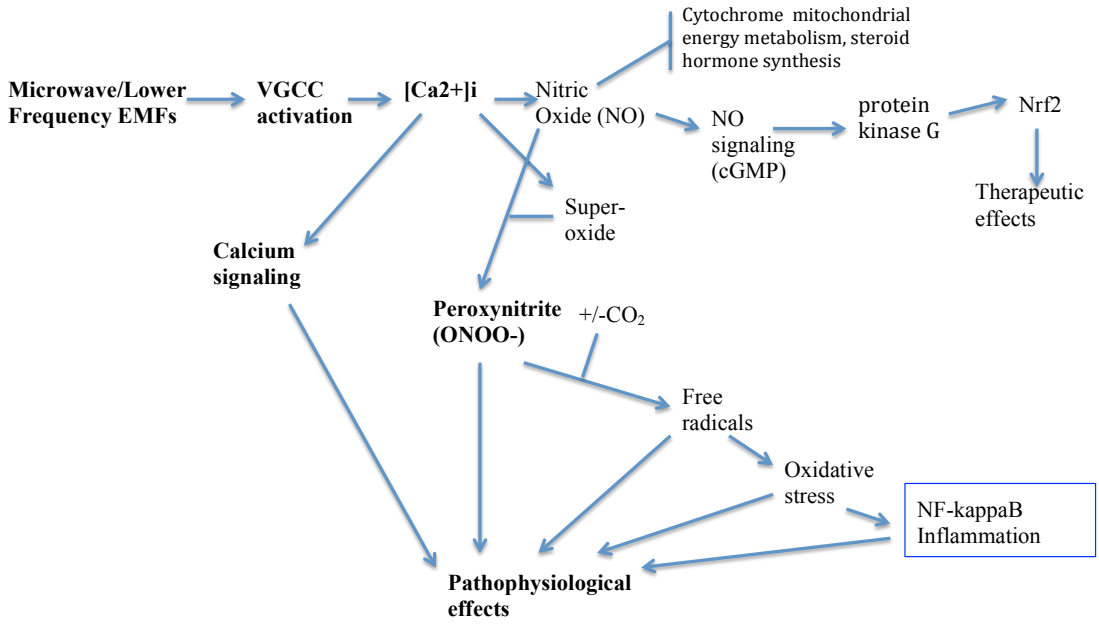

Fig. 1 How EMFs Act via VGCC Activation to Produce Various Effects

The mechanisms by which various effects can be generated by VGCC activation are outlined in Fig. 1. Going across the top of Fig. 1, it can be seen that increased intracellular calcium [Ca2+]i can increase nitric oxide (NO) synthesis, stimulating the NO signaling pathway (going to the right from top, center), to produce therapeutic effects. NO (very top) can also bind to cytochromes and inhibit their activity. NO binding to the terminal oxidase in the mitochondria inhibits energy metabolism and lowers, therefore, ATP. NO binding to cytochrome P450s, lowers synthesis of steroid hormones, including estrogen, progesterone and testosterone. The P450 lowering also lowers detoxification and vitamin D activity. Most of the pathophysiological effects are produced by the peroxynitrite/free radical/oxidative stress pathway center to lower right (Fig. 1) and also by excessive calcium signaling pathway (slightly left of center, Fig. 1). Some of the ways these are thought to produce various well-established EMF effects are outlined in Table 1.

Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO_2 adduct. Four studies of EMF exposure, cited in [4] showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [19,20].
Lowered male/female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and testosterone levels. It seems likely that

	these explanations may be oversimplified. One additional mechanism that may be important in producing lowered fertility is that VGCC activation and consequent high [Ca2+]i levels is known to have a key role in avoiding polyspermy. Consequently, if this response is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and [Ca2+]i role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive Ca2+ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both of these mechanisms are involved following EMF exposure. A third mechanism for triggering apopotosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [7].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and [Ca2+]i elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become "exhausted" as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive [Ca2+]i induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive [Ca2+]i producing increasing protein misfolding [21-23]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

Each of the seven established EMF effects, discussed above, can be generated through the mechanisms outlined in Fig. 1, as shown by Table 1. An eighth, heat shock protein induction can also be so explained (Table 1). Several other such effects, including EMF causation of

cataracts, breakdown of the blood-brain barrier, lowered nocturnal melatonin are also so explained, as discussed earlier [5]. The primary mechanism for therapeutic effects was discussed in [4,24,25] and was also shown to be generated via such VGCC downstream effects. Fifteen mechanisms for EMF cancer causation are described in ref [7]; these are far too complex to describe in this document so the reader is referred to ref [7].

It can be seen, in summary, that we are far beyond the issue whether there are non-thermal EMF effects. Rather many researchers have identified many established effects of EMF exposure. The main direct targets of non-thermal EMF exposure, the VGCCs have also been identified and how these get activated by EMF exposure acting on the VGCC voltage-sensor has also been determined. And finally we have identified how a wide variety of these effects can be generated via downstream effects produced by such VGCC activation.

Our current safety guidelines are based only on heating (thermal) effects. Heating is produced predominantly by forces on singly charged groups in the aqueous phases of the cell but the forces on the voltage sensor are approximately 7.2 million times higher. Therefore, our current safety guidelines are allowing us to be exposed to EMFs that are approximately 7.2 million times too strong. That 7.2 million figure is somewhat similar to the estimate given by the Bioinitiative Report and by the Building Biologists, based on completely different considerations.

It should be obvious, that non-thermal EMFs:

1. Attack our nervous systems including our brains leading to widespread neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in all common chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce both cancer and mutations in germ line cells with germ line mutations producing mutations impacting future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lowered sex hormones, lowered libido, increased levels of spontaneous abortion and, as already stated, attacks on the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and increased calcium signaling.
8. Act in the cells of our bodies via 15 different mechanisms to cause cancer.

By attacking all of these important systems in the body, EMFs attack everything we care about including our health (in many ways), our reproductive systems, the integrity of our genomes and our ability to produce healthy offspring.

There are 79 different reviews listed at the end of Chapter 1, with each documenting the existence of one or more of these various non-thermal EMF effects. What, then, do the two organization reports that the EU authorities and U.S. authorities rely upon, ICNIRP and SCENIHR 2015, have to say about these independent reviews. The answer is absolutely nothing! Neither one of them

uses any of these independent reviews to assess EMF effects. This whole area is discussed in much more detail in Chapter 5, below.

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects

Two questions that must be raised about the effects of these low-intensity EMFs producing biological effects is are they cumulative and are they reversible? I am aware of several different types of evidence for cumulative effects and also for irreversible effects.

Three of the human occupational exposure studies from the 1970's reviewed in the Raines, National Aeronautics and Space Administration (NASA) study [26], showed that effects increased substantially with increasing time of exposure to a particular type and intensity of EMF. While these three studies each show cumulative effects but they provide no data on possible irreversibility of these neurological/neuropsychiatric effects. However the largest review of such occupational exposures (Hecht [28]) does provide substantial evidence on the cumulative nature and irreversibility of these neurological/neuropsychiatric effects.

Hecht [28] reviewed 60 different studies of occupational exposures that were done between 1960 and 1990 in the Soviet Union and East Germany. These were occupational exposure studies of over 3500 people, who were exposed to microwave frequency EMFs at intensities of less than 1/1000th of our safety guidelines. These studies [28] found that these EMFs produced neuropsychiatric effects similar to those found in my much more recent study [3], listed in Chapter 1 as well as on cardiac effects. Neither the neuropsychiatric findings nor the cardiac findings were unique however. Similar neuropsychiatric effects have been found to be caused by low intensity EMF exposures [27,29-34]. Cardiac effects have also been found in humans [26,29,30,32,34,35] similar to those found by Hecht [28].

Hecht [28] reports that exposures at those very low intensities for up to 3 years produced increased sympathetic nervous system activity, apparently in response to the EMF stress, following the classic stress sequence described by Hans Selye in 1953. No other effects were apparent during this circa 3 year period. However longer exposure produced observable neurological/neuropsychiatric and cardiac effects as well as other effects which were initially modest. Exposures of 3 to 5 years typically produced effects that could be largely reversed after 2 to 3 years in a no-EMF exposure environment. Hecht states that "if detected early, effective therapy is possible." However longer than 4 to 5 years exposures produced more severe effects which did not reverse when the persons were subsequently put into a no-EMF exposure environment. These and other effects continued to worsen with 10 years of exposure or longer. This cumulative nature of such EMF exposures was noted in two earlier reviews cited by Hecht et al [36,37]. These studies, then, provide very large amounts of evidence both for the cumulative nature of these neuropsychiatric effects, as well as the apparent irreversibility of these effects as they become more severe. Hecht also notes that "decline in health status increasingly amplifies EMF effects." This a pattern of increasing apparent sensitivity produced by previous exposure is similar to that described in the Western literature on electromagnetic hypersensitivity (EHS), something that Hecht recognizes [28]. EHS something that is discussed very briefly below in this section.

There are strong similarities between the Hecht [28] findings on microwave frequency EMFs in humans and the impacts of such EMFs on cellular and organ histology in rodents, as were reviewed in Tolgskaya and Gordon [38] and discussed in Pall [3]. In rodents, initially non-thermal exposures over periods of 1 to 2 months produced modest changes in structure of the brain and of the neurons. When such exposures ceased, most of the structural changes

disappeared – that is the changes were largely reversed when the animals were placed back into a no-EMF environment. However more months of exposure produced much more severe impacts on brain and neuronal structure and these were irreversible [38, 3]. More recent, Western country and other country studies cited in [3], provide much further support for brain impacts similar to those found in Soviet and also other country brain studies reviewed by Tolgskaya and Gordon[38]. Tolgskaya and Gordon [38,3] also reported findings that in histological studies, the nervous system was the most sensitive organ in the body, followed closely by effects on the heart and the testis, although many other organs were also impacted. Thus, the Tolgskaya and Gordon review [38,3] provides very important support for the findings of neurological/neuropsychiatric effects, the cardiac effects, discussed immediately above and below, and the reproductive effects discussed in Chapter 1. By comparing the animal studies with the human studies, one can see the striking similarities, with the major difference being that the effects in rodents are much more rapid than the effects on humans. Given the much higher metabolic rates in rodents and much lower life spans in rodents, the timing difference is not surprising. With regard to the issues of cumulative nature and irreversibility, both rodent and human studies provide strong support for both neurological and neuropsychiatric effects showing both cumulative nature and irreversibility and show a similar pattern of cumulative effects with the cardiac effects.

What are the cardiac effects discussed briefly above, that are produced by non-thermal microwave frequency EMF exposures? The effects include tachycardia (rapid heartbeat) where some people with apparent EHS, on blinded exposure to cordless phone radiation have instantaneous tachycardia, an effect that is also essentially instantaneously reversible on cessation of exposure [28,35,36]. So tachycardia can be an almost instantaneous response to EMFs and it is sometimes also found with arrhythmia. Prolonged exposures produce both arrhythmias and bradycardia (slow heart beat) [26-30,32]. Similar EMF cardiac effects were seen in animal studies, with the earliest of these going back to the late 1960s.

Some of the early studies on long-term EMF cardiac effects are listed in Table 2, below. They show that such chronic exposures produce bradycardia and sometimes arrhythmia. The early Soviet studies (labeled USSR) reported similar findings to those found in the western studies (Table 2).

Table 2. Chronic Exposure, Non-Thermal EMF Cardiac Effects from NASA Review [26]

Study	**Effects Reported**
Schwan 1977	Cardiology changes
Dwyer 1978	Bradycardia, hypotension
Sadicikova (USSR)	Bradycardia, hypo & hypertension, cardiac pain, systolic murmur
Kalyada (USSR)	“cardiovascular changes”
Sadichikova (USSR)	Changes in cardiovascular system
Pressman 1970	QRS interval in ECG increased (bradycardia), also arrhythmia
Domanski (USSR)	Bradycardia, hypotension, ECG changes (shows both bradycardia and arrhythmia)
Lerner (1980)	Bradycardia
Stuchley (1978)	Bradycardia (measured in 2 ways), hyper & hypotension, cardiac pain, systolic murmur.

Arrhythmias, especially when they are accompanied by bradycardia, are often associated with sudden cardiac death. We are having an epidemic of young, apparently healthy athletes dying in

the middle of an athletic competition of apparent sudden cardiac death, which may, therefore be possibly caused by EMF exposures [39]. Some of these individuals have been saved from death [39] and subsequently found to be suffering from bradycardia and arrhythmias. Another type of cardiac effect is that when apparent EHS people are exposed to Wi-Fi, cell phone, cell phone tower or smart meter radiation, they are reported to suffer from heart palpitations. Each of these four types of cardiac effects, tachycardia, arrhythmias, bradycardia and heart palpitations involve aberrations in the electrical control of the heartbeat. How can these be produced?

The heartbeat is controlled by pacemaker cells in what is called the sino-atrial node of the heart. Those pacemaker cells have been shown to have very high densities of the T-type VGCCs which may make these cells particularly susceptible to direct effects of the EMFs (recall that EMFs act via VGCC activation). The T-type and the L-type VGCCs have essential roles in controlling the heartbeat. It follows that EMF exposures, acting directly on the pacemaker cells of the heart, can produce tachycardia responses. Furthermore, gene mutations in a VGCC gene that produce increased VGCC activity can produce both tachycardia and arrhythmia in young babies carrying those mutations; these young children die of sudden cardiac death at a very young age. How then do we get bradycardia? Bradycardia is produced when EMFs chronically impact the sino-atrial node, such that the dysfunction involved in heart failure, which is very complex, produces dysfunction of the pacemaker cells of the heart, producing bradycardia [40].

It follows from this that EMF-produced bradycardia and chronic arrhythmias are likely to be caused by heart-failure-like changes that particularly impact the sino-atrial node of the heart, including the tissue remodeling found in heart failure. This model has been confirmed by the findings of Liu et al [41], who found that pulsed microwave frequency EMF produced tissue remodeling that specifically impacted the sino-atrial node of the heart with remodeling changes similar to those found in heart failure [40]. Heart failure develops in a cumulative fashion and, based on current medicine at least, is an irreversible process involving tissue remodeling and a large number of other biochemical and physiological changes [41]. It seems likely, therefore, that the EMF effects on the heart are both cumulative and irreversible.

You will recall, from the discussion at the beginning of Chapter 1, that there are 18 reviews documenting that EMF produces lowered fertility. These act via diverse mechanisms. These include tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovary remodeling and oocyte apoptosis, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, and lowered libido. We already have sperm count drops to below 50% of normal in every technologically advanced country on earth [1]. We also have fertility drops to well below replacement levels in every technologically advanced country on earth, with one exception. Clinical observations argue that while there are sometimes technical fixes that allow some reproduction, infertility appears to be inherently irreversible. The Magras and Xenos [2] in mice, also discussed in Chapter 1 shows that radiofrequency radiation exposures well below our safety guidelines, produce immediate drops in mouse reproduction in the first litter. Further exposures to the same EMF levels produced a crash in reproduction essentially to zero, a crash that appeared to be essentially irreversible.

We don't know that humans will behave very similarly to mice. We do know that the EMFs produce the diverse effects on human reproduction listed in the previous paragraph. My prediction is that even if exposures level off where they are now, we will start seeing crashes in reproduction within about 5 years. If we go ahead with 5G, that crash may be almost instantaneous.

Mutation accumulation produced by cellular DNA damage is likely to be both cumulative and irreversible, as well, because later mutations are highly unlikely to reverse previously occurring mutations. It has been estimated that all we need to have is an increase in germ line mutation of 2 ½ to 3-fold, to become over time, extinct from the very high levels of mutations in each newborn. From the high levels of DNA damage produced in human sperm from common EMF exposures, we may be already well above that level.

It follows from this that we already face four existential threats produced by microwave frequency EMF exposures to the survival of every technologically advanced society on earth:

1. Cumulative and irreversible neurological/neuropsychiatric effects.
2. Cumulative and irreversible reproductive effects.
3. Cumulative and irreversible cardiac effects, leading to sudden cardiac death.
4. DNA effects in germ line, including sperm cells, leading to major impacts on our gene pool and high mutation frequencies.

Any one of these can destroy us on its own and with the ever increasing exposures and especially the vast increases in exposure that the 5G rollout will inevitably produce, that destruction is likely to be imminent. These don't even take into consideration the cancer effects, the hormonal effects or other effects produced by increased oxidative stress or increased apoptotic cell death. There is extraordinary evidence for each of these effects of EMF exposure, which have been repeatedly documented in the reviews listed in Chapter 1.

The following information is derived from an abstract that I used for a talk at the Neuroscience 2016 meeting in Los Angeles, a meeting that was focused on Alzheimer's disease and similar dementias. The discussion here raises the question of whether Alzheimer's and other dementias may be still another set of irreversible diseases where cumulative effects of microwave frequency EMFs may have important causal roles. Dementias and other types of neurological deaths have had unexplained rapid recent increases [42-44]. The parallel between these increases and the increases in cell phone and other EMF exposures suggested that such exposures may cause dementia increases [45]. Reports show people circa age 30 developing Alzheimer's or other very early onset dementias and even younger people are reported to develop digital dementias, dementias caused by heavy use of digital devices [46-48]. One of the questions being raised here, is whether digital dementias are caused, at least in part, by the EMF exposures produced by these digital devices and the Wi-Fi fields involved in their usage, rather than solely by such things as screen time, as is often assumed. As you have seen in chapter 2, microwave and lower frequency EMFs act via activation of the VGCCs, leading to increases in intracellular calcium ([Ca2+]i) and downstream effects including increased Ca2+ signaling, NO, superoxide, peroxynitrite, free radicals, oxidative stress, NF-kappaB and mitochondrial dysfunction.

Each of these downstream effects have been shown to have important roles in causing Alzheimer's disease and other neurodegenerative diseases [49-51]. These all suggest plausible mechanisms for action for EMFs causing Alzheimer's disease. Furthermore the amyloid-beta protein (Aβ) which has an specific role in causing Alzheimer's disease, is produced in increasing amounts by elevated [Ca2+]i, and small Aβ aggregates form Ca2+ channels in the plasma membrane and aggregates also raise [Ca2+]i via increased VGCC and RYRr activity, suggesting a vicious cycle between Aβ and [Ca2+]i in Alzheimer's disease. This argues that increased intracellular calcium levels, produced by the EMFs increases Aβ and increased Aβ increases intracellular calcium, in what may be the central mechanism in causing Alzheimer's disease.

Four rodent studies support an EMF role in Alzheimer's disease. A series of short pulses of EMFs in young rats, produced the following in the equivalent of middle aged rats: elevated brain Aβ and oxidative stress; lowered cognition and memory [52,53]. 900 MHz exposures produces oxidative stress, increased Aβ and lowered miR-107, all found in Alzheimer's disease brains [52-55]. There are many animal studies showing roles for [Ca2+]i through both VGCCs and RYRs in causing Alzheimer's disease in rodent models; these include studies with calcium channel blockers and studies of transgenic mice with varying VGCC and RYR expression. Very low EMF exposures can produce, however, protective responses [56,57]; this is not surprising because EMF therapy is thought to act via NO signaling and protein kinase G (see Fig.1, Chapter 2) and this pathway is reported to protect from Alzheimer's disease. Epidemiological studies have shown that exposure of humans of 50/60 Hz EMFs, which also act via VGCC activation, can cause elevated Alzheimer's disease incidence [58,59]. Interestingly, a 1997 article in Microwave News, discussing two such epidemiological findings on EMFs and Alzheimer's disease in humans, found that occupational exposures to EMFs produced as much as a four-fold increase in Alzheimer's disease [59A]. That same article [59A] suggested a similar mechanism to the mechanism suggested here, namely that increased [Ca2+]i following EMF exposure produces increases in Aβ. In conclusion, a wide range of studies support the view that low intensity microwave frequency exposures acting via VGCC activation and [Ca2+]i, can produce increases in Aβ and other causal factors of Alzheimer's disease in humans and in animals and EMFs have been shown to produce Alzheimer's effects in rats.

These various findings on EMFs and Alzheimer's disease, the increasingly early onset of dementias and the occurrence of digital dementias, all suggest we may have another very high level threat caused by EMF exposures, possibly involving cumulative EMF effects and leading to severe, irreversible brain damage.

Chapter 4 EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Most arguments that have been made that microwave frequency EMFs may be much more damaging to young children have centered on the much smaller skulls and skull thickness in young children, increasing the exposure of their brains to EMFs [60, 61]. However there are other arguments to be made. EMFs have been shown to be particularly active in producing effects on embryonic stem cells [62-71]. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age [62, 63], impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures [62-64, 71]. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development [66,71], something that may be relevant to autism causation.

It is my belief that the role of [Ca2+]i in synapse development is also relevant to the possible EMF causation of autism. The Hecht review of Soviet occupational exposure studies [28] reports that "younger persons show a greater sensitivity to electromagnetic fields than adults." These are all very problematic issues and we cannot rule out the possibility that there are other problematic issues as well. Redmayne and Johansson [72] reviewed the literature showing that there are age-related effects, such that young people are more sensitive to EMF effects. It follows from these various findings that the placement of Wi-Fi into schools around the country and the not uncommon placing of cell phone towers on schools may well both be a high level threats to the health of our children as well being a threat to teachers and any very sensitive fetuses teachers

may be carrying, as well. Mr. Barrie Trower, a retired military intelligence expert from the U.K. has been going around the world, at his expense, speaking against Wi-Fi in schools. His knowledge on this is based in part on classified information which he is unable to discuss, but has given him great concern.

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document

One thing that I think we can all agree upon, is that the SCENIHR 2015 [73] document is an important document. The reason for its importance is that previous industry-friendly documents, and there have been many of them, have only reviewed very limited amounts of the literature on EMF effects. Consequently all of these other documents are open to the criticism that they have cherry picked what little data they have chosen to discuss. SCENIHR 2015 [73] has a reference list of almost 48 pages in length, going from page 233 to 280. So it appears that SCENIHR 2015 may have done a much more thorough and defensible review of the literature. Our assessement of SCENIHR 2015 [73] is important because of the confidence expressed in this document both by Mr. Ryan and Dr. Vinciūnas and also by the U.S. National Cancer Institute. The question that is being raised here is whether SCENIHR 2015 is thorough and defensible or not.

The Speit/Schwarz Controversy: How SCENIHR Has Put Out Seven Falsehoods in Support of the Industry Progaganda Position

I am going to start by discussing a single particularly important issue from [73]. At the end of Table 5 in [73]. there is a claim that a 2013 study by Speit et al [74] was unable to replicate the findings of a 2008 study published by Schwarz et al [75]. In Table 5 they state further that Speit el al found "No effect on DNA integrity (MN) and DNA migration (comet); Repetition study of Schwarz et al, 2008." What is called loss of DNA integrity here, measured by formation of micronuclei (MN), is caused by the formation of double strand breaks in cellular DNA. The comet assay measures single strand breaks in cellular DNA. Schwarz et al [75] found strong evidence that there were large increases in both single strand and double strand breaks in cellular DNA following very low intensity exposures to a cell phone-like pulsed radiation, but SCENIHR claims that Speit et al [74] were unable to repeat the earlier study. Elsewhere (p.89, bottom) SCENIHR states that "By using the same exposure system and the same experimental protocols as the authors of the original study, they failed to confirm the results. They did not find any explanation for these conflicting results (Speit et al, 2013)."

A careful examination of both [74] and [75] finds the following: 1. Speit et al [74] used a lymphocytic cell line, HL-60; Schwarz et al [75] studied human fibroblasts. This is a big difference because, as we have already said, different cell types behave differently. 2. Speit et al [74] used 1800 MHz radiation; Schwarz et al [75] used 1950 MHz radiation (the frequency of UMTS, also called 3G). Again we have a potentially important difference because effects are influenced by the frequency used. 3. Speit et al [74] used a continuous wave EMF; Schwarz et al [75] used a highly pulsed EMF, with high levels of both KHz and MHz pulsations to mimic the pulsation pattern of 3G cell phones. This is expected to produce very large differences between the two studies. 4. Speit et al [74] used a reverberation exposure chamber; Schwarz et al [75] did not use any exposure chamber. This could be another very large difference between the two studies, a difference that will be discussed toward the end of this chapter. 5. So where did the claim come from that Speit was trying to repeat the Schwarz study? Speit et al [74] says in their paper that they were trying to repeat another study (not Schwarz) that was described in a report but was never published. 6. Speit et al [74] do not even cite the Schwarz et al [75] paper, so obviously they did not intend to repeat Schwarz. We have then SCENIHR 2015 stating three

multifaceted falsehoods that Speit et al [74] tried to repeat the earlier studies of Schwarz et al [75], that they were unable to repeat those Schwarz et al [75] studies and that they used identical methodology to that used by Schwarz et al [75]. In addition to those three are four underlying falsehoods – namely that the two studies used very different methodologies, notably differing in the cell type studied, differing in the frequency used, differing widely in the in pulsations used and differing in the use of an exposure chamber. *Each of these falsehoods are SCENIHR's not Speit et al [74]'s, each of them can be easily seen to be false by even a superficial reading of these two papers.*

As you might guess, there is a major story behind all of this. The very low intensity exposure used in the Schwarz et al [75] study produced large numbers of DNA breaks, larger than that produced by 1600 chest X-rays. This conclusion can be made by comparing the results of Schwarz et al [75] with the earlier study of Lutz and Adlkofer [76]. From this comparison, it seems clear that non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of our cells than is a similar energy of ionizing radiation. When this was found, the industry went into attack mode, attacking the two Professors who collaborated in [75], Prof. Franz Adlkofer in Germany and Prof. Hugo Rüdinger in Austria. The first couple of years of these attacks have been described in some detail on pp 117-131 in Dr. Devra Davis' book Disconnect [77]. Before the SCENIHR 2015 document was drafted, it was clear that the publishers who had published Adlkofer's and Rüdinger's work, not just the Schwarz et al [75] study but other papers by the same research group, had long since rejected the industry propaganda claims. In addition. Adlkofer had won a lawsuit in the German courts against his main accuser. He has subsequently since won a second such lawsuit. The last paragraph on p.89 in SCENIHR 2015 is word for word industry propaganda. What is clear is that SCENIHR is wittingly or unwittingly serving as a propagandist for the industry in and that process, SCENIHR has no difficulty in putting forth seven obvious, individually important falsehoods.

One question that needs to be raised is how is it possible for microwave frequency EMFs to produce much more cellular DNA damage than a comparable energy level of ionizing radiation? Both ionizing radiation and microwave/lower frequency EMFs act via free radicals to attack the DNA. If you examine Fig. 1, Chapter 2, you will see how low intensity microwave frequency EMFs can act (p. 20). The free radicals that attack the DNA are breakdown products peroxynitrite.. The sequence of events leading to those free radicals starts, of course with the extraordinarily high sensitivity of the VGCC voltage sensor to the electrical forces of the EMFs that open the VGCC calcium channels. Following that there are three steps in the process leading to peroxynitrite elevation *each of which have high levels of amplification*. The first of these is that when the VGCC channels are open, they allow the influx of about a million calcium ion per second into the cell. The second amplification is that elevated intracellular calcium [Ca2+]i activates the synthesis of both nitric oxide (NO) and superoxide. The third amplification is that the formation of peroxynitrite is proportional to the product of nitric oxide concentration *times* the superoxide concentration. When you have three sequential amplification mechanisms, you can get a very large response, in this case free radical attack on cellular DNA, from a very small initial signal. That is where much of the existential crises are coming are from, with EMFs threatening the survival of every technologically advanced country on earth.

Going back to falsehoods perpetrated by SCENIHR regarding Speit/Schwarz, here are two possible interpretations for those seven falsehoods. One is that SCENIHR is simply an industry propaganda organ. The second is that we have a group of scientists (SCENIHR) who are largely incompetent and that it is just coincidence that these seven falsehoods serve the industry propaganda case. Either of these interpretations completely destroy the claims of confidence in

SCENIHR that Mr. Ryan and Dr. Vinciūnas made in the documents they wrote that were referred to in the Preface of this document.

I have written here another 27 pages critiquing the SCENIHR 2015 [73] document. If you are already convinced that the SCENIHR claims that there are no established non-thermal EMF effects are false and that we have eight extremely well documented effects (Chapter 1) and that we have detailed mechanisms of how these effects are produced (Chapter 2), then I suggest you skip to the summary of Chapter 5 starting on p. 57 and then go on to the consider the U.S. situation in Chapter 6 and 5G in Chapter 7. If, however, you are not so convinced, you need to read the intervening 27 pages.

22 Reviews on EMF Effects, 20 of Which Are Ignored by SCENIHR, Two of Which Are Discussed in [73] but Essentially Dismissed

Now let's go on to consider how SCENIHR 2015 [73] considers the many independent reviews, listed in Chapter 1, which disagree with them and also fall into the 2009 through 2013 period that SCENIHR claims to have thoroughly considered. See Table 3.

Table 3: 2009 to 2013 Reviews that Should Have Been Cited and Discussed in SCENIHR 2015

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.	Meta-analysis study of cell phone usage and brain cancer. The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.	Nothing. Review is not cited and not discussed.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.	This review identifies the plasma membrane as a target of RF-EMW. In addition, the effects of RF-EMW on plasma membrane structures (i.e. NADH oxidase, phosphatidylserine, ornithine decarboxylase) and voltage-gated calcium channels are discussed. We explore the disturbance in reactive oxygen species (ROS) metabolism caused by RF-EMW and delineate NADH oxidase mediated ROS formation as playing a central role in oxidative stress (OS) due to cell phone radiation (with a focus on the male reproductive system). This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on	Nothing. Review is not cited and not discussed.

	the effect of RF-EMW on male reproductive system.	
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Effects of cell phone exposure on the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects, genotoxicity potential, neurohormonal secretion and tumour induction. The proposed mechanisms by which cell phones adversely affect various aspects of human health, and male fertility in particular, are explained, and the emerging molecular techniques and approaches for elucidating the effects of mobile phone radiation on cellular physiology using high-throughput screening techniques, such as metabolomics and microarrays, are discussed. A novel study is described, which is looking at changes in semen parameters, oxidative stress markers and sperm DNA damage in semen samples exposed in vitro to cell phone radiation.	Nothing. Review is not cited and not discussed.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.	101 publications are exploited which have studied genotoxicity of radiofrequency electromagnetic fields (RF-EMF) in vivo and in vitro. Of these 49 report a genotoxic effect and 42 do not. In addition, 8 studies failed to detect an influence on the genetic material, but showed that RF-EMF enhanced the genotoxic action of other chemical or physical agents. Variation in results may in part be explained by the different cellular systems and from the variety of analytical methods being used. Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms.	Nothing. Review is not cited and not discussed.
[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.	A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have	Nothing. Review is not cited and not discussed.

	investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.	
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.	Extremely low frequency (ELF) and radio frequency (RF) magnetic fields (MFs) pervade our environment. Whether or not these magnetic fields are associated with increased risk of serious diseases, e.g., cancers and Alzheimer's disease, is thus important when developing a rational public policy. Our objective was to provide an unbiased review of the current knowledge and to provide our general and specific conclusions. RESULTS: The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease. There is further evidence that one of these biological processes (decreased melatonin production) may also lead to breast cancer. Finally, there is evidence that exposures to RF MF and ELF MF have similar biological consequences. CONCLUSION: It is important to mitigate ELF and RF MF exposures through equipment design changes and environmental placement of electrical equipment.	Nothing. Review is not cited and not discussed.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Latest epidemiological data reveal a significant increase in risk of development of some types of tumors in chronic (over 10 years) users of mobile phone. It was detected a significant increase in incidence of brain tumors (glioma, acoustic neuroma, meningioma), parotid gland tumor, seminoma in long-term users of mobile phone, especially in cases of ipsilateral use (case-control odds ratios from 1.3 up to 6.1). Two epidemiological studies have indicated a significant increase of cancer incidence in people living close to the mobile telephony base station as compared with the population from distant area. These data raise a question of adequacy of modern safety limits of electromagnetic radiation (EMR) exposure for humans. For today the limits were based solely on the conception of thermal mechanism of biological effects of RF/MW radiation. Meantime the latest experimental data indicate the significant metabolic changes in living cell under the low-intensive (non-thermal) EMR exposure. Among reproducible biological effects of low-intensive MWs are reactive oxygen species overproduction, heat shock proteins	Nothing. Review is not cited and not discussed.

	expression, DNA damages, apoptosis. Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain.	
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.	Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.	Nothing. Review is not cited and not discussed.
[86] Giuliani L, Soffritti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.	Contains entire articles on: 1. Influence of mobile phone radiation on cognitive function. 2. Impact of DECT cordless phone radiation on heart rate variability and on the autonomic nervous system. 3 & 4. Two articles on the impact of radiofrequency radiation on the blood-brain barrier. 5 & 6. Two articles on microwave/radiofrequency radiation and cancer causation. 7. Epidemiological studies of EMF impact on human reproduction.	Nothing. Review is not cited and not discussed.
[87] Khurana, V. G., Hardell, L., Everaert,	We identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone	Nothing. Review is not

J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.	base stations (cell phone antennae). Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.	cited and not discussed.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018	Both anecdotal reports and some epidemiology studies, reviewed in this study, have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. Cardiac effects were also reported. Symptoms reported may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.	Nothing. Review is not cited and not discussed.
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.	With the popularized use cell phones, more and more concern has been aroused over the effects of their radiation on human health, particularly on male reproduction. Cell phone radiation may cause structural and functional injuries of the testis, alteration of semen parameters, reduction of epididymal sperm concentration and decline of male fertility. This article presents an overview on the impact of cell phone radiation on male reproduction.	Nothing. Review is not cited and not discussed.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.	The carcinogenic effect of MW irradiation is typically manifested after long term (up to 10 years and more) exposure. Nevertheless, even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby. In addition, model studies in rodents unveiled a significant increase in carcinogenesis after 17-24 months of MW exposure both in tumor-prone and intact animals. To that, such metabolic changes, as overproduction of reactive oxygen species, 8-hydroxi-2-deoxyguanosine formation, or ornithine	Nothing. Review is not cited and not discussed.

	decarboxylase activation under exposure to low intensity MW confirm a stress impact of this factor on living cells. We also address the issue of standards for assessment of biological effects of irradiation. It is now becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation. We conclude that recent data strongly point to the need for re-elaboration of the current safety limits for non-ionizing radiation using recently obtained knowledge. We also emphasize that the everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure.	
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.	Review is devoted to the analysis of biological effects of microwaves. The results of last years' researches indicated the potential risks of long-term low-level microwaves exposure for human health. The analysis of metabolic changes in living cells under the exposure of microwaves from mobile communication systems indicates that this factor is stressful for cells. Among the reproducible effects of low-level microwave radiation are overexpression of heat shock proteins, an increase of reactive oxygen species level, an increase of intracellular Ca2+, damage of DNA, inhibition of DNA reparation, and induction of apoptosis. Extracellular-signal-regulated kinases ERK and stress-related kinases p38MAPK are involved in metabolic changes. Analysis of current data suggests that the concept of exceptionally thermal mechanism of biological effects of microwaves is not correct. In turn, this raises the question of the need to revaluation of modern electromagnetic standards based on thermal effects of non-ionizing radiation on biological systems.	Nothing. Review is not cited and not discussed.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1 . Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.	The safety of human exposure to an ever-increasing number and diversity of electromagnetic field (EMF) sources both at work and at home has become a public health issue. To date, many *in vivo* and *in vitro* studies have revealed that EMF exposure can alter cellular homeostasis, endocrine function, reproductive function, and fetal development in animal systems. Reproductive parameters reported to be altered by EMF exposure include male germ cell death, the estrous cycle, reproductive endocrine hormones, reproductive organ weights, sperm motility, early embryonic development, and pregnancy success. At	Nothing. Review is not cited and not discussed.

2012.39.1.1	the cellular level, an increase in free radicals and [Ca(2+)]i may mediate the effect of EMFs and lead to cell growth inhibition, protein misfolding, and DNA breaks. The effect of EMF exposure on reproductive function differs according to frequency and wave, strength (energy), and duration of exposure. In the present review, the effects of EMFs on reproductive function are summarized according to the types of EMF, wave type, strength, and duration of exposure at cellular and organism levels.	
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	The use of mobile phones is now widespread. A great debate exists about the possible damage that the radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phones exerts on different organs and apparatuses. The aim of this article was to review the existing literature exploring the effects of RF-EMR on the male reproductive function in experimental animals and humans. Studies have been conducted in rats, mice, and rabbits using a similar design based upon mobile phone RF exposure for variable lengths of time. Together, the results of these studies have shown that RF-EMR decreases sperm count and motility and increases oxidative stress. In humans, 2 different experimental approaches have been followed: one has explored the effects of RF-EMR directly on spermatozoa and the other has evaluated the sperm parameters in men using or not using mobile phones. The results showed that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities, and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, decreased motility (particularly rapid progressive motility), normal morphology, and decreased viability. These abnormalities seem to be directly related to the duration of mobile phone use.	Nothing. Review is not cited and not discussed.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/	Sections on EMF effects: SECTION 4: EVIDENCE FOR INADEQUACY OF THE STANDARDS SECTION 5: EVIDENCE FOR EFFECTS ON GENE AND PROTEIN EXPRESSION SECTION 6: EVIDENCE FOR GENOTOXIC EFFECTS – RFR AND ELF DNA DAMAGE SECTION 7: EVIDENCE FOR STRESS RESPONSE (STRESS PROTEINS) SECTION 8: EVIDENCE FOR EFFECTS ON IMMUNE FUNCTION SECTION 9: EVIDENCE FOR EFFECTS ON NEUROLOGY AND BEHAVIOR SECTION 10: EFFECTS OF EMF FROM WIRELESS COMMUNICATION UPON THE	Nothing. Review is not cited and not discussed.

	BLOOD-BRAIN BARRIER SECTION 11: EVIDENCE FOR BRAIN TUMORS AND ACOUSTIC NEUROMAS SECTION 12: EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA) SECTION 13: EVIDENCE FOR EFFECTS ON MELATONIN: ALZHEIMER'S DISEASE AND BREAST CANCER SECTION 14: EVIDENCE FOR BREAST CANCER PROMOTION SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR	
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.	The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation. A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However, pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are	This was cited. Sole statement is: "(see Pall, 2013 for a review of studies suggesting effects through voltage-gated calcium channels)." None of the important implications listed on the left are used in any way in the rest of the SCENIHR 2015 document See text for further discussion..

	known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. Other Ca(2+) -mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.	
[95] Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	The aim of the study was to discuss the mechanisms and risk factors of EMR changes on reproductive functions and membrane oxidative biology in females and males. It was reported that even chronic exposure to EMR did not increase the risk of reproductive functions such as increased levels of neoantigens abort. However, the results of some studies indicate that EMR induced endometriosis and inflammation and decreased the number of follicles in the ovarium or uterus of rats. In studies with male rats, exposure caused degeneration in the seminiferous tubules, reduction in the number of Leydig cells and testosterone production as well as increases in luteinizing hormone levels and apoptotic cells. In some cases of male and female infertility, increased levels of oxidative stress and lipid peroxidation and decreased values of antioxidants such as melatonin, vitamin E and glutathione peroxidase were reported in animals exposed to EMR. In conclusion, the results of current studies indicate that oxidative stress from exposure to Wi-Fi and mobile phone-induced EMR is a significant mechanism affecting female and male reproductive systems.	This was listed on p.285 under ***Literature identified but not cited.*** SCENIHR chose not to cite or discuss this paper, although they had identified it.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.	The response of cells to different types of electromagnetic fields can be induced by low-level (athermal) high frequency (HF) electromagnetic fields (EMFs) exposure associated with mobile phone technologies. There are many examples of biological effects involving the epigenome. EMFs could trigger protein activation mediated by ligands, such as Ca2+, that alter the conformation of binding proteins, especially the NADPH plasmic membrane oxidase, so inducing increased formation of reactive oxygen species (ROS) that may alter proteomic functions. Classical anti-apoptotic and procarcinogenic signaling pathways that are commonly found activated in human malignancies and in inflammation mainly involve the tran-	Nothing. Review is not cited and not discussed.

	scription factor NF-κB. The microenvironment that exists during chronic inflammation can contribute to cancer progression. The data support the proposition that long term HF-EMF exposure associated with improper use of cell phones can potentially cause cancer.	
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	BACKGROUND: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a "possible", human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF. METHODS:All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered. RESULTS: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements. CONCLUSION:Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.	Nothing. Review is not cited and not discussed. The Hill criteria are THE well-accepted way of analyzing biological plausiblility of epidemiologic al evidence. It is unacceptable for SCENIHR not to consider this review when attempting to analyze epidemiologic al evidence of EMF cancer causation.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of	The International Agency for Research on Cancer (IARC) at WHO evaluation of the carcinogenic effect of RF-EMF on humans took place during a 24-31 May	This paper is cited and discussed

mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	2011 meeting at Lyon in France. The Working Group consisted of 30 scientists and categorised the radiofrequency electromagnetic fields from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields (RF-EMF), as Group 2B, i.e., a 'possible', human carcinogen. The decision on mobile phones was based mainly on the Hardell group of studies from Sweden and the IARC Interphone study. We give an overview of current epidemiological evidence for an increased risk for brain tumours including a meta-analysis of the Hardell group and Interphone results for mobile phone use. Results for cordless phones are lacking in Interphone. The meta-analysis gave for glioma in the most exposed part of the brain, the temporal lobe, odds ratio (OR)=1.71, 95% confidence interval (CI)=1.04-2.81 in the ≥10 years (>10 years in the Hardell group) latency group. Ipsilateral mobile phone use ≥1640h in total gave OR=2.29, 95% CI=1.56-3.37. The results for meningioma were OR=1.25, 95% CI=0.31-4.98 and OR=1.35, 95% CI=0.81-2.23, respectively. Regarding acoustic neuroma ipsilateral mobile phone use in the latency group ≥10 years gave OR=1.81, 95% CI=0.73-4.45. For ipsilateral cumulative use ≥1640h OR=2.55, 95% CI=1.50-4.40 was obtained. Also use of cordless phones increased the risk for glioma and acoustic neuroma in the Hardell group studies. Survival of patients with glioma was analysed in the Hardell group studies yielding in the >10 years latency period hazard ratio (HR)=1.2, 95% CI=1.002-1.5 for use of wireless phones. This increased HR was based on results for astrocytoma WHO grade IV (glioblastoma multiforme). Decreased HR was found for low-grade astrocytoma, WHO grades I-II, which might be caused by RF-EMF exposure leading to tumour-associated symptoms and earlier detection and surgery with better prognosis. Some studies show increasing incidence of brain tumours whereas other studies do not. It is concluded that one should be careful using incidence data to dismiss results in analytical epidemiology. The IARC carcinogenic classification does not seem to have had any significant impact on governments' perceptions of their responsibilities to protect public health from this widespread source of radiation.	very briefly. See text for discussion.
[99] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that	Mobile phones are two-way microwave radios that also emit low levels of electromagnetic radiation. Inconsistent results have been published on potential risks of brain tumors tied with mobile phone use as a result of important methodological differences in study design and statistical power. Some studies have	Nothing. Review is not cited and not discussed.

radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	examined mobile phone users for periods of time that are too short to detect an increased risk of brain cancer, while others have misclassified exposures by placing those with exposures to microwave radiation from cordless phones in the control group, or failing to attribute such exposures in the cases. In 2011, the World Health Organization, International Agency for Research on Cancer (IARC) advised that electromagnetic radiation from mobile phone and other wireless devices constitutes a "possible human carcinogen," 2B. Recent analyses not considered in the IARC review that take into account these methodological shortcomings from a number of authors find that brain tumor risk is significantly elevated for those who have used mobile phones for at least a decade. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age 20 have greater than a fourfold increased risk of ipsilateral glioma. Given that treatment for a single case of brain cancer can cost between $100,000 for radiation therapy alone and up to $1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries. Significant additional shortages in oncology services are expected at the current growth of cancer. No other environmental carcinogen has produced evidence of an increased risk in just one decade. Empirical data have shown a difference in the dielectric properties of tissues as a function of age, mostly due to the higher water content in children's tissues. High resolution computerized models based on human imaging data suggest that children are indeed more susceptible to the effects of EMF exposure at microwave frequencies. If the increased brain cancer risk found in young users in these recent studies does apply at the global level, the gap between supply and demand for oncology services will continue to widen. Many nations, phone manufacturers, and expert groups, advise prevention in light of these concerns by taking the simple precaution of "distance" to minimize exposures to the brain and body. We note that brain cancer is the proverbial "tip of the iceberg"; the rest of the body is also showing effects other than cancers.	

Of these 22 reviews, 19 are found in the PubMed database, the most widely used medical database in the world, so there is no excuse for not discussing these 19, but only two of them were discussed (see below). With regard to the eight different types of effects that I consider established non-thermal EMF effects, each of them were reviewed in multiple studies described in Table 3 as follows: Cancer 12 reviews [78,82,83-87,90,94,96-98]; Oxidative stress/free

radicals 8 reviews [79,80,84,90,92,-96]; Cellular DNA damage 10 review [4,79,80-82,84,90-92,94]; Apoptosis/cell death 3 reviews [79,82,91]; Lowered fertility 7 reviews [80,86,89,92-95]; Neurological/neuropsychiatric effects 4 reviews [80,87,88,94]; Calcium overload 4 reviews [4,91,92,96]; Endocrine effects 2 reviews [92,95]. It is not clear why so many important reviews on effects are not found in SCENIHR 2015 [73]. What is perhaps surprising, is that these reviews also document many other effects, none of which are clearly acknowledged by SCENIHR. These include stress responses; breakdown of the blood-brain barrier; fetal and neonatal effects; therapeutic effects; Alzheimer's disease; increased nitric oxide; endometriosis; changes in protein levels (proteomics) and changes in gene expression; NF-kappaB elevation; increased suicide; changes in protein kinase activity including ERK and p32MAPK; mechanisms associated with oxidative stress including elevated NADPH/NADH oxidase increased lipid peroxidation and decreased enzymatic antioxidant activity, increased ornithine decarboxylase; and autism. It can be seen from this that the SCENIHR 2015 document seems to be systematically avoiding considering substantial bodies of evidence regarding a very large range of repeatedly reported EMF effects, each of which challenges the SCENIHR position that no effects are established.

Three specific issues regarding apparent cancer causation by EMFs need to be discussed here. Five of these reviews each review a body of evidence showing that cancer rates are higher on the side of the head where people use their cell phones and cordless phones, the ipsilateral side, as opposed to the opposite side of the head, called the contralateral side [78,84,85,98,99]. These are very important studies because they are not likely to be affcted by how complete the reporting data are, or whether there are affects produced by chemicals, ionizing radiation or other EMFs; each of these factors should not be specific for the side of the head impacted. The contralateral side of the head serves as a control that can be compared with the ipsilateral side of the head. What is strange about the SCENIHR 2015 document, is that it avoids discussing all of these data presented in these five reviews. That is even true for [98] which is discussed very briefly in SCENIHR 2015. Only one body of evidence from [98] is discussed in SCENIHR 2015 but several others are not discussed, including the two bodies of evidence which each find statistically significant rises in ipsilateral cancer as compared with contralateral cancer. The ipsilateral findings produce very strong arguments that cell phones and/or cordless phones do cause brain cancer in humans. The best evidence suggests that both cell phones and cordless phones do cause cancer. What does SCENIHR 2015 [73] say about ipsilateral cancer? [73] states, on p. 74 that "ORs for glioma were higher in subjects who reported phone use mostly on the same side of the head (ipsilateral) as their tumour than for use on the opposite side (contralateral). For meningioma, ORs for temporal lobe tumours were slightly lower than for other locations, while a similar pattern as for glioma of higher ipsilateral ORs compared to contralateral ORs was seen." On p. 76, SCENIHR states that "Afterwards, in an attempt to quantify the relationship, Interphone and the Hardell studies were analysed in a meta-analytical approach (Hardell et al., 2013a), an OR of 1.71 (CI: 1.04-2.81) was found for temporal glioma among ipsilateral mobile phone users of 10+ years of use…." On p. 77, regarding a study designed to assess the reliability of self-reported cell phone usage in young brain cancer patients, a study **not** designed to assess ipsilateral effects in patients whose cancer cases may likely have been caused by cell phone usage, the SCENIHR 2015 document states "No clear patterns were seen when comparing ipsilateral and contralateral use." That is not surprising. It can be seen from this that 2 out of 3 studies that SCENIHR discussed argue that there is increased ipsilateral cancer and argue therefore that cell phones or cordless phones do cause cancer. Furthermore, they ignore large amounts of data, cited in [78,84,85,98,99] that provide further support for this view. When SCENIHR wishes to take the opposite position from that taken in these reviews, it is incumbent on SCENIHR to cite them, to discuss the data and opinion presented in those reviews and then and only then can they argue for their position. Having failed to do those things, SCENIHR loses credibility in any argument that they are doing what they can to protect our

health. The same is true for all of the other effects where they similarly fail to cite large numbers of obviously relevant reviews, each arguing for various health effects produced by EMF exposures.

Two other findings from these reviews are important in assessing EMF cancer causation. Refs. [85 and 99] each provide evidence that younger people are more susceptible to cancer causation by EMFs than are adults. SCENIHR takes the opposite view but cannot argue credibly without considering those who differ. The other finding found in [97] is that the epidemiological evidence on cancer causation by microwave frequency EMFs satisfies most of the Hill criteria. The Hill criteria are THE well-accepted criteria that allow one to distinguish chance associations from causal roles in epidemiology. Because epidemiology is the main basis for the arguments that SCENIHR makes against the conclusion that EMFs cause cancer, it is essential that SCENIHR carefully examine the Hill criteria. They fail to do so. They also ignored this study where these criteria were examined and where it was concluded that the majority of the Hill criteria argue that EMFs do cause cancer. This again, undercuts any claim that SCENIHR has carefully considered critically important findings with regard to EMF health effects.

There are several places in the SCENIHR 2015 document, where they state that no mechanisms have been identified by which claimed effects of EMFs can be produced. These can be found by searching the SCENIHR 2015 document using "mechanism" as the search term. However [4] clearly states that the VGCC activation mechanism triggered by EMF exposure can produce, via this mechanism, cellular DNA damaging effects, can produce therapeutic effects and can produce oxidative stress effects. It can be seen, therefore that SCENIHR has no problem making repeated claims that have been falsified by information that they presumably have examined. It also can be seen from this, that even in the cases where SCENIHR cites and very briefly discusses a review that disagrees with them, one can have no assurance that the information is used by SCENIHR in its assessment of health impacts. The causation of cellular DNA damage by EMFs acting via VGCC activation also has important implications with regard to cancer causation. Because almost all cases of cancer start with mutagenic DNA damage in the cell destined to become a cancer cell, this shows how EMFs can initiate the process of carcinogenesis.

It is clear that the SCENIHR 2015 document neither cited nor discussed 20 out of 22 reviews that have documented non-thermal effects of EMFs. In addition, the most important findings of the two that were cited in the document were ignored in the document as well. Therefore SCENIHR has systematically avoided discussing the most important implications of reviews that fell into the time frame they purport to have studied and disagreed with SCENIHR on the existence of important effects. The question can be raised, however, as to whether the SCENIHR has done a better job in its consideration of primary literature citations. To answer that question, I am using a database of important primary literature, regarding effects of cell phone EMFs that we are commonly exposed to.

<u>23 Genuine Cell Phone Studies, Each of Which Should Be Discussed in SCENIHR 2015, 20 of Which Are Not.</u>

Panagopoulos et al [100] showed that whereas 46 out of 48 studies on genuine cell phone radiation showed health-related effects, the majority of studies on simulated cell phones reported no statistically significant effects. They [100] interpreted the difference of results as having been caused by the lowered pulsation rate of the "simulated" cell phone exposures. While I am sure that is part of the explanation, there may be other possible differences that are discussed later in this chapter.

Of those 48 genuine cell phone studies, 23 fell into the time frame (Jan. 2009 through Dec. 2013) reviewed in SCENIHR, 2015. Because of the importance of cell phones and therefore cell phone radiation in our lives, I am using these 23 as a database of primary literature studies that should all be covered in the SCENIHR 2015 [73] document. How many of these 23 were reviewed and cited in SCENIHR 2015? The answer is four (17%) and I will discuss how each of them were discussed below. I have inserted 17 of these into Table 4 below, but six were left out, because they are easy to summarize. These six are all Drosophila studies, none of which were discussed in SCENIHR 2015 [73] but are easy to summarize. All six Drosophila studies were focused on lowered fertility following EMF exposure, with the majority of these focused on lowered female fertility. Four of the six found increased apoptosis following cell phone EMF exposaure and four of the six also found cellular DNA damage following exposure. These are important because of the similarities of each of these effects to effects found in mammals. They are also important because they found DNA damage in Drosophila eggs, whereas mammalian eggs no similar studies have been done because of the difficulty in doing so. Two of these six Drosophila studies, also identified a low intensity exposure window which produced much larger effects than did lower or higher intensities. These exposure windows make it difficult or impossible to predict EMF effects based on EMF intensities. However, the industry and industry friendly groups such as SCENIHR repeatedly make such false predictions.

In mammals there are many studies showing DNA damage in sperm following EMF exposure. This DNA damage in germ line cells is particularly importance because of the importance of mutations passed onto progeny. Table 4 summarizes the other 17 genuine cell phone radiation findings that that SCENIHR 2015 [73] should be discussing, 15 of which were not discussed or cited in SCENIHR 2015.

Table 4: Genuine Cell Phone Studies that Fell into the 2009 through 2013 SCENIHR 2015 period

Citation studied	Cell Phone Effects Reported	SCENIHR comments
1. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. 2009 Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. Clinics (Sao Paulo) 64:561-565.	The present study was designed to evaluate the effects of RF-EMR from mobile phones on free radical metabolism and sperm quality. MATERIALS AND METHODS: Male albino Wistar rats (10-12 weeks old) were exposed to RF-EMR from an active GSM (0.9/1.8 GHz) mobile phone for 1 hour continuously per day for 28 days. Controls were exposed to a mobile phone without a battery for the same period. The phone was kept in a cage with a wooden bottom in order to address concerns that the effects of exposure to the phone could be due to heat emitted by the phone rather than to RF-EMR alone. Animals were sacrificed 24 hours after the last exposure and tissues of interest were harvested. RESULTS: One hour of exposure to the phone did not significantly change facial temperature in either group of rats. No significant difference was observed in total sperm count between controls and RF-EMR exposed groups. However, rats exposed to RF-EMR exhibited a significantly reduced percentage of motile sperm. Moreover, RF-EMR exposure resulted in a significant increase in lipid peroxidation and low GSH content in the testis and epididymis.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

	CONCLUSION: Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility.	
2. Gul A, Celebi H, Uğraş S. 2009 The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280:729-733. doi: 10.1007/s00404-009-0972-9.	The aim of this study was to investigate whether there were any toxic effects of microwaves of cellular phones on ovaries in rats. METHODS: In this study, 82 female pups of rats, aged 21 days (43 in the study group and 39 in the control group) were used. Pregnant rats in the study group were exposed to mobile phones that were placed beneath the polypropylene cages during the whole period of pregnancy. The cage was free from all kinds of materials, which could affect electromagnetic fields. A mobile phone in a standby position for 11 h and 45 min was turned on to speech position for 15 min every 12 h and the battery was charged continuously. On the 21st day after the delivery, the female rat pups were killed and the right ovaries were removed. The volumes of the ovaries were measured and the number of follicles in every tenth section was counted. RESULTS: The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries. CONCLUSION: We suggest that the microwaves of mobile phones might decrease the number of follicles in rats by several known and, no doubt, countless unknown mechanisms.	Not cited and not discussed by SCENIHR.
3. Imge EB, Kiliçoğlu B, Devrim E, Cetin R, Durak I. 2010 Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. Int J Radiat Biol 86:1044-1049. doi: 10.3109/09553002.2010.501838.	To evaluate effects of mobile phone use on brain tissue and a possible protective role of vitamin C. MATERIALS AND METHODS: Forty female rats were divided into four groups randomly (Control, mobile phone, mobile phone plus vitamin C and, vitamin C alone). The mobile phone group was exposed to a mobile phone signal (900 MHz), the mobile phone plus vitamin C group was exposed to a mobile phone signal (900 MHz) and treated with vitamin C administered orally (per os). The vitamin C group was also treated with vitamin C per os for four weeks. Then, the animals were sacrificed and brain tissues were dissected to be used in the analyses of malondialdehyde (MDA), antioxidant potential (AOP), superoxide dismutase, catalase (CAT), glutathione peroxidase (GSH-Px), xanthine oxidase, adenosine deaminase (ADA) and 5'nucleotidase (5'-NT). RESULTS: Mobile phone use caused an inhibition in 5'-NT and CAT activities as compared to the control group. GSH-Px activity and the MDA level were also found to be reduced in the mobile phone group but not significantly. Vitamin C caused a significant increase in the activity of GSH-Px and non-significant increase in the activities of 5'-NT,	Not cited and not discussed by SCENIHR.

	ADA and CAT enzymes. CONCLUSION: Our results suggest that vitamin C may play a protective role against detrimental effects of mobile phone radiation in brain tissue.	
4. Sharma VP, Kumar NR. 2010 Changes in honeybee behavior under the influence of cell phone radiation. Curr Science 98: 1376-1378.	Honeybee behaviour and biology has been affected by electrosmog since these insects have magnetite in their bodies which helps them in navigation. There are reports of sudden disappearance of bee populations from honeybee colonies. The reason is still not clear. We have compared the performance of honeybees in cellphone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.	Not cited and not discussed by SCENIHR.
5. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, Curcio G, van Dijkman S, Melgari JM, Giambattistelli F, Rossini PM. 2010 Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 121:163-171. doi: 10.1016/j.clinph.2009.11.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization. METHODS: Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007). RESULTS: Compared with the young subjects, the elderly subjects showed a statistically significant ($p<0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition. CONCLUSIONS: These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging. SIGNIFICANCE: This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.	Was cited and discussed – see text.
6. Kumar NR,	The present study was carried out to find the effect of cell	Not cited

Sangwan S, Badotra P. 2011 Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol Int. 2011 Jan;18(1):70-2. doi: 10.4103/0971-6580.75869.	phone radiations on various biomolecules in the adult workers of Apis mellifera L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.	and not discussed by SCENIHR.
7. Favre D. 2011 Mobile phone-induced honeybee worker piping. Apidologie 42:270-279.	Electromagnetic waves originating from mobile phones were tested for potential effects on honeybee behavior. Mobile phone handsets were placed in the close vicinity of honeybees. The sound made by the bees was recorded and analyzed. The audiograms and spectrograms revealed that active mobile phone handsets have a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.	Not cited and not discussed by SCENIHR.
8. Cammaerts MC, Debeir O, Cammaerts R. 2011. Changes in Paramecium caudatum (protozoa) near a switched-on GSM telephone. Electromagn Biol Med. 2011 Mar;30(1):57-66. doi: 10.3109/15368378.2011.566778.	The protozoan Paramecium caudatum was examined under normal conditions versus aside a switched-on GSM telephone (900 MHz; 2 Watts). Exposed individuals moved more slowly and more sinuously than usual. Their physiology was affected: they became broader, their cytopharynx appeared broader, their pulse vesicles had difficult in expelling their content outside the cell, their cilia less efficiently moved, and trichocysts became more visible. All these effects might result from some bad functioning or damage of the cellular membrane. The first target of communication electromagnetic waves might thus be the cellular membrane.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.
9. Çam ST, Seyhan N. 2012 Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88:420-424. doi: 10.3109/09553002.2012.666005.	To analyze the short-term effects of radiofrequency radiation (RFR) exposure on genomic deoxyribonucleic acid (DNA) of human hair root cells. SUBJECTS AND METHODS: Hair samples were collected from eight healthy human subjects immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. RESULTS: The data showed that talking on a mobile phone for 15 or 30 min significantly increased ($p < 0.05$) single-strand DNA breaks in cells of hair roots close to the phone. Comparing the 15-min and 30-min data using the paired t-	Not cited and not discussed by SCENIHR.

	test also showed that significantly more damages resulted after 30 min than after 15 min of phone use. CONCLUSIONS: A short-term exposure (15 and 30 min) to RFR (900-MHz) from a mobile phone caused a significant increase in DNA single-strand breaks in human hair root cells located around the ear which is used for the phone calls.	
10. Vecchio F, Tombini M, Buffo P, Assenza G, Pellegrino G, Benvenga A, Babiloni C, Rossini PM. 2012 Mobile phone emission increases inter-hemispheric functional coupling of electroencephalographic α rhythms in epileptic patients. Int J Psychophysiol 84:164-171. doi: 10.1016/j.ijpsycho.2012.02.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate - after a prolonged exposure - inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young and elderly subjects (Vecchio et al., 2007, 2010). Here we tested the hypothesis that this can be even more evident in epileptic patients, who typically suffer from abnormal mechanisms governing synchronization of rhythmic firing of cortical neurons. Eyes-closed resting EEG data were recorded in ten patients affected by focal epilepsy in real and sham exposure conditions. These data were compared with those obtained from 15 age-matched normal subjects of the previous reference studies. The GSM device was turned on (45 min) in the "GSM" condition and was turned off (45 min) in the other condition ("sham"). The mobile phone was always positioned on the left side in both patients and control subjects. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following frequency bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha1 (about 6-8 Hz), alpha2 (about 8-10 Hz), and alpha3 (about 10-12 Hz). The effects on the patients were investigated comparing the inter-hemispheric EEG coherence in the epileptic patients with the control group of subjects evaluated in the previous reference studies. Compared with the control subjects, epileptic patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha rhythms (about 8-12 Hz) in the GSM than "Sham" condition. These results suggest that GSM-EMFs of mobile phone may affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients. If confirmed by future studies on a larger group of epilepsy patients, the modulation of the inter-hemispheric alpha coherence due to the GSM-EMFs could have clinical implications and be related to changes in cognitive-motor function.	Was cited and discussed – see text.
11. Al-Damegh MA. 2012 Rat testicular impairment induced by electromagnetic radiation from a conventional cellular	OBJECTIVE: The aim of this study was to investigate the possible effects of electromagnetic radiation from conventional cellular phone use on the oxidant and antioxidant status in rat blood and testicular tissue and determine the possible protective role of vitamins C and E in preventing the detrimental effects of electromagnetic	Listed under literature identified but not cited.

telephone and the protective effects of the antioxidants vitamins C and E. Clinics 67:785-792	radiation on the testes. MATERIALS AND METHODS: The treatment groups were exposed to an electromagnetic field, electromagnetic field plus vitamin C (40 mg/kg/day) or electromagnetic field plus vitamin E (2.7 mg/kg/day). All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks. RESULTS: There was a significant increase in the diameter of the seminiferous tubules with a disorganized seminiferous tubule sperm cycle interruption in the electromagnetism-exposed group. The serum and testicular tissue conjugated diene, lipid hydroperoxide, and catalase activities increased 3-fold, whereas the total serum and testicular tissue glutathione and glutathione peroxidase levels decreased 3-5 fold in the electromagnetism-exposed animals. CONCLUSION: Our results indicate that the adverse effect of the generated electromagnetic frequency had a negative impact on testicular architecture and enzymatic activity. This finding also indicated the possible role of vitamins C and E in mitigating the oxidative stress imposed on the testes and restoring normality to the testes.	SCENIHR knew about this paper but decided not to discuss it.
12. Aldad TS, Gan G, Gao X-B, Taylor HS. 2012 Fetal radiofrequency radiation from 800-1900 MH-rated cellular telephone affects neurodevelopment and behavior in mice. Scientific Rep 2, article 312.	Neurobehavioral disorders are increasingly prevalent in children, however their etiology is not well understood. An association between prenatal cellular telephone use and hyperactivity in children has been postulated, yet the direct effects of radiofrequency radiation exposure on neurodevelopment remain unknown. Here we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that these behavioral changes were due to altered neuronal developmental programming. Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation. Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.	Was cited and discussed, see text.
13. Liu C, Gao P, Xu SC, Wang Y, Chen CH, He MD, Yu ZP, Zhang L, Zhou Z. 2013 Mobile phone radiation induces mode-dependent	A mouse spermatocyte-derived GC-2 cell line was exposed to a commercial mobile phone handset once every 20 min in standby, listen, dialed or dialing modes for 24 h. DNA damage was determined using an alkaline comet assay. RESULTS: The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there	Not cited and not discussed by SCENIHR.

DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin. Int J Radiat Biol. 2013. 89: 993-1001. doi: 10.3109/09553002.2013.811309.	were significantly higher increases in the dialed and dialing modes than in the listen mode. Interestingly, these results were consistent with the radiation intensities of these modes. However, the DNA damage effects of MPR in the dialing mode were efficiently attenuated by melatonin pretreatment. CONCLUSIONS: These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and also suggest a simple preventive measure: Keeping mobile phones as far away from our body as possible, not only during conversations but during 'dialed' and 'dialing' operation modes. Since the 'dialed' mode is actually part of the standby mode, mobile phones should be kept at a safe distance from our body even during standby operation. Furthermore, the protective role of melatonin suggests that it may be a promising pharmacological candidate for preventing mobile phone use-related reproductive impairments.	
14. Koca O, Gökçe AM, Öztürk MI, Ercan F, Yurdakul N, Karaman MI. 2013 Effects of intensive cell phone (Philips Genic 900) use on the rat kidney tissue. Urol J. 2013 Spring;10:886-891.	To investigate effects of electromagnetic radiation (EMR) emitted by cell phones on the rat kidney tissue. MATERIALS AND METHODS: Twenty-one male Albino rats were divided into 3 groups, each comprising 7 rats. Group 1 was exposed to a cell phone in speech mode for 8 hours/day for 20 days and their kidneys were removed. Group 2 was exposed to EMR for 20 days and then their kidneys were removed after an interval of 20 days. Cell phone used in the present study was Philips Genie 900, which has the highest specific absorption rate on the market. RESULTS: Light microscopic examination of the kidney tissues obtained from the first group of rats revealed glomerular damage, dilatation of Bowman's capsule, formation of large spaces between the tubules, tubular damage, perivascular edema, and inflammatory cell infiltration. The mean severity score was 4.64 ± 1.7 in group 1, 4.50 ± 0.8 in group 2, and 0 in group 3. While there was no significant difference between group 1 and group 2 ($P > .05$), the mean severity scores of groups 1 and 2 were significantly higher than that of the control group ($P = .001$ for each). CONCLUSION: Considering the damage in rat kidney tissue caused by EMR-emitting cell phones, high-risk individuals should take protective measures.	Not cited and not discussed by SCENIHR.
15. Meo SA, Al Rubeaan K. 2013 Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile	Extensive use of mobile phones has been accompanied by a common public debate about possible adverse effects on human health. No study has been published so far to establish any association between the fastest growing innovation of mobile phone and fasting blood glucose. The aim was to determine the effects of exposure to electromagnetic field radiation generated by mobile	Not cited and not discussed by SCENIHR.

phones on fasting blood glucose. Int J Occup Med Environ Health 26:235-241. doi: 10.2478/s13382-013-0107-1.	phones on fasting blood glucose in Wistar Albino rats. MATERIALS AND METHODS: 40 Male Albino rats (Wistar Strain) were divided into 5 equally numerous groups. Group A served as the control one, group B received mobile phone radiation for less than 15 min/day, group C: 15-30 min/day, group D: 31-45 min/day, and group E: 46-60 min/day for a total period of 3 months. Fasting blood glucose was determined by using Spectrophotometer and serum insulin by Enzyme-linked Immunosorbent Assay (ELISA). The Homeostatic Model (HOMA-B) was applied for the assessment of β-cell function and (HOMA-IR) for resistance to insulin. RESULTS: Wister Albino rats exposed to mobile phone radiation for longer than 15 min a day for a total period of 3 months had significantly higher fasting blood glucose ($p < 0.015$) and serum insulin ($p < 0.01$) compared to the control group. HOMA-IR for insulin resistance was significantly increased ($p < 0.003$) in the groups that were exposed for 15-30 and 46-60 min/day compared to the control rats. CONCLUSION:The results of the present study show an association between long-term exposure to activated mobile phones and increase in fasting blood glucose and serum insulin in Albino rats.	
16. Tsybulin O, Sidorik E, Brieieva O, Buchynska L, Kyrylenko S, Henshel D, Yakymenko I. 2013 GSM 900 MHz cellular phone radiation can either stimulate or depress early embryogenesis in Japanese quails depending on the duration of exposure. Int J Radiat Biol 89:756-763. doi: 10.3109/09553002.2013.791408.	Our study was designed to assess the effects of low intensity radiation of a GSM (Global System for Mobile communication) 900 MHz cellular phone on early embryogenesis in dependence on the duration of exposure. MATERIALS AND METHODS: Embryos of Japanese Quails were exposed in ovo to GSM 900 MHz cellular phone radiation during initial 38 h of brooding or alternatively during 158 h (120 h before brooding plus initial 38 h of brooding) discontinuously with 48 sec ON (average power density 0.25 μW/cm(2), specific absorption rate 3 μW/kg) followed by 12 sec OFF intervals. A number of differentiated somites were assessed microscopically. Possible DNA damage evoked by irradiation was assessed by an alkaline comet assay. RESULTS: Exposure to radiation from a GSM 900 MHz cellular phone led to a significantly altered number of differentiated somites. In embryos irradiated during 38 h the number of differentiated somites increased ($p < 0.001$), while in embryos irradiated during 158 h this number decreased ($p < 0.05$). The lower duration of exposure led to a significant ($p < 0.001$) decrease in a level of DNA strand breaks in cells of 38-h embryos, while the higher duration of exposure resulted in a significant ($p < 0.001$) increase in DNA damage as compared to the control. CONCLUSION: Effects of GSM 900 MHz cellular phone radiation on early embryogenesis can be either stimulating or deleterious depending on the duration of exposure.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

17. Luo Q, Jiang Y, Jin M, Xu J, Huang HF. 2013 Proteomic analysis on the alteration of protein expression in the early-stage placental villous tissue of electromagnetic fields associated with cell phone exposure. Reprod Sci 20:1055-1061. doi: 10.1177/1933719112473660.	To explore the possible adverse effects and search for cell phone electromagnetic field (EMF)-responsive proteins in human early reproduction, a proteomics approach was employed to investigate the changes in protein expression profile induced by cell phone EMF in human chorionic tissues of early pregnancy in vivo. METHODS: Volunteer women about 50 days pregnant were exposed to EMF at the average absorption rate of 1.6 to 8.8 W/kg for 1 hour with the irradiation device placed 10 cm away from the umbilicus at the midline of the abdomen. The changes in protein profile were examined using 2-dimensional electrophoresis (2-DE). RESULTS: Up to 15 spots have yielded significant change at least 2- to 2.5-folds up or down compared to sham-exposed group. Twelve proteins were identified-procollagen-proline, eukaryotic translation elongation factor 1 delta, chain D crystal structure of human vitamin D-binding protein, thioredoxin-like 3, capping protein, isocitrate dehydrogenase 3 alpha, calumenin, Catechol-O-methyltransferase protein, proteinase inhibitor 6 (PI-6; SerpinB6) protein, 3,2-trans-enoyl-CoA isomerase protein, chain B human erythrocyte 2,3-bisphosphoglycerate mutase, and nucleoprotein. CONCLUSION: Cell phone EMF might alter the protein profile of chorionic tissue of early pregnancy, during the most sensitive stage of the embryos. The exposure to EMF may cause adverse effects on cell proliferation and development of nervous system in early embryos. Furthermore, 2-DE coupled with mass spectrometry is a promising approach to elucidate the effects and search for new biomarkers for environmental toxic effects.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated, as being caused be cell phone radiation, in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here. One question that needs to be raised with regard to SCENIHR is why so many clearly important primary literature studies of cell phone radiation (perhaps the most important source of human microwave irradiation) are not discussed in SCENIHR 2015. I will discuss certain particular articles that I think are particularly important for *particular reasons*. Subsequently, I will discuss the three articles that SCENIHR does discuss.

One of the more interesting studies not discussed by SCENIHR, is #11 in Table 4. This was published by a woman scientist in Saudi Arabia. What it shows is that 15, 30 or 60 minutes per day of cell phone radiation disrupts the structure of the rat testis and also produces high levels of oxidative stress as shown by measuring 5 different markers of oxidative stress. Such studies have been done for several decades, with oxidative stress having been shown in many different organs

following EMF exposures. What is particularly important in this study is that high levels of two different antioxidants, vitamin C and vitamin E, were each shown to produce substantial protection of the testis structure from the EMF effects while partially normalizing the oxidative stress elevation. What this clearly shows is that the oxidative stress causes the testis tissue disruption. So we don't just have evidence for two effects, testis disruption and oxidative stress but we have strong evidence that one causes the other. It is exactly these connections that are essential for the progression of the science!

13 is another study not discussed by SCENIHR which is particularly important. It looks at cell phone radiation DNA damage produced in a mouse spermatocyte-derived cell line. What it finds is that DNA damage is particularly high when the cell phone is in the dialed or dialing mode, as opposed to a listen mode. They also state that the radiation levels in the three modes correspond, at least roughly, to the DNA damage effects seen. They also show that pretreatment with melatonin (which is known to have antioxidant effects) greatly lowers the DNA damage produced by the cell phone EMF exposures. This is similar to the study discussed immediately above because it again shows that one effect, DNA damage is produced by another effect, namely oxidative stress/free radical elevation. You will recall that as discussed in Chapter 2, cellular DNA damage following EMF exposure is produced by the attacks by on the DNA by peroxynitrite derived free radicals. This study provides confirmation for that mechanism.

#14 is another study not discussed by SCENIHR which is also particularly important. It looks at the impact of cell phone radiation on kidney structure of rats, using six different measures of kidney structure. There were two groups of rats that were exposed to cell phone radiation which were both compared with each other and with normal unexposed control rats. The two exposed groups differed from each other in one group the kidney structure was assessed immediately following the 20 day exposure period. The second exposure group was also exposed for 20 days but was given 20 days subsequently with no exposure to see if the kidney structure spontaneously recovered. There was no recovery seen in the second group, showing that the kidney damage was effectively irreversible. In Chapter 3, several tissue remodeling type effects produced by EMF exposure appeared to be irreversible. Study #14 may add an additional such effect to that list.

#15 is another study not discussed by SCENIHR which is also particularly important. In this study control (unexposed) rats were compared with rats exposed to cell phone radiation for: less than 15 minutes per day, 15 to 30 minutes per day, 31 to 45 minutes per day or 45 to 60 minutes per day. Rats exposed to over 15 minutes per day of cell phone radiation showed type 2 diabetes onset-like effects, with higher fasting glucose levels and higher serum insulin levels. This appears to be, therefore a study showing important hormone dysfunction. It should be noted that the same research group has found similar changes in people living near cell phone towers [101]. Consequently, this is still another situation where findings in experimental animal studies appear to be directly applicable to humans.

Of the papers that were discussed, it is my opinion that the Aldad et al paper (#12, Table 4) is perhaps the most important. The paper starts out discussing the very large increase in ADHD that we have had in recent years, an increase which suggests that one or more environmental changes must be involved. This paper is from a distinguished laboratory, Hugh Taylor's laboratory at Yale, and was published in one of the highly respected Nature journals and the paper, at this writing has been cited 89 times, showing a high level of scientific interest in it. The paper showed that prenatal exposure of pregnant mice to cell phone radiation produced three highly statistically significant changes in the adult mice. These were a decrease in measured memory function, increase in hyperactivity and increase in anxiety. They also showed that there was a dose dependent decrease in an important neurological parameter, the frequency of miniature

excitatory postsynaptic currents, allowing the authors to conclude "that these behavioral changes were due to altered neuronal developmental programming." SCENIHR states the following about this study: "Neurodevelopment from a functional point of view was studied by Aldad et al. (2012) who exposed mice in utero and investigated them as adults for certain behavioural traits and electrophysiological characteristics. Exposure is poorly described but is reported to be to a muted telephone (900-1800 MHz) during the entire gestation period. After blinded investigations, the authors concluded that exposed animals displayed hyperactivity, memory deficiencies, decreased anxiety, and impaired glutamatergic transmission. Although the study employs relevant biological end-points, it cannot be used for any conclusions regarding pre-natal mobile phone exposure and functional development of the brain." SCENIHR fails to tell us why they claim the exposures were poorly described nor do they provide any reasoning on why "it cannot be used for any conclusions regarding pre-natal mobile phone exposure and development of the brain." It is hard to see how such results could be found unless there are substantial effects of pre-natal exposure. Because the study used genuine cell phone radiation, the effects seen are disturbing. It would be reasonable for SCENIHR to call for more studies of this type to see if they can be replicated. Having said that there have been five subsequent studies that I found where pre-natal mouse exposure to non-thermal EMFs produced substantial and somewhat similar adult neurological effects and or behavioral effects [102-106]. These five included exposures to Wi-Fi and to DECT (cordless phone) EMFs. These studies provide, then, strong evidence that prenatal exposures to EMFs can in animals, produce ADHD-like effects even into adulthood. They also show that during the late prenatal period, the developing brain is particularly sensitive to the effects of microwave frequency EMFs and raise the issue of how long after birth such sensitivity is also seen. It is common for SCENIHR and other industry friendly organizations to treat experimental studies as if they had the weaknesses of epidemiological studies. They don't because they can and do in these cases, directly demonstrate causation. In epidemiology, causation can be inferred but not directly demonstrated. What about epidemiological evidence with regard to EMF causation of ADHD? There are two such studies that each provide evidence for an association between prenatal cell phone exposures and development of ADHD [107,108]. SCENIHR knew about both of these, since it discusses one of them which is, in turn, based on the earlier one. Why then did SCENIHR not make the connection of those two studies with at Aldad study (#12 in Table 4)? That is of course an important failure, given that the Aldad study greatly strengthens the argument for EMF causation of ADHD.

Given the current situation where there are a total of 6 studies showing that pre-natal EMF exposures, including cell phone, Wi-Fi and cordless phone EMFs can cause ADHD-like effects in mice and two human epidemiological studies suggesting a similar mechanism in humans and the parallel between the huge increase in ADHD in humans and the huge increase in microwave frequency EMF exposures, is there any other type of evidence that supports a causal role for EMFs? It turns out there is. EMFs act primarily via VGCC activation (Chapter 20. Genetic polymorphism studies show that elevated VGCC activity has a role in causing ADHD [109], acting to a substantial extent prenatally. This is the way real science works. It is not the way that SCENIHR works.

The Vecchio et al 2010 paper (#5, Table 4) was discussed in SCENIHR 2015 as follows: "A study by Vecchio et al. (2010) analysed age-dependent EMF effects on alpha activity in waking EEGs in 16 older (47-84 years) and 15 younger subjects (20-37 years). Participants were exposed to a GSM signal (902.40 MHz, modulation frequencies: 8.33 and 217 Hz) for 45 min with a maximum SAR of 0.5 W/kg emitted by a commercially available mobile phone which was set using a test card in a double-blind cross-over paradigm. EEG was recorded for 5 min prior to and following exposure at 19 electrodes. The authors found an increased inter-hemispheric coherence of frontal alpha EEG activity after GSM exposure which was statistically significant for the

elderly subjects but not for the young ones. This might point to a GSM-EMF related inter-hemispheric synchronization of alpha rhythms as a function of physiological aging." Another related study (#by the same research group was also cited and discussed SCENIHR 2015 [73] as follows: "Vecchio et al. (2012a) used the same study design to investigate an exposure effect in patients with epilepsy. Data from 10 patients were compared to results from 15 age- matched controls from previous studies. Patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha-rhythms under exposure as compared to control subjects. According to the authors, these results might indicate a GSM exposure effect on inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients."

What do I have to say about the two Vecchio studies? They are both based on an earlier 2007 study which showed that increased EEG coherence between the two hemispheres of the brain was produced by genuine cell phone EMF exposure. What the 2010 study (#5 in Table 4) shows is that the EMF-induced increased coherence is much higher in older adults than it is in younger adults. What the 2012 study (#10 in Table 4) shows is that the EMF-induced coherence seen in people with epilepsy is also much higher than in people without epilepsy. These three studies then provide large amounts of evidence for a neurological effect of cell phone radiation that is influenced by two variables, age and epilepsy. These findings should be looked at the context of the 23 reviews, listed in Chapter 1, each showing that EMFs produce both neurological and/or neuropsychiatric impacts on the brain. Here we have still another neurological effect, one that is influenced by age and epileptic condition. There are, then three important findings in these studies. One is that while we have had quite lot of evidence showing that children are more sensitive to EMF effects than adults, this is the first clear finding, to my knowledge, that suggests that older people may be more sensitive to a neurological effect. The linkage to epilepsy should not be surprising as some EHS people are reported to have seizures triggered by very low intensity EMF exposures. Finally, the communication between the two hemispheres of the brain has been known for over half a century to be through what is called the corpus callosum, a structure deeply buried in the middle of the brain, linking the two hemispheres. These effects increasing the coherence between the two hemispheres are probably produced, therefore, through the impact of the EMFs on the corpus callosum. That implies, in turn, that the EMFs act much more deeply in the brain than the industry claims is possible.

The problem with SCENIHR is that it lives in a totally fictional universe where none of those EMF effect reviews exist or at least none of them have any relevance to the SCENIHR world. Neither of the two Vecchio et al studies, discussed in the previous two paragraphs, are used by SCENIHR [73] to make any conclusions about EMF effects or lack thereof – they are only cited in the quote that I gave you. We know that because because the citations are by author's last name and are, therefore easily searchable. Similarly, the Aldad et al (#12) study discussed two paragraphs further up, was also never cited except in the quotation given. So none of these three papers are used to assess any effects of EMFs or lack of effects. The same thing is true of the two reviews from Table 3 that were cited and discussed in [73]. They also were only cited in the quoted section and are never used to assess EMF effects or the mechanism of EMF action. As previously noted, there are several statements in SCENIHR 2015 [73] regarding lack of any available mechanism to explain claimed EMF effects, something that is directly contradicted by one of those cited and discussed reviews [4]. The consequence of all of that is that we have two very large and very consequential bodies of literature, the reviews on EMF effects and the literature on genuine cell phone radiation effects, which are entirely missing from any SCENIHR 2015 [73] conclusion.

<u>Is There Another Systematic Effort by Industry to Corrupt the Literature that Has Been Followed to Some Extent by SCENIHR?</u>

The important roles of pulsation, window effects, frequency, cell type and polarization in determining biological activity of EMFs were discussed in Chapter 1, where it was noted that SCENIHR fails to pay attention to any of these roles. That failure shows up in many places in the document. In Tables 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of SCENIHR 2015 [73], the discussion of each table centers on how many studies found apparent effects and how many did not. But these numbers are irrelevant to the issue of whether there are effects or not. In fact one can argue that the industry, knowing about the roles of each of these factors, could fund any number of studies designed to give apparent negative results just by manipulating these factors to minimize responses and by only studying tiny numbers of individuals to produce low statistical power. This approach closely describes the approach used in seven studies of what were claimed to be genuine Wi-Fi studies that were described by Foster and Moulder [110] in Table 4 of their paper. Those seven studies were shown [11] to all have used an EMF that was not genuine Wi-Fi, despite claims to the contrary. They each used one of two types of reverberation exposure chamber for their rodent exposures, with each type of chamber greatly lowering the polarization of the EMFs [11] and also generating some level of destructive interference from variable path lengths produced by the reverberations. Each of these changes from genuine Wi- Fi is predicted to lower effects. Foster and Moulder [110] concluded that there was no effect in any of these studies. However tiny numbers of rodents were studied, between 3 and 15 in each class, such that these studies have very low statistical power to conclude anything substantive.

It is not possible to conclude no effect even with large studies. At most one can claim that there is no statistically significant evidence of an effect. With tiny numbers, a claim of no effect is complete nonsense. This problem with "no effect" claims is documented in a section of Rothman et al., Modern Epidemiology, 3rd Edition, a highly respected source of information, cited over 19,000 times according to the Google Scholar database. It states (p. 151, bottom) that: "A common misinterpretation of significance tests is that there no difference between two observed groups because the null test is not statistically significant, in that P is greater that the cutoff for declaring statistical significance (again, usually 0.05). This interpretation confuses a descriptive issue (whether two observed groups differ) with an inference about the superpopulation. The significance test refers only to the superpopulation, not the observed groups. To say that the difference is not statistically significant means only that one cannot reject the null hypothesis that the superpopulation groups are the same; it does not imply that the two groups are the same." All such claims of "no effect" are, therefore flawed. When they are made regarding very small studies with very low statistical power, they are particularly deeply flawed.

Were these seven studies designed to fail? I don't think we can say for certain but they certainly *look* as if they may have been. They also raise the serious question about whether the industry may be corrupting the science, by using their knowledge of the roles of pulsation, window effects, frequency, cell type and polarization.

The SCENIHR 2015 document has 127 places in the 221 pages of text where the term "no effect" was found (these can be easily found by searching the document using "no effect" for the search terms (that also picks up "no effects" statements. The first two of these 127 places are used properly, to describe the null hypothesis. *Each of the other 125 should not be there*, with each of those 125 overstating the case and therefore, improperly supporting the industry propaganda case.

In any case, the only way to show that there are inconsistencies or conflicts in the EMF literature is to carefully repeat studies finding such effects, not to flood the literature with studies done under other conditions. The logic used throughout SCENIHR 2015 [73] of just counting numbers of studies is deeply flawed.

Summary of Flaws in SCENIHR 2015

The first set of flaws, is that SCENIHR is perfectly willing to make statements which they know or should have known are false. The most egregious example of this is the Speit/Schwarz controversy described at the beginning of this chapter where there are seven clear falsehoods *created by SCENIHR*, each of which greatly strengthens the telecommunications industry propaganda positions. There are many others, described in this chapter that are substantive, but less egregious than the Speit/Schwarz falsehoods.

There is a vast literature, both in the review literature and in the primary literature studies, that disagrees strongly with the SCENIHR positions and is completely ignored by SCENIHR. In a few cases, such studies are cited and very briefly discussed by SCENIHR but then they have no impact on the assessments that SCENIHR makes in the SCENIHR 2015 document [73]. In most cases, they are neither cited nor discussed. The situation here is similar to an organization that has two sets of books, the fake books that are used in public and then a genuine set of books that includes all of the data that are too inconvenient to be included in the fake set of books.

The finally, we have three additional considerations which interact with each other to produce the completely bogus logic used by SCENIHR and by other organizations that have taken positions similar those taken by SCENIHR. One of those considerations comes from our knowledge that pulsation pattern, cell type, polarization and frequency can all influence biological effects and that there are exposure windows that produce much larger effects than are seen with either lower or higher intensities. Our knowledge of these factors mean that it is possible for the telecommunications industry to foster any number of studies where it is unlikely that statistically significant evidence of effects will be seen. I have presented examples where this may have been done. One of the most bizarre things about the SCENIHR 2015 document [73] is that there is a sentence on p. 101 where they state "In some of these cases, the effect seemed to be dependent on the cell type investigated and by the electromagnetic parameters applied (frequency, modulation)." Modulation and pulsation are the same thing. They know about these three factors and therefore, they know that these factors may explain differences in results obtained by different studies. But they still falsely assume that such differences imply inconsistencies in results and falsely assume that it makes sense to simply count apparent positive and apparent negative studies as a way of assessing whether there are effects or not.

SCENIHR has often falsely stated that these studies show no effects as opposed to lack of statistical significance of any effects. SCENIHR 2015 document has 125 places where such bogus claims of "no effect" are found. They repeatedly claim the literature is inconsistent but studies done under different conditions are *not* inconsistent because they are more likely to be due to genuine biological heterogeneity of responses. The false logic described here is used, in turn, to support another highly pervasive false logic. I've documented where SCENIHR has simply counted numbers of studies showing so many findings of effects and some other number of findings of "no effect." But these numbers are meaningless, when the studies are done under different conditions and where the "no effect" numbers can easily be inflated by studies designed to produce such results. They are also, of course, meaningless, when large numbers of studies that show effects are eliminated by SCENIHR by the simple process of pretending they don't exist. You can see from this, that the entire logical framework behind the SCENIHR 2015 [73] document is completely bogus.

Lastly, before going on to the situation in the U.S. and with 5G, there is one other thing I want to state here. In 2005, Dr. Jared Diamond published a book [111] entitled "Collapse: How

Societies Choose to Fail or Succeed." In it he documents how each society that "chose to fail," chose paths that had some short term gains but also had much more severe longer-term consequences. This is exactly what we have been doing with the EMFs, except that the consequences are much more severe than the collapse of one society – here all of the advanced technology societies on earth are at great risk.

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

We in the U.S. often take great pride in our scientific research. That is, of course, especially true of U.S. scientists, of which I am one. We have far more Nobel laureates than any other country so we think of ourselves as being the #1 science country in the world. But we have had, over the past 20 years, almost no scientific primary literature studies, either laboratory studies or epidemiological studies, on non-thermal microwave frequency EMF effects. We had much more such research in this area 35 years ago,

In terms of non-thermal effects of microwave frequency (sometimes called radiofrequency) EMFs, the U.S. government published documents acknowledging the existence of large numbers of such non-thermal effects. This included the 1971 U.S. Office of Naval Medical Research Institute Report [30] and the 1981 report from the National Aeronautics and Space Administration (NASA) [26]. The most recent such report acknowledging widespread non-thermal EMF effects was the NCRP report [112] published in 1986. It follows that for the past 32 years, the U.S.government has been in denial on what *had been* repeatedly recognized by our government and is of great importance to protecting our health. 1986 turns out to be a key year because in that year, the U.S. Environmental Protection Agency (EPA) shut down its in house research program studying non-thermal EMF effects. In 1986, the U.S. Office of Naval Research, which had been funding grants in this area, stopped funding any new grants – the already funded grants were funded to the end of the grant period but no new grants were funded past 1986. A few years later, I think it was in late 1994, a similar shutdown of grants went into effect at the NIEHS, the part of the National Institutes of Health (NIH) which supports environmental health research. In 1999, the last U.S. agency that had been funding some research in this area, The Department of Energy also shut down what little research it had been funding.

The consequences of those shutdowns is that of the 17 studies on people living near cell phone towers, not a single study has been done in the U.S. Of the 23 studies of effects of genuine Wi-Fi EMFs, each of them showing effects [11], not a single study was done in the U.S. Of the over 50 studies on genuine cell phone radiation effects, only single one was done in the U.S, the NTP cell phone cancer study required by the Congress. So we have a situation where the U.S. government is encouraging EMF exposures and, in many cases, making it impossible to avoid EMF exposures while doing nothing or almost nothing to ensure our safety. There are a tiny number of studies that somehow sneak through, such as the Aldad et al study (#12 in Table 4) discussed in the preceding chapter, which was funded through the Child and Human Development Institute of the NIH, but these are few and far between.

How did these shutdowns happen? I don't know about 1986 but have some useful information from 1994/1995.

Attacks by the Telecommunications Industry on Two U.S. Scientists

Dr. Henry Lai from the University of Washington and a collaborator, NP Singh were using the alkaline comet assay, discussed earlier in this document to measure single stranded breaks in cellular DNA. They found a substantial elevation of the levels following low level EMF exposure in late1994. Before that finding had even been published, they found that they were targets of a severe attack from the telecommunications industry. A key document providing evidence of this was what was called the "War-Gaming" memo [113], where an executive named Norm Sandler, head of the Corporate Communications Department of Motorola (at that time the largest cell phone company) sent the memo to Michael Kehs of a public relations campaign in Washington DC (dated Dec. 13, 1994), describing their planned response to these at that time, unpublished findings. The memo stated that "While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of power levels of wireless communication devices.

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar were not conducted at cellular (that is cell phone) frequencies."

(My comments are as follows: It is true that Lai/Singh used a different frequency from that used by cell phones. So the industry was correct about that. But the findings also show that the industry claims that there cannot be any non-thermal effects are wrong, and that may be more important. Singh had a reputation of being a genuine international expert on comet assays, so I doubt that methodology was a problem. If this had nothing to do with DNA damage or health risks, Motorola would not be worrying about these findings. There were at that time (1994) previously published studies of EMF effects on cellular DNA including the concurrent Sarkar findings and including findings of chromosome breaks and rearrangements reported in [30]).

Further down, the memo: "I think we have sufficiently war-gamed the Lai-Singh issue, assuming that SAG (Scientific Advisory Group, a group linked to the telecom industry) and the CTIA (the umbrella telecom lobbying, publicity and legal organization) have done their homework. We want to run this by George Carlo and fill him in on contacts we have made."

Under Excerpts from Confidential Working Draft #3. Question and Response:

Q. How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News that the results—if replicated—could throw previous notions of RF safety into question?
R. It is not a question of downplaying the significance of the Lai study. In his comments to Microwave News, Dr. Sheppard raised the key question: Can it be replicated and interpreted? We will wait and see."
(My comments: Replication needed to be done, so that was a valid point. The interpretation was and is clear – it is that EMF exposures produce large increases in the numbers of single strand breaks in the cellular DNA.)

"Action Planned: In addition to response materials prepared by SAG (see attached copies) we will work with SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.

Then they talk about Media Strategy where Motorola stays in the background with SAG and CTIA in front."

Three important things happened to Dr. Henry Lai at about this time [114,115]. In November 1994, before the War-Gaming memo had been written, a representative of the industry called the NIH claiming that money had been misspent from the Henry Lai grant for the DNA studies. Dr. Lai faxed the NIH an explanation which was accepted. However, the cutoff of new NIEHS funding appears to have occurred at this time, such that the industry pressure is likely to have been important. Furthermore [114] "The industry made a full-court press to discredit the DNA break study. A consistent and coordinated message was put out to marginalize Lai and Singh. For instance, in November 1994 (note: this was also before the War-Gaming memo was written), Q. Balzano, then a senior Motorola executive, wrote to us (Microwave News) that "Even if it is validated, the effects it purports to show may be inconsequential." (My comment is that DNA breaks produced at intensity levels well below safety guidelines are *not* inconsequential. If they were, the industry would not be worrying so much about them). Ron Nessen, the CTIA's top spokesman told a Florida newspaper that "It's not very relevant." He also tried to cast doubt on the comet assay pioneered by Singh to measure DNA breaks. It "may not be scientifically valid." Quite a number of months later, the head of the WTR (successor organization to SAG) wrote a 6 page letter to the President of the University of Washington to try to get him to fire both Lai and Singh [114, 115]. Neither was fired, but this is what you face when you get results that the telecommunications industry does not like.

(My comments: The basic findings of the Lai and Singh studies have been replicated more than two dozen times, at this writing. There have also been many replicates of the findings of increased micronucleus formation and oxidized bases in the DNA following non-thermal EMF exposures. All of that replication and the 21 reviews that were listed in Chapter 1 each showing non-thermal cellular DNA damage have still not gotten the telecommunications industry to admit that these DNA effects are occurring. The industry apparently does not care about the replication but cares, rather, about having talking points. Furthermore, when the industry was trying to get Dr. Lai's research funding cut off or later was trying to get both Lai and Singh fired, they were trying to *prevent* replication rather than encouraging it).

So Dr. Henry Lai was the first major scientist who came under vicious attack from the telecommunications industry and their allies, but he was certainly not the last. There are many such scientists including Prof. Adlkofer in Germany and Prof. Rüdinger in Austria. I know of nine others who have been attacked in the U.S. or in Europe. But here is a situation where the U.S. instead of leading world science in the right direction has been leading it into corruption. There are others.

I want to talk about another especially important case of such an attack on a U.S. scientist, that of Professor Om Gandhi. Gandhi is a professor at the University of Utah who, for many years was doing modeling of cell phone EMF exposures on the brains of humans. He was modeling such exposures for a substantial period of time of time based on the head of what was called standard anthropomorphic man (SAM). SAM was modeled from a 6 foot 2 inch, 200 pound man, a man in the upper 10% of men for head size and estimated skull thickness. He was doing such cell phone modeling for the telecommunications industry and received an important honor for this research. Because the safety guidelines are based only on thermal effects, the modeling was aimed at determining heating of the human brain by cell phone radiation.

Prof. Gandhi became concerned about the fact that both the head size and skull thickness of SAM was greater than that of most men and essentially all women and children and consequently began modeling a typical woman and typical 10 year old child, When he did that he found that the cell phone EMF exposures to the brain were much too high, even based on their own standards, standards that were and are only based on heating. The timing of these events was from 1975 through 1996. I will be quoting on what occurred subsequently. I have received permission from Dr. Devra Davis to make these quotes from pages 81 through 88 of her book Disconnect [77]. I will use a different font for those quotes so that you can see them easily.

Based on the new work he had produced, Gandhi called for a revision of the safety standards that regulated cell phones. The industry was stunned. For years, Gandhi had been one of those on whom they had counted. If Gandhi's work went uncontested, it would mean that children, women and men with smaller heads could not safely use some electronic devices or that these devices would have to be redesigned to emit less radio frequency radiation. The industry's first response was to cut off all of Gandhi's funding.

Going to p. 86 from [77]:

Gandhi explained that something has gone very wrong with standard setting in the United States in the past few years.

"Starting in the late 1980s, I chaired the committee to set standards for radio-frequency exposures before all cell phones ever existed. About a decade ago, C.K. Chou, then at the City of Hope Hospital, replaced me. Within two years, Chou had moved. He became a senior executive with Motorola—a clear conflict of interest. The committee that advises as to cell phone standards is supposed to be independent and had never before been led by someone from the very industry it advises. Under Chou's leadership, the committee relaxed standards for cell phones as of 2005. Having spent my entire life developing models of the brain, I know how things work. I also know that what we have done here is to ratchet up exposures, without actually telling people we have done so. Today's standards for cell phones have more than doubled the amount of radio-frequency radiation allowed into the brain."

The next quote starts at 2002, before the more than doubling of those radiation standards (pp. 87-88 from [77]).

By 2002 the gloves were off and the industry made it clear to Gandhi that they would take him on directly. Gandhi remembers being told by an industry colleague who was once a student and friend, "If you insist on publishing these papers saying that children get more exposed than adults and saying our test procedure is not valid, you can expect that we will not fund you."

Gandhi replied, "I am a university professor. I don't need your money."

Next industry tried to place an article by Chou critiquing Gandhi's models in the journal of which Gandhi had been editor and chief and in which he had published dozens of articles, and asked that either his (that is Gandhi's) article criticizing the grounds for setting standards be removed, or that they be allowed to publish Chou's rejoinder.

Gandhi reports that four different peer reviews of Chou's critique of my work indicated that Chou's critique of my work was 'scientific junk.' Only when the editor of the journal balked did the industry finally relent. Despite this success in beating back one attempt to discredit Gandhi's work, the effort to increase allowable amounts of radio frequency radiation was won on a major front. As the new chief of the standard-setting committee, Chou masterminded changes in the standards, and the committee, which now included a large majority of industry experts, issued new recommendations, ignoring Gandhi's analysis showing that these would effectively double exposures.

(I want to comment on this. I've published three papers on the physics of EMF action [4,5,11]. In each of them, I have taken the industry arguments about the physics seriously. Even though it was clear that the industry arguments were wrong, because of the clear existence of so many effects that occur at non-thermal levels of exposure, the industry arguments claiming that there could only be thermal effects were substantive and therefore, had to be considered. What I find, in the previous six paragraph, is that the industry itself is ready to throw out its own arguments, when they conflict with their ability to make massive profits. The issues here are very simple. Anyone with the most elementary understanding of the geometry of the head and a high school knowledge or physics, will know that a person with a smaller head and thinner skull will be exposed to higher brain levels of radiation from cell phones.)

What is obvious about this is that the industry does not care about health impacts, as long as they can maintain some deniability. What is also obvious is that the telecommunications industry can act to systematically corrupt an organization that, in effect, regulates the telecommunications industry. That in turn means that other organizations that, in effect, regulate the industry must be scrutinized for possible corruption. Those include ICNIRP, SCENIHR, WHO, the FCC and the FDA.

<u>When Have Somewhat Similar Things Happened in Other Situations in the U.S.?</u>

Is this approach to obfuscating the science unusual? Not really, but it appears to be much more extreme than usual, with the telecommunications industry and EMF effects. I suggest looking at the book on "Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health" by Dr. David Michaels. I've cited a book review of that book here [116]. The review starts out with the statement that "Creating doubt – at least enough to derail government regulation – is an art form long practiced and highly perfected by some sectors of private industry. In the book, Professor David Michaels vividly demonstrates how each such industry channels some of its profit to 'product defense firms' and 'self interested scientists' who conduct research designed to cast doubt on the science that supports regulation." (I will add that it also casts doubt on the science that may support lawsuits, as well.) "As a result of the doubt created, regulation is long-delayed and thousands of people (or perhaps millions) suffer and die unnecessarily." The industries that are covered in the book include tobacco, lead, asbestos, Merck (the maker of Vioxx), global warming, chromium, beryllium, artificial butter flavoring (diacetyl, the cause of often fatal popcorn lung). I think you will see parallels with what went on with SCENIHR (Chapter 5) and with the telecommunications industry actions (this chapter). Part of the problem with these precedents, is that nobody went to prison, despite the many deaths and injuries that were perpetrated and in most of these cases, the industries involved ended up making more money than they lost in the subsequent lawsuits. The precedent has been set that you can get away with almost anything if you are big enough and powerful enough and rich enough. That

may have been sufficient to encourage the telecommunications industry to follow a similar, although, in my opinion, much more aggressive pathway.

One question that can be asked is whether there are any major international political figures who appear to have a good understanding of the EMF/health issue? When I was asked that question, I was able to come up with only one person. That person is President Vladimir Putin of Russia. This inference comes from an interview of Dr. Dietrich Klinghardt, who practices in Seattle, by Dr. Joseph Mercola, that occurred in December 2017, an interview that was entirely focused on EMF health effects [117]. In that context Dr. Klinghardt states that a lecture that Putin gave to the Russian assembly said, "We do not need to go to war with America. America is committing collective suicide by the way they are using electricity. We just have to wait until they are all in the psychiatric hospital." When I saw that, I asked myself whether it is plausible that Vladimir Putin has a deep understanding of the neuropsychiatric effects of the EMFs? And then I thought, of course, Vladimir Putin was the head of the KGB when the latter studies reviewed by Dr. Karl Hecht [28] were being done in the Soviet Union. The most important effects that were shown to be produced by the EMFs, in those studies, were the neuropsychiatric effects. Furthermore, the Putin statement apparently shows not only a substantial understanding of those effects but also the fact that they are cumulative and become irreversible, as shown in those studies [28] and in other studies discussed in Chapter 4. One thing that I would add is that President Putin apparently practices what he preaches. He avoids smart phones [118].

It is my opinion, that the CIA and other international intelligence agencies should examine these issues very carefully to assess whether they see the kinds of threats that I see. Those agencies are very good at obtaining information from various sources and determining probable threats to national and international security. It should not be difficult to come to an assessment, especially because some of us have done much of the work that needs to be done. The threat here is self-inflicted, it is not caused by any foreign power or set of powers. But it is the most serious national or international security threat that we have faced, in my opinion, with the exception of nuclear annihilation.

Propaganda:

In the initial days of the controversy regarding cell phones, in 1993, the industry developed a huge public relations effort in the face of lawsuits and adverse press reports impacting the industry. Paul Staiano, President of Motorola General Systems stated in a 1993 ABC 20/20 interview [119] that, “Forty years of research and more than ten thousand studies have proved that cellular phones are safe.” So I asked how many studies of cell phone safety or lack there of had been published by the end of 1993. The way I did that was to search in the PubMed database under (cell phones or cellular phones or mobile phones). I found about 11,000 hits, roughly 99% of them having nothing to do with health safety, and then looked at the few studies that had been published before the end of 1993. The only study I found that had any connection with health or safety, was one on driving safety while using a cellular phone, giving equivocal results with regard to driving safety. So there, were apparently no studies done on cell phone safety at that time. Furthermore, even if there had been any studies, they could not possibly show that “cellular phones are safe.” At most they might show that there was no statistically significant evidence of an effect but that only shows that you have not proven an effect, not that you have proven the opposite. It can be seen, therefore, that this propaganda statement is complete nonsense. Furthermore, we know that the Panagopoulos et al [100] review, showed that 46 out of 48 genuine cell phone studies that they reviewed showed effects. So the facts are exactly opposite of the industry propaganda on this. If this was the beginning of propaganda in the U.S. let’s look at something much more recent.

Berezow and Bloom Op-Ed Document: Recommendation to Limit Maryland School Wi-Fi Is Based on "Junk Science"

Berezow and Bloom, [120] start their 2017 op-ed with the claim that "The CEHPAC, an agency within Maryland's Department of Health and Mental Hygeine, has recommended that schools reduce or eliminate students' exposure to Wi-Fi because it believes wireless signals might cause cancer. *This is pure, unadulterated junk science. At least three separate, major areas of scientific knowledge can unambiguously confirm that wireless radiation is completely safe* (italics added)."

They continue with the physics [120], stating that "CEHPAC fails to realize that all radiation is not created equal. The energy of nuclear radiation, X-rays and UV light is high enough to damage our bodies and cause cancer. But other forms of radiation are energetically weak by comparison. They cannot cause cancer." This argument has validity with regard to individual photons, as I stated in my first paper on the activation of VGCCs by EMFs [4], but it is completely bogus with regard to EMFs as a whole. It has been known for 70 years that a person walking in front of a high powered radar machine will rapidly die, but Berezow and Bloom claim that cannot happen because the fields are "energetically weak." Furthermore, as discussed in Chapter 2 and elsewhere [5,11], the voltage sensor that controls the opening of the VGCCs is extraordinarily sensitive to electrical forces of EMFs, with the forces on the voltage sensor being approximately 7.2 million times greater than the forces on singly charged groups in the aqueous parts of our cells and tissues. It can be seen, therefore, that Berezow and Bloom [120] while claiming to be experts, are profoundly ignorant of the relevant physics.

Berezow and Bloom [120] state that "According to the NIH's National Cancer Institute [121], well performed studies that included over one million people showed no connection between cell phone use and cancer." There is no such statement in the NCI 2016 [121] document – I suggest the reader look it up – it differs substantially from the op-ed characterization of it. The NCI 2016 [121] document, states that "there is currently no consistent evidence that non-ionizing radiation increases cancer risk" (sole supporting citation in NCI 2016 [121] was SCENIHR 2015 [73]). It has been shown above in Chapter 5, that SCENIHR 2015 is not a credible source of information on this and as shown, in Chapter 1, there are 35 different reviews that each provide strong evidence that EMFs do cause cancer. So claiming, that EMF causation of cancer is, in Berezow & Bloom's words, "pure, unadulterated junk science" is nonsense. What is amazing here is that the U.S. NTP study, published by Wyde et al [122], clearly shows that cell phones do cause cancer but it was completely left out of the Berezow & Bloom statement.

Let's go to their third "major area of scientific knowledge" – Berezow and Bloom [120] state that "the only known health effects from Wi-Fi are due to psychosomatics." That is, "people who believe that something will make them sick will report feeling ill, even if nothing is happening externally." Some of the Wi-Fi studies (Table 1 in [11]) are cell culture studies, some are animal model studies where EMF exposures are compared with sham exposures. While there may be a very weak argument regarding some but not other human studies when they are not done blinded, there is no argument that effects in any of the other studies are caused by "psychosomatics." Berezow and Bloom do not look at any of the 23 studies of Wi-Fi reviewed in [11], each of which showed effects and it is clear that most of them cannot possibly be due to psychosomatics. What is surprising here, is that the trillion dollar set of telecommunication industries, having been working on their propaganda for over a quarter of a century, is unable to produce a more convincing argument.

Have There Been Individual Research Studies Designed to Fail and Therefore Corrupt the Scientific Literature?

The first example, that I am aware of, where false science has been produced to supposedly show that an important EMF observation was unrepeatable also came from the U.S. It was described in Dr. Davis' book [77]. Dr. Allen H. Frey (pronounced Fry) published a paper in 1975 in Annals of the New York Academy of Science showing that low intensity pulsed EMF exposures produced a breakdown of the blood-brain barrier, the barrier in the blood vessels in the brain and the brain tissue that protects the brain from toxic chemicals and also infectious agents. The methodology that he used was to inject the fluorescent dye fluorescein into the blood (IV) and then use its fluorescence to detect whether and to what extent it penetrates into the brain tissue from the blood. A subsequent paper was published in 1978 [123], using similar methodology *except* that the fluorescein instead of being injected into the blood, was injected by intraperitoneal (IP) injection. When a compound is injected IP, it enters the blood only slowly over a substantial period of time, so that when one does a short term experiment looking at penetration through the blood-brain barrier, essentially nothing is seen. This was a transparent attempt to claim that the studies of Dr. Frey had been repeated with negative results, but the Frey studies had not be replicated.

I am aware of many papers that were flawed like the seven studies of simulated Wi-Fi, discussed near the end of Chapter 5 that were each touted by Foster and Moulder [110]. Let me remind you of what the flaws were in those seven studies. Firstly, each of them used EMFs that were the correct frequency for Wi-Fi but differed in pulsation from genuine Wi-Fi. Each of these studies used a reverberation exposure chamber which is predicted to decrease effects by both decreasing the polarization of the EMFs and increasing the destructive interference of the EMFs. They also used tiny numbers of animals for each study group, such that any statistics would have very low power. Finally, Foster and Moulder claimed each of them showed "no effect" when one can only at best claim there was no statistically significant evidence of an effect. Given the tiny numbers, the lack of statistical significance is of very little importance. I find that this pattern has been followed in a substantial number of additional studies.

What I want to discuss here is a paper that had each of those four properties but had several additional flaws, as well. I am aware of three legal proceedings in the U.S., where the industry side of that case touted the paper to be discussed, as being a particularly strong one. This paper by Ziemann et al [124] is entitled "Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. In other words, the title claims that the 902 MHz frequency, studied and the 1747 MHz frequency also studied in the paper cannot cause DNA damage or other types of genotoxicity."

On p. 456 of Ziemann et al [124], the authors make clear that they are studying the effects of simulated cell phone radiation, not actual cell phone radiation. You will recall that Panagopoulos et al [110] found that almost all studies of genuine cell phone radiation found effects whereas less than half of simulated cell phone studies showed effects. This raises an important question about why Ziemann et al [124] opted to study simulated cell phone radiation. Much of the funding of the Ziemann et al paper (see pp. 462-463) came from industry sources. Funding source is not a flaw but it is a reason to look at the paper particularly closely. 2. The Ziemann et al [124] study used a stainless steel exposure chamber similar to the reverberation chambers discussed in Chapter 5 of this document. The chamber is predicted, to produce lower effects because of lowered polarization and increased destructive interference 3. The study is described as being a two year study of radiation effects. However the cells examined for micronuclei (their marker for genotoxicity (cellular DNA damage)), were mouse erythrocytes (red blood cells), and such

erythrocytes have a lifespan of only about 30 days; because of the inherent instability of micronuclei in replicating cells, such micronuclei in erythrocytes may possibly be generated over at most a 30 day period. It is misleading to describe this as a two year study when only the last 30 days are relevant to generating the marker being studied. 4. In rats and humans, erythrocytes containing micronuclei are selectively removed from circulation very quickly (see p. 459 of Ziemann et al [124]). While Ziemann et al claim that mice do not have a similar mechanism for selective rapid removal, the only citation that they provide is a study published by Chaubey et al (1993) showing that this was apparently true with Swiss mice; Ziemann et al [124] chose to use B6C3F1/CrlBR mice, a different inbred mouse strain which may well behave quite differently from Swiss mice. It follows from this that we have no idea whether the strain studied is similar to Swiss mice with regard to selective removal of erythrocytes containing micronuclei.

5. Ziemann et al [124] show that male and female mice behave quite differently with regard to levels of micronuclei (Tables I and III in [124]); however in their experimental study (Figure 2), males and females were combined in doing the statistics. What that inevitably does is to produce greater variations in micronuclei levels within different animal groups, making it substantially more difficult to detect any statistical significance among different animal groups in the study. It also means that it is important to use similar ratios of males and females in the experimental groups and we have no idea whether this was done or not. 6. In section A of Figure 2, there were only 8 animals in each group studied. In section B of Figure 2, there are only 5 to 9 animals in each animal group studied. These tiny numbers mean that there is only extremely low statistical power to detect any effects of EMF exposure and therefore these tiny studies make it almost impossible to say anything at all about the results. 7. The Ziemann et al study [124] provide none of their raw data; consequently we are in a situation where we have no way of judging whether their statistical analysis was done properly. We also have no way to use any such data as part of a meta-analysis of multiple studies, which may have much more power than do any single study (particularly such a tiny one). Consequently, the lack of statistical significance they report, cannot be properly assessed by the reader. 8. When one does a study looking at the possible effects of some variables, in this case a couple of simulated cell phone radiation studies, the most you can say about an apparent negative result is that "we did not see any statistically significant effects." When you have tiny studies such a described under 7 above, then the lack of statistical significance tells you almost nothing. But even with a very large study such as with thousands of mice including hundreds in each experimental group, all you can say is that "we did not see any statistically significant effects." 9. What do Ziemann et al conclude? They state in their title that there is an "Absence of genotoxic potential of 902 MHz (GSM) and 1747 (DCS) wireless communication signals." Did they study these EMFs in all organisms and all cell types? No of course not. Did they study all possible pulsation patterns of these two frequency EMFs? No of course not. Did they study all types of genotoxicity found following low-intensity EMF exposures? No, just one, micronuclei in erythrocytes in an inbred strain of mice. This title alone should tell any competent scientist that the paper is deeply flawed, completely apart from the preceding 8 flaws, with each of the 8 adding substantially to the flaws in this paper.

<u>George Carlo Letter</u>

Dr. George Carlo is an interesting and controversial figure who has both a law degree (JD) and a PhD in, I believe, epidemiology. He had worked in the telecommunications industry for years as head of the SAG and then WTR research arms. Dr. Carlo wrote an important letter to the heads of the telecommunications companies on October 7, 1999. The letter he sent to the head of AT&T is available on the internet [125]. In his book [126] Carlo lists all of the people sent the letter and also provides the text of the letter.

Carlo was, at that time the soon to be retiring head of the WTR, which was the CTIA/telecommunications industry research arm. In the letters to the heads of the telecommunications industry companies, Carlo discusses the types of evidence arguing that cell phones do apparently cause cancer and that they do cause DNA damage to our cellular DNA. The DNA damage, suggested that the apparent cancer causation was real. Carlo continues the letter as follows [125]:

"Today, I sit here extremely frustrated and concerned that appropriate steps have not been taken by the wireless industry to protect consumers during this time of uncertainty about safety." Continuing further down, Carlo adds:

"Alarmingly, indications are that some segments of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow up by calling for and supporting more research. The most important measures of consumer protection are missing: complete and honest factual information to allow informed judgment by consumers about assumption of risk; the direct tracking and monitoring of what happens to consumers who use wireless phones; and, the monitoring of changes in the technology that could impact health.

I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO with them in following a non-effectual course that will likely result in a regulatory and consumer backlash."

This is an important letter for several reasons. After October 7, 1999 the heads of the telecommunications companies or, for that matter anyone else at those companies, could no longer legitimately claim that they did not know there were serious health concerns with cell phones, with targeting cell phones to young children, or with increasing allowable cell phone exposure radiation. The last of these was done a few years later, as you have already seen.

The concerns Carlo expresses about the FCC (Federal Communications Commission) and the FDA (U.S. Food and Drug Adminstration) are particularly important in the U.S., because both the FCC and the FDA had already been given important regulatory roles when the Carlo letter was written. The FCC had been given the power of regulating the location of cell phone towers by the 1996 telecommunications act, which also *prohibited, as I understand it, any state or local government from protecting their people's health by regulating cell phone tower positioning*. In other words, the 1996 telecommunications act *de facto* stated that the U.S. Federal government valued telecommunication industry profits over every single health impact of microwave frequency radiation, *no matter how serious* it is, to the American people. There have been several subsequent pieces of legislation that have made the situation still worse. The FDA had been given the power to regulate radiation emissions from cell phones and other devices that emit microwave/radiofrequency radiation, with cell phone regulation apparently being shared with the FCC.

<u>What Can We Say About the FCC?</u>

There was a very informative document about the FCC published by the Safra Institute for Ethics at Harvard University [127] entititled "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates." One of the sections in that document shows why both the FCC role and the telecommunications industry role were so important with regard to the 1996 telecommunications act:

Section 332(c)(7)(B)(iv) of the Act remarkably, and that adverb seems inescapably best here, wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 322(c)(7)(B0(iv) of the Communications Act Provides:
No State or local government or instrumentality thereof may regulate the placement, construction of personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority – along with the public's right to guard its own safety and health, Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

What, then are the consequences of all of this? The 17 studies that have been done on people living near cell phone towers show that many people within 300 meters (about 1000 feet) of a cell phone tower are afflicted by six of the health effects found in those many reviews listed in Chapter 1. Two of those effects have not been looked at. According to this literature, people living within 300 meters of cell phone towers suffer from widespread neuropsychiatric effects, cellular DNA damage, cancer, oxidative stress, elevated apoptosis (cell death), and hormonal effects. They also suffer from cardiac effects like those discussed in Chapter 3 and from hypertension and also anemia. The two extremely well documented EMF health effects that have not been looked at are the reproductive effects and the high levels of intracellular calcium. That does not tell us these are not also caused in people living near cell phone towers, just that no one has looked. Roughly 30% of the people in this country live within 300 meters of a cell phone tower so the impact on health is major. But few know about this and the media and our government, including especially the FCC and FDA are keeping it all a deep dark secret. Not a single one of these 17 studies have been done in the U.S. Consequently, when the U.S. has ensured that we are irradiated by well over 300,000 of these cell phone towers, it has done absolutely nothing to determine what the consequences of exposure are. Of course we are impacted not only by cell phone towers near where we live but also near where we work or go to school and to some extent, when we are driving around town. These high levels of exposure are not necessary. Switzerland has safety guidelines that are 100 times more stringent than ours, Russia has safety guidelines that are 1000 times more stringent than ours. The health effects we see now will no doubt rise much further in the future without any increasing exposure, because many of these effects are cumulative, eventually becoming irreversible.

I would encourage you to look at the whole FCC as a captured agency document [127] – it can be downloaded at no cost from the internet [127]. It is very interesting and adds considerably to my short comments here regarding corruption.

So what does the FCC have to say about EMF effects on its web site [128]? I have copied some relevant sections as follows:

At relatively low levels of exposure to RF radiation, i.e., levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven. Such effects, if they exist, have been referred to as "non-thermal" effects. A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard. It is generally agreed that further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether changes in safety limits are needed to protect human health. (Back to Index)

CAN PEOPLE BE EXPOSED TO LEVELS OF RADIOFREQUENCY RADIATION THAT COULD BE HARMFUL?

Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant heating and increased body temperature. However, there may be situations, particularly in workplace environments near high-powered RF sources, where the recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or mitigation actions may be necessary to ensure the safe use of RF energy. (Back to Index)

CAN RADIOFREQUENCY RADIATION CAUSE CANCER?

Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page . (Back to Index)

Let's look at the first paragraph. In the third and fourth sentence, they state that there have been non-thermal effects reported but then say that "in most cases they have not been reproduced." Is that true? No. The 79 reviews listed in Chapter 1 have each found repeated studies documenting one or more of the EMF effects. You can't get a review published without multiple studies. And the fact that so many of these effects have been repeatedly reviewed, over many years shows that similar patterns of evidence have been found over long periods of time. *The FCC provides not one iota of evidence on its claims, despite the fact that such a claim of inability to reproduce findings absolutely requires extensive documentation to be scientifically valid. This difference in documentation, means that any one of those 79 reviews listed in Chapter 1 is vastly more scientific in showing the falsity of the FCC statement than is the FCC statement itself, which is completely undocumented.*

Let's go on to the cancer claim at the bottom of the copied section. The FCC states that "A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard." You will note here that there are no specifics, nor were there any specifics on the section discussed in the previous paragraph. What we have here are completely undocumented FCC claims, with no specifics whatsoever and claims that are clearly contradicted by each of the 35 reviews on cancer causation by EMF exposure. They are also clearly contradicted by the 21 reviews on cellular DNA damage following EMF exposures, something that the FCC says nothing about. It has been known for decades, that the process of carcinogenesis (cancer causation) usually starts with one or more mutations in the cellular DNA, mutations that can be caused by each of the three types of cellular DNA damage known to be caused by EMF exposure.

The sort of pattern seen here, where we have gross generalizations followed by no or completely inadequate documentation goes on with the industry propaganda [119,120] as discussed earlier, as well as in the Speit/Schwarz discussion from early in Chapter 5. What you see in each of those cases is everything falls apart when you look carefully at the facts. The situation with the FCC statements is very similar. There can be little doubt that the FCC is acting as a propaganda organization here, as strongly suggested by the George Carlo letter [125,126] and the FCC as a captured agency [127] document.

Three questions: Does the FCC know that these statements that it has made are not factual? Does it know how non-thermal EMF effects actually are produced? Does it know that its safety guidelines do not protect our health? That answer to all three of these questions is yes. How do I know? I know because I did a PowerPoint presentation to the FCC in September 2016 which presented findings in each of these important areas. My account of that presentation, written two days after it occurred, follows:

Professor Emeritus Martin L. Pall presented Powerpoint presentation on the main mechanism of action of non-thermal microwave frequency EMFs to the FCC

I met with Julius Knapp, Chief of OET, Martin Doczkat, Branch Chief, OET/Technical Analysis Branch, and Ed Mantiply Engineer OET/Associate Chief at the Federal Communications Commission on September 21, 2016 to present a Powerpoint presentation and answer questions. The presentation showed that non-thermal microwave and lower frequency EMFs act via voltage-gated calcium channel (VGCC) activation. The most important findings demonstrating this mechanism are that various effects produced by such non-thermal exposures can be blocked or greatly lowered by calcium channel blockers, drugs that are highly specific for blocking VGCCs. The reason why such low intensity non-thermal exposures activate the VGCCs is because the voltage sensor of the VGCCs is exquisitely sensitive to the electrical forces produced by these EMFs. The forces on the voltage sensor are calculated to be about 7.2 million times higher than are the forces on singly charged chemical groups in the aqueous phases of the cell. This very high level sensitivity also predicts that the safety guidelines allow us to be exposed to EMF intensities that are approximately 7.2 million times too high.

The actions produced by such VGCC activation go mainly through the excessive intracellular calcium levels produced by such activation. Excessive calcium acts via three main pathways to produce effects in the body. Therapeutic effects are produced through the nitric oxide signaling pathway whereas many pathophysiological effects are produced by the peroxynitrite/oxidative stress pathway. Excessive calcium signaling also produces pathophysiological effects. Numerous effects produced following non-thermal EMF exposures can be produced by these pathways including oxidative stress, cellular DNA damage, cancer, widespread neuropsychiatric effects, breakdown of the blood brain barrier, lowered male and female fertility and various endocrine (that is hormonal) changes.

It has long been known that pulsed EMFs are usually much more biologically active than are non-pulsed (or continuous wave) EMFs and this difference appears to be consistent with the VGCC mechanism. Because all wireless communication devices communicate via pulsations, such devices may be of special concern.

Three concerns were expressed with regard to 5G: 1. The stronger absorption of the very high frequencies involved require the setting up of vast numbers of antennae, making it essentially impossible to avoid damaging exposures. 2. The stronger absorption suggests that these EMFs may be particularly active in activating the VGCC voltage sensor. 3. The very high level and complexity of pulsations also may make for much more biological damage via VGCC activation.

There was substantial discussion of the need for biological safety testing. That discussion focused on the using cells in culture that have high densities and different types of VGCCs. Responses can be monitored by either monitoring intracellular calcium levels or by measuring nitric oxide production using a nitric oxide electrode.

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We had what would be considered in diplomatic circles a good and productive meeting, but since that time the FCC has doubled down on their positions, pushed much further on 5G, leading us to the mega-crisis situation which we are faced with now. Instead of actually testing 5G radiation biologically for safety, using the methods that were discussed in that meeting, the FCC has instead opted to put out tens of millions of 5G antennae without any biological safety testing of genuine 5G radiation. That is the insanity that we are in.

What About the FDA?

The Food and Drug Administration (FDA) was given the power to regulate devices that emit microwave frequency EMFs. This was not an unreasonable decision, given that the FDA was already regulating the safety of medical devices, where one can argue that there are similar challenges involved. The FDA was given this responsibility without any additional funding. So obviously, it was and is distinctly limited in what it can do.

What the FDA did was to issue a Letter of Intent for Proposed Collaboration in Mobile Phone Research between the Food and Drug Administration and the Cellular Telecommunications

Industry Association (CTIA), [129] Dated October 20, 1999. This would involve a Cooperative Research and Development Agreement (CRADA). Later in their Letter of Intent, it states under Initial Research Under the CRADA [129]: "The first study to be conducted would follow up on the findings of studies previously conducted by WTR but not yet published using the micronucleus assay, a test which detects structural effects on genetic material. Research data in the literature from RF exposure studies using the micronucleus assay are conflicting, and warrant follow-up study." You will see here that the FDA is accepting the industry claim that these studies are conflicting even though, having been done under different circumstances, they are not.

The basic approach of the CRADA was that the industry would fund any research to be done and decide what research should be done by whom and how and what information would be published subsequently.

You may recall that Dr. George Carlo wrote a very important letter to the heads of the telecommunications companies, described earlier. That letter was dated two weeks before the date of the letter or intent. Carlo's letter stated: "I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO… ." Carlo who had been up to that point, an industry insider, and apparently had reason to think that the FDA had been corrupted, or what he called conscripted by parts of the telecommunications industry two weeks before the letter of intent was written. I don't think this is definitive evidence that the FDA has been corrupted, and it can even be argued that it is not evidence at all. But it does suggest, however, that we need to look further into this issue.

Let's go on to the results of this CRADA [130]. The FDA reports the following findings from the CRADA: "FDA's cooperative research and development agreement (CRADA) with the Cellular Communication & Internet Association (CTIA) has resulted in research projects focused on two topics - mechanistic studies related to genotoxicity and exposure assessment studies. All studies funded through the CRADA have been completed, and no association was found between exposure to radiofrequency (RF) radiation from cell phones and adverse health effects." I have been unable to get copies of these studies and therefore cannot comment on them.

The CRADA also lead to a National Academy of Sciences (NAS) workshop on EMFs that lead, in turn, to a 2008 NAS report. That 2008 NAS report can be accessed from [130]. It is a useful report, in my view, albeit one that leaves out much of what was already known in 2008. It does ***not*** say that there are no clear non-thermal effects and specifically calls for study of the neurological effects, suggesting that "that neural networks are a sensitive biological target." It also calls for much research on biophysical or biochemical molecular mechanism(s) that may lead to the non-thermal effects. It also calls for much more study on cancer. There has been a large amount of progress in each of these three areas since 2008, including of course the identification of VGCC activation as the most important but not necessarily the only biophysical mechanism. The problem with regard to the FDA is that as far as one can tell, the FDA has paid no attention to either the 2008 report or to the subsequent progress we have had in these several areas.

Let's shift our attention to what the FDA currently says about the impacts of these EMFs? On their web site [131], the FDA states the following:

Is there a connection between certain health problems and exposure to radiofrequency fields via cell phone use?

The results of most studies conducted to date indicate that there is not. In addition, attempts to replicate and confirm the few studies that did show a connection have failed.

According to current data, the FDA believes that the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes. Still, there is a consensus that additional research is warranted to address gaps in knowledge, such as the effects of cell phone use over the long-term and on pediatric populations.

There was a similar statement made by the FCC, in previous section, and also similar statement was made by Samsung, one of world's largest producers of cell phones which reads a follows [132]:

Over the past 15 years, scientists have conducted hundreds of studies looking at the biological effects of radio frequency energy emitted by cell phones. While some researchers have reported biological changes associated with RF energy, these studies have failed to be replicated. The majority of studies published have failed to show an association between between exposure to radio frequency from a cell phone and health problems.

Neither the FDA statement nor the Samsung statement give us any idea what possible effects are being considered here, what literature was used for such a consideration. These statements are completely undocumented and therefore must be viewed as being unscientific. In Chapter 1, 79 reviews were given that each showed the existence of one or more effects. Eignt different of effects were each documented in from 12 to 35 reviews. Such reviews must be extensively documented or one cannot get them published. Any one of those reviews provides, therefore, a much stronger argument for presence of one or more effects than do the FDA, FCC and Samsung statements put together arguing for the opposite. One thing that is strange about the FDA statement is that they are talking specifically about cell phones even though they are tasked with regulating safety on all such microwave/radiofrequency devices. What I have done below is to put together the 16 reviews which are completely or largely focused on cell phone radiation effects so that we can see what specific effects have been found to be caused by cell phone radiation. I will summarize those effects below.

Table 5: Reviews on Cell Phone Effects and the Effects Found in Each

Review on Cell Phone Effects	Effects Found
La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	Multiple effects on male reproduction
Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Cellular DNA damage, neurological/neuropsychiatric effects, apoptosis
Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.	Apoptosis, increased oxidative stress, increased intracellular calcium
K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.	Male infertility, cellular DNA damage, lowered melatonin, increased stress protein expression
Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced	Oxidative stress, male and female reproductive signaling dysfunction

radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	
Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Cancer, cellular DNA damage, apoptosis; higher cancer incidence on ipsilateral side of the head, not contralateral
Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.	Neurological dysfunction
Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.	Cancer – epidemiological review
Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.	Cancer – meta-analysis on long-term cell phone use and brain tumors
Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	Mobile and cordless phone radiation caused brain cancer based on the Hill criteria for causation (most important criteria for causation in epidemiology)
Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	Mobile and cordless phone exposures associated with increased risk of glioma and acoustic neuroma; higher cancer increase on ipsilateral side of the head
Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Cell phone and cordless phone radiation are a probable carcinogens; cancer increase on ipsilateral side of the head, not contralateral side
Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.	Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen
Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014.	Association between mobile phone risk and tumor risk
Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8.	The association between mobile phone use and brain cancer is higher in independently funded studies than in industry funded studies
Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-	This is a bibliography of studies on cell phone radiation and cancer – most

frequency-radiation-cancer/ (Accessed Sept. 9, 2017)	support the view that cell phones do cause cancer

The effects of specifically cell phone radiation that have been found in these reviews (Table 5) include: lowered male reproductive function, lowered female reproductive function, increased cellular DNA damage, neurological/neuropsychiatric effects, increased stress protein synthesis, increased intracellular calcium, apoptosis, lowered melatonin, oxidative stress, cancer (10 reviews) and specifically increased ipsilateral cancer (3 reviews). So there are 11 different cell phone effects where there is substantial enough evidence to warrant publication in one or more review articles. Each of these effects has been shown to occur in response to other microwave frequency EMFs and therefore should be considered to be caused by EMFs more broadly.

The summary of Table 4, Chapter 5, the genuine cell phone primary literature studies that fell into the 2009-2013 time frame, started as follows: "If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated to be produced by cell phone radiation in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here."

It can be seen from Tables 4 & 5 and the preceding two paragraphs, that there is a vast amount of literature on repeatedly found effects of cell phone radiation, effects which make a mockery of the *completely undocumented and non-specific* FDA claims to the contrary.

Let's look at another part of the FDA statement which also shows similarities to statements made elsewhere [131]:

The biological effects of radiofrequency energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radiofrequency energy, including both radio waves and microwaves, are not great enough to cause the ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat) and other forms of electromagnetic radiation with relatively low frequencies.

This is almost identical to another Samsung statement and also to an FCC statement that I have not copied. Here is the Samsung statement [133]:

The biological effects of RF energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays, can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radio frequency energy, including both radio waves and microwaves, are not great enough to cause ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat), and other forms of electromagnetic radiation with relatively low frequencies.

While RF energy does not ionize particles, large amounts can increase body temperatures and cause tissue damage. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat.

The three paragraphs from the FDA statement are word for word identical to the first three paragraphs of the Samsung statement. The last paragraph in the Samsung statement was deleted from the FDA statement. It is clear from this that either the FDA statement is derived from the earlier industry statement rather than the other way around or both are derived from a previous statement similar to the Samsung statement.

These types of statements have given rise to shorter statements that are all something like the following:

Non-ionizing radiation consists of photons that do not have enough energy to break chemical bonds including the chemical bonds of DNA.

All of these statements are technically correct. They are also highly misleading. They are often falsely interpreted as meaning that there cannot be any effects of non-ionizing, non-thermal EMF exposures ***including indirect effects***. There are many possible indirect effects that may occur, given the complexity of biology. But our situation goes way beyond that, because we know that most of the effects are produced via VGCC activation which produces, as downstream effects, the free radical breakdown products of peroxynitrite (Fig. 1, Chapter 2). Those free radical breakdown products attack DNA, proteins and other biological constituents in ways that are very similar to the ways in which ionizing radiation attack these same molecules. Ionizing radiation was shown by Arthur Compton, who won the Nobel prize in physics in 1927, for showing that ionizing radiation produces large numbers of free radicals through what has become known as Compton scattering, with those free radicals being responsible for most of the biological effects of ionizing radiation. So the often repeated industry claim that ionizing radiation is dangerous but non-ionizing radiation is not, <u>is wrong</u> – both of them produce similar effects mediated through free radical generation. However the dangers of non-ionizing radiation may eclipse the dangers of ionizing radiation under some conditions because of something that is discussed early in Chapter 5, at the end of the Speit/Schwarz discussion. There are three processes which occur in the sequence by which EMF activation leads to peroxynitrite breakdown product radicals, each of which have high levels of amplification (each discussed on p. 29 in Chapter 5). Thus potentially and I believe actually microwave frequency EMFs can produce under suitable conditions, much more efficient free radical production than occurs from a similar energy level of ionizing radiation.

The FDA may have had a long history of playing fast and loose with the truth. For example, Microwave News article published in 2003, provides this account of what occurred at the FDA in 1993 [134]:

1993 FDA Memo Data "Strongly Suggest" Microwaves Can Promote Cancer.

In the spring of 1993 at the height of the public concern over cell phone brain tumor risks, the Food and Drug Adminstration (FDA) biologists concluded [134] that the available data "strongly suggest" that microwaves can "accelerate the development of cancer." This assessment is from an internal agency memo recently obtained by Microwave News under the Freedom of Information Act.

"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both" wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (in vitro) studies which supported cancer risk.

Yet in its public statements at that time, the agency played down these findings [134]. For instance in a Talk Paper issued in early February, the FDA stated that there was "limited evidence that suggests that lower levels (of microwaves) might cause adverse effects."

"A few studies suggest that (microwave) levels (from cellular phones) can accelerate the development of cancer in laboratory animals," the FDA added [134], "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

I have three comments. Firstly, if you look at the 35 citations in the list on cancer causation in Chapter 1, you will see that there are 8 citations (#s 2-7 & 15 & 19) which provide similar evidence of stimulation of tumor promotion, four of which (#s 3-6) were published around 1993, the time of the FDA memo and public statement described above. Therefore, there was a substantial literature including peer-reviewed primary literature and review articles which produced similar conclusions to those of the FDA internal memo. The importance of the memo is that the FDA knew about these findings and opted to cover them up.

Secondly if you compare the rhetoric in the 1993 memo with the first quote from the current FDA web site quoted in this section, you will see some striking similarities. They both first refer to "a few studies" which are not identified, followed by raising uncertainties and then finally raising doubt as to whether these findings apply to cell phone radiation. The pattern of the FDA rhetoric has not changed much in 25 years.

If one includes the middle statement also quoted from the FDA web site, we have three FDA statements each of which downplays any biological effects and each of which are strongly rebutted by extensive peer-reviewed independent scientific literature. I'm not sure we can say the FDA has been corrupted by the industry, but what we can say is that it has been functioning as if it has been corrupted for 25 years.

In mid-2009 Margaret A. Hamburg, the new commissioner of the FDA, and Joshua M. Sharfstein, her principal deputy commissioner, published a commentary article in the New England Journal of Medicine [135] which included the following:

"One of the greatest challenges facing any public health agency is that of risk communication. … The FDA's job is to minimize risks through education, regulation, and enforcement. To be credible in all these tasks, the agency must communicate frequently and clearly about risks and benefits—and about what organizations and individuals can do to minimize risk. When, like the FDA, Americans must make choices about medication, devices, foods, or nutrition in the absence of perfect information, the FDA cannot delay in providing reasonable guidance —guidance that informs rather than causes unnecessary anxiety. For these communications to have credibility, the public must trust the agency to base its decisions on science."

These were and are laudable goals. As far as I can tell, with regard to EMF effects, the FDA has failed to base either its communications or its decisions on science.

Summary of Chapter 6

In the areas discussed in Chapter 6 what used to be the primacy of U.S. science has completely disintegrated. It has disintegrated because of the cessation of U.S. government funding for either experimental studies or epidemiological studies. It has disintegrated due to attacks on U.S. and International scientists, attacks that started in the U.S. with the attacks on Dr. Henry Lai. It has disintegrated because of aggressive industry propaganda, propaganda that has no connection with the real science. It has disintegrated because of the outright corruption of the committee to set standards for radio-frequency exposures and the FCC and the possible and *de facto* corruption of the FDA. The telecommunications industry has been aware of much of the problems with their approach since the 1999 letter to them from George Carlo. The FCC has been aware of much more of the science since my presentation to them in September 2016. The FDA has been aware of contrary findings since 1993. Each of them has, if anything, doubled down on their fictions since those respective times.

Many of these things are going on internationally; however the U.S. has often been leading the world in these processes. All of the actions we have seen to corrupt the science and public understanding of the science have the effect of making it vastly more difficult for individuals impacted by the EMFs to protect themselves from further harm. We have many effects that are cumulative and become irreversible as they become more severe, effects that impact at a minimum, tens of millions of Americans and hundreds of millions of people elsewhere in the world. *Industrial and regulatory organizations make it difficult or impossible for people to have scientifically valid information also make it difficult or impossible for people to protect themselves from the accumulation of these effects, leading to severe irreversible effects. Each of the organizations involved, both U.S. and international that collaborate in this process, have important responsibility for the consequences.* I think damage goes way beyond tens and hundreds of millions of people, because I think we are looking at cumulative severe impact on our brain function, on our reproductive function and on our DNA, and that these, in turn will lead to the crash of every single technologically advanced country on earth, barring a major change in course. That will happen fairly quickly, in my opinion, even without 5G but 5G will greatly speed up the process and perhaps even add new egregious effects

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know

We have already discussed two issues that are essential to understanding 5G. One is that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (often called

continuous wave) EMFs. A second is that the EMFs act by putting forces on the voltage sensor of the VGCCs, opening these calcium channels and allowing excessive calcium ions to flow into the cell. The voltage sensor is extraordinarily sensitive to those electrical forces, such that the safety guidelines are allowing us to be exposed to EMFs that are something like 7.2 million times too high.

The reason that the industry has decided to go to the extremely high frequencies of 5G is that with such extremely high frequencies, it is possible to carry much more information via much more pulsation than it is possible to carry with lower frequencies even in the microwave range. We can be assured, therefore, that 5G will involve vastly more pulsation than do EMFs that we are currently exposed to. It follows from that, that any biological safety test of 5G must use the very rapid pulsations including whatever very short term spikes may be present, that are to be present in genuine 5G. There is an additional process that is planned to be used in 5G: phased arrays (https://en.wikipedia.org/wiki/Phased_array). Here multiple antenna elements act together to produce highly pulsed fields which are designed for 5G, to produce increased penetration. 5G will entail particularly powerful pulsations to be used, which may, therefore, be particularly hazardous.

The only data we have, to my knowledge, on millimeter wave frequencies of 5G used *non-pulsed EMFs in the millimeter frequency range of 5G, not genuine 5G*. Such millimeter waves have been shown to produce a number of downstream effects of VGCC activation. One millimeter wave study showed that it activated both the VGCCs and also the voltage-gated potassium channels, suggesting that it worked via the voltage sensor, as do other EMFs [136]. Any such data tells us almost nothing about how biologically active genuine very highly pulsed 5G will be. I take it that from their statements, that both Mr. Ryan and Dr. Vinciūnas are ready to put out 10s of millions of 5G antennae to afflict every single person in the EU with 5G radiation without even a single biological test of safety of genuine 5G. In the U.S., the FCC has taken a much worse position. The FCC is not only willing to allow such completely untested exposures but has also been has been aggressively pushing to promote installation of 5G antennae, such that antennae are already being installed in parts of the U.S. In a world where shocking behavior has become less and less shocking, I consider EU and U.S. views and actions to be shocking. The U.S. situation is mass insanity. I would have hoped that the Europeans, who think of themselves as being much more thoughtful than Americans, would have been genuinely more thoughtful.

Why does 5G need such high numbers of antennae? It is because the 5G radiation is much more absorbed as it enters various materials. The approach is to use many more antennae with one found every few houses, such that 5G can sufficiently penetrate local walls. Such absorption usually involves the interaction with electrically charged groups, such that such high absorption is likely to involve placing forces on electrically charged groups. Because such forces are the way in which EMFs activate the VGCCs, it seems highly likely, therefore, that 5G radiation will be particularly active in VGCC activation.

In summary, then, 5G is predicted to be particularly dangerous for each of four different reasons: 1. The extraordinarily high numbers of antennae that are planned. 2. The very high energy outputs which will be used to ensure penetration. 3. The extraordinarily high pulsation levels. 4. The apparent high level interactions of the 5G frequency on charged groups presumably including the voltage sensor charged groups.

Now what the telecommunications industry argues is that 5G radiation will be mostly absorbed in the outer 1 or 2 mm of the body, such that they claim that we don't have to worry about the effects. There is some truth to that, but there are also some caveats that make any conclusions

made from that, much more suspect. In any case, these surface effects of 5G will have especially strong impact on organisms with much higher surface to volume ratios. Consequently, I predict that many organisms will be much more impacted than we will. This includes insects and other arthropods, birds and small mammals and amphibia. It includes plants including even large trees, because trees have leaves and reproductive organs that are highly exposed. I predict there will be major ecological disasters as a consequence of 5G. This will include vast conflagrations because EMF exposures make plants much more flammable.

But let's get back to humans. The industry has also made claims that more conventional microwave frequency EMFs are limited in effect to the outer 1 cm of the body. We know that is not true, however because of the effects deep in the human brain, on the heart and on hormone systems. Perhaps the most important two studies demonstrating effects deep within the body are the studies of Professor Hässig and his colleagues in Switzerland on cataract formation in newborn calves [137,138]. These two studies clearly show that when pregnant cows are grazing near mobile phone base stations (also called cell phone towers), the calves are born with very greatly increased incidences of cataracts. It follows from these findings that even though the developing fetuses are very deep in the body of the mother and should be highly protected from the EMF exposures, they are not so protected. And because the EMF safety guidelines in Switzerland are 100 times more stringent than are the safety guidelines in most of the rest of Europe, in the U.S., Canada and most of the rest of the world, the more general safety guidelines allow greatly excessive exposures and penetration of effects. The claims of industry that microwave frequency EMFs only act in the outer centimeter of the body are clearly false.

How then can both conventional microwave frequency EMFs and 5G radiation act deeply within the body? You may correctly observe that the electrical effects of the EMFs activate the voltage sensor and that the direct electrical forces are rapidly attenuated in the body. So how can we get deep effects? I think the answer is that the magnetic parts of the EMFs have been known for decades to penetrate much more deeply than do the electrical parts. The magnetic fields put forces on mobile electrically charged groups dissolved in the aqueous phases of the body and small individual movements of the charged groups can regenerate electric fields that are essentially identical to the electric fields of the original EMFs, carrying the same frequency and same pulsation pattern, although with lower intensity. An example of this is given in the Lu and Ueno [139] study. Because the voltage sensor is so stunningly sensitive to electrical forces and part of the reason for that is the very high level of amplification of the electrical field across the plasma membrane, we have an almost perfect way in which to produce EMF effects deeply within our bodies.

I am very concerned that 5G may produce effects like those we already see produced from lower frequency EMFs but are much more severe. I am also concerned that we will also see responses that are qualitatively different. Let me give you three possible examples of the latter type and one quantitative example. Each of the four types of blindness, have downstream effects of VGCC activation as causal factors: cataracts, detached retinas, glaucoma and macular degeneration. The aqueous and vitreous humors in the eye may be an ideal environment for the regeneration of the electrical fields within the eye. We may, therefore have a gigantic epidemic of each of the four types of blindness. Another concern focuses on kidney dysfunction, which was shown in Chapter 5 to be impacted by EMFs. The kidneys have much fluid, both blood and also what will become urine, which may allow efficient the regeneration of electrical fields. Such regeneration may be expected to impact both the glomerular filtration and also the reabsorption, both essential to kidney function. Does this mean that 5G will produce very large increases in kidney failure? The only way to find out is to do biological safety testing of genuine 5G radiation. Let me give you a third example. Fetuses and very young babies have much more water in their bodies than do

adults. Therefore, they may be a special risk for impacts of 5G, because of great increases in the regeneration of the electrical fields. Here one can think of all kinds of possibilities. Let me suggest two. We may have a gigantic (sorry about using that word again) epidemic of spontaneous abortion due the teratogenic effects. Another possibility is that instead of autism being one birth in 38, however horrendous that is, it could be one out of two, or even a majority of births. I don't know that these will happen, but these are the kinds of risks we are taking and there are many others one can think of. Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world.

This brings us back to the earlier point. The only way to do 5G safety testing is to do genuine 5G biological safety testing. I have published on how this can be done relatively easily at relatively low cost and have, as you saw in the Chapter 6, told the FCC how this can be done. Those tests must be done by organizations completely independent of industry and that leaves out both ICNIRP and SCENIHR and a lot of other organizations.

Now we will get into the precautionary principle which is specially relevant to the EU but may have lessons for all of us.

Dr. Vinciūnas' last full paragraph reads as follows: "The recourse to the EU's precautionary principle to stop distribution of 5G products appears too drastic a measure. We need first to see how this technology will be applied and how the scientific evidence will evolve. Please be assured that the Commission will keep abreast of the scientific evidence in view of safeguarding the health of European citizens at the highest level possible and in line with its mandate."

Article 191 defines the **Precautionary Principle** as follows:

"According to the European Commission the precautionary principle may be invoked when **a phenomenon, product or process may have a dangerous effect**, identified by a **scientific and objective evaluation**, **if this evaluation does not allow the risk to be determined with sufficient certainty**.

Recourse to the principle belongs in the general framework of **risk analysis** (which, besides risk evaluation, includes risk management and risk communication), and more particularly in the context of **risk management** which corresponds to the decision-making phase.

The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary decisions.
The precautionary principle may only be invoked when the **three preliminary conditions** are met:

identification of potentially adverse effects;
evaluation of the scientific data available;
the extent of scientific uncertainty."

The question now is what about 5G? We have with 5G strong suspicions of similar or much more severe risk of effects documented elsewhere in this document. We have no biological safety testing of genuine 5G radiation. Therefore, we have no risk analysis or risk management because we have no risk assessment whatsoever on 5G. So here we have Dr. Vinciūnas arguing that the request for precautionary principle application is premature. But it is not the request for

the use of the precautionary principle that is premature, it is the Commission's claim that it has done the required risk analysis and risk assessment. This is the bizarre world that we live in.

The European Commission has done nothing to protect European citizens from the very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect U.S. citizens. The U.S. FCC has been worse than that, acting in wanton disregard for our health.

Let me close, as follows. There have been certain points in our history where people have stood up to strong destructive forces against what often appeared to be insurmountable odds. Those people are THE most honored people in our history. The people who failed to do so are among the most despised people in our history. I am not at all sure we will have historians to record us 100 years from now or even 30 years from now, given the direction in which we are heading. But if we do, rest assured that these are the standards by which we will all be judged.

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