RESPONSUM

om

hvorvidt det vil være i strid med menneske- og miljøretlige regler at etablere 5G-systemet i Danmark

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Responsummet baseres på retsreglerne i Den Europæiske Menneskerettighedskonvention, FNs børnekonvention, EUs habitatdirektiv, fuglebeskyttelsesdirektiv og forsigtighedsprincip, samt Bern- og Bonn-konventionerne om beskyttelse af dyr og planter.

Besvarelsen er opdelt i et pkt. 1, som vedrører faktum (om 5G-systemet samt forskning i skadevirkninger ved radiofrekvent elektromagnetisk stråling), og et pkt. 2, der sammenholder faktum med ovennævnte retsregler. Pkt. 3 indeholder en overordnet konklusion.

Indholdsfortegnelse

1. Faktum.

1.1. Hvad er 5G?

"5G" er en samlebetegnelse for den næste (femte) generation af kommunikationssystem til mobiltelefoner og internetbrug. Det har ikke nogen lovbaseret definition, og er tilsyneladende hverken fuldstændigt fastlagt eller standardiseret.

Den tilgængelige information om det påtænkte system kommer primært til udtryk via de tiltænkte opgaver og formål, som 5G skal varetage, jf. f.eks. Europa-kommissionens "Working document" af 14. september 2016, pkt. 3, og teleindustriens 5G-manifest[1] af 7. juli 2016.

5G-systemet er bl.a. beskrevet således i den videnskabelige litteratur, jf. Neufeld og Kuster (2018), p. 705:

"THE FIFTH generation of wireless communication technology (5G) promises to facilitate transmission at data rates up to a factor of 100 times higher than 4G. For that purpose, higher frequencies (including millimeter-wave bands), broadband modulation schemes, and thus faster signals with steeper rise and fall times will be employed, potentially in combination with pulsed operation for time domain multiple access. 5G is designed as a ubiquitous communication system spanning applications such as high-bandwidth mobile data and telephony, real-time machine-to-machine communication (e.g., autonomous mobility), and the Internet of Things (IoT)."

Det er bl.a. ikke endnu fastlagt, hvilke frekvensbånd 5G-systemet ville benytte, og det fremgår af følgende tabel, at de frekvenser, der bl.a. overvejes, er de samme, som hidtil har været udnyttet til tidligere generationer[2]:

Table 1: The Main Frequency Bands for 5G Standards Taken up Globally

Frequency Band	Frequency Range	Countries/Regions	Comments
Low Band	<1 GHz (UHF) usually 600/700 MHz	EU, USA, India	Current favourite as longer range, so less costly infrastructure and more familiar technology
Mid Band	3-5 GHz (above UHF)	EU, Korea, Rep., China, India with USA at 2 GHz; China and Japan in 2020	More spectrum available, with compromise on range and performance
High Band	20-100 GHz	EU, USA, Korea, Rep.; in 2020 - China, Japan, India	Short range (10-150m), high speed, low latency

Source: Bertenyi, 2017; authors.

Det hedder i et svar af 1. april 2019 fra Energi-, Forsynings- og Klimaministeren til folketingets udvalg om samme om systemets påtænkte implementering i Danmark bl.a.:

"De grænseværdier, der bliver anvendt i Danmark, har baggrund i anbefalinger fra EU, der er baseret på værdier fastlagt af den internationale kommission for ikke-ioniserende stråling

1 http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=16579

2 Tabellen er anvendt i Europa-Parlamentets rapport af april 2019 om "5G Deployment – State of play in Europe, USA and Asia", s. 10.

(ICNIRP).

Teleselskaberne skal sikre overholdelse af grænseværdierne, som er 2 W/kg, hvor folk opholder sig og færdes. Disse grænseværdier er teknologineutrale og det betyder, at grænseværdierne gælder uanset, hvilken teknologi der er tale om fx 2G, 3G, 4G eller 5G.

Teleselskaberne har oplyst, at de forventer, at antallet af antennepositioner vil blive forøget med 15-25 % frem mod 2025 som følge af udrulningen af 5G. Det er teleselskabernes forventning, at den samlede elektromagnetiske eksponering (stråling) vil blive øget med 10-20 % i forhold til i dag.

Teleselskaberne forventer, at eksponeringen fra mobilnettene fortsat vil ligge langt under grænseværdierne, også når 5G-nettene er fuldt udbyggede.

5G-nettet vil være baseret på højere frekvenser end de øvrige teknologier, og mobilsignalerne vil derfor række kortere. Det betyder, at der vil være behov for at lave et mere fintmasket net med flere basestationer (small cells). Disse basestationer vil sende med en lavere effekt end fx de antenner, som sender på 2G, 3G og 4G. Strålingen vil derfor også være tilsvarende mindre."[3]

1.2. Forskningen.

I hvert fald siden 1966 har der været videnskabelig forskning, som dokumenterede helbredsmæssige skadevirkninger ved elektromagnetiske felter.[4]

Det er denne forskning, som skal sammenholdes med det påtænkte 5G-systems kendte karakteristika, jf. pkt. 1.1. ovenfor, og de "grænseværdier" (maksima for udledning af en bestemt form for miljøpåvirkning), der p.t. anvendes i EU og Danmark, jf. pkt. 2.1. nedenfor.

Det har ikke været praktisk muligt at gennemgå det fulde tilgængelige videnskabelige materiale, som underbygger de ovenfor beskrevne skadevirkninger på menneskers og dyrs helbred ved eksponering for radiofrekvent elektromagnetisk stråling, da dette materiale tæller flere tusinder artikler.

Det gennemgåede materiale er dels fremfundet af undertegnede selv, dels fremsendt af bestiller, herunder efter anmodning fra undertegnede.

1.2.1. Fokus i nærværende responsum.

Opmærksomheden er centreret omkring de resultater, der positivt dokumenterer enten egentlige skadevirkninger eller risici herfor på mennesker, dyr og planter.

I det omfang sådanne dokumenterbare forskningsresultater foreligger, er disse i sagens natur af langt større betydning, end undersøgelser, der ikke har været i stand til at identificere en skadevirkning eller risiko herfor, al den stund sidstnævnte gruppering ikke i sig selv udelukker, at der rent faktisk er skadevirkninger eller risici.

Er det én gang lødigt videnskabeligt bevist, at der er enten skadevirkning eller risiko for skade, er det ikke relevant, om der ti andre gange er gennemført lødige forsøg, som ikke kunne påvise en sådan skadevirkning eller risiko. Det er blot op til videnskaben at afklare, hvorfor de ti øvrige lødige forsøg ikke påviste det, der nu foreligger videnskabeligt bevist, for på denne

3 Se i øvrigt pkt. 2.1 nedenfor om de i Danmark anvendte grænseværdier.

4 Jf. Pall 2018 p. 9, der henviser til Marha K. 1966, artiklen: *"Biological effects of high-frequency electromagnetic fields (translation)"*.

måde bedre at kunne forstå hvorfor og hvordan skaderne opstår eller kan opstå.[5]

Dette kan muligvis illustreres med undersøgelse af bestanden af svaner: Konstateres det ved én undersøgelse, at der findes sorte svaner, er det ikke relevant, at der ved ti andre undersøgelser ikke er fundet nogen svaner, der var sorte. Det er nu engang påvist, at den sorte svane eksisterer, og det kan muligvis være nyttigt at afklare, hvorfor de ti andre undersøgelser ikke konstaterede det samme.[6]

Det ville være misvisende, om man forsøgte sig med en "statistisk gennemsnitsbetragtning", og på den måde f.eks. konkluderede, at der kun er 1/11 sandsynlighed for, at den sorte svane rent faktisk findes, fordi dette kun er bevist ved én undersøgelse, mens ti andre ikke fandt noget bevis herfor.

1.2.2. Mennesker: Helbredsmæssige skader og risici.

1.2.2.1. DNA-skader.

I 2015 foretoges en videnskabelig gennemgang af de dengang mere end 100 tilgængelige peer-reviewed studier, som vedrørte undersøgelsen af såkaldt "oxidative effekter" af lav-intensitets radiofrekvent stråling (herefter forkortet: RFR).

Undersøgelsen (Yakymenko et al 2015[7]) viste bl.a., at det var plausibelt, at EHS-lignende[8] tilstande i hvert fald til dels forårsages af eksponering overfor lav-intensitets RFR (p. 195), og at eksponeringen kunne medføre kræft (p. 196), begge fremkaldt af "oxidativt stress". Det konstateredes således, at 93% af undersøgelser viste at strålingen medførte dannelsen af reaktive oxdative forbindelser og oxidatit stress i alle undersøgte levende organismer fra celler, planter, insekter, forsøgsdyr til mennesker (sædceller), jf. ibid. p. 186.

Yakymenko et al 2015, p. 186:

"All above mentioned studies dealt with the effects of low-intensity RFR. This means that the intensity of radiation was far below observable thermal effects in biological tissues, and far below safety limits of the International Commissions on Non-Ionizing Radiation Protection (ICNIRP) (ICNIRP, 1998)."[9]

Ibid., p. 187:

"Low-intensity RFR is referred to as radiation with intensities which do not induce significant thermal effects in biological tissues. Accordingly, any intensity of RFR under the ICNIRP limits can be referred to as low-intensity. In this paper we will analyze only the effects of low-intensity RFR."

Ibid., p. 196 (konklusion):

"...a broad biological potential of ROS and other free radicals, including both their mutagenic effects and their signaling regulatory potential, makes RFR a potentially hazardous factor for

5 Se i samme retning Philips et al (2009), *"Electromagnetic fields and DNA damage."*, offentliggjort i det videnskabelige tidsskrift "Pathophysiology" nr. 16 (2009), p. 79–88, p. 84 – 85. P. 85 anføres: *"Each study to investigate RFR-induced DNA damage must be evaluated on its own merits, and then studies that both show effects and do not show effects must be carefully evaluated to define the relationship of experimental variables to experimental outcomes and to assess the value of experimental methodologies to detect and measure these outcomes (see Section 2)."*

6 Eksemplet er bl.a. anvendt af videnskabsfilosoffen Karl Popper.

7 Offentliggjort i det videnskabelige tidsskrift "Electromagnetic Biology and Medicine", nr. 35 2016, pp. 186 – 202.

8 EHS står for Elektro Hyper Sensitivitet, og er en fysisk lidelse, hvorefter personen får en række symptomer af ophold i nærheden af udstyr, der afgiver elektromagnetisk stråling. Kaldes ofte "el-overfølsomhed".

9 Disse grænseværdier omtales nærmere i pkt. 2.1 nedenfor.

human health. We suggest minimizing the intensity and time of RFR exposures, and taking a precautionary approach towards wireless technologies in everyday human life."

Det amerikansk baserede, forskerdrevne "BioInitiative 2012 - A Rationale for Biologically-based Exposure Standard for Low-Intensity Electromagnetic Radiation" har d. 15. november 2017 offentliggjort en gennemgang af 200 da foreliggende undersøgelser af radiofrekvent elektromagnetisk strålings påvirkning af frie radikaler (*"free radicals"*), som fremkalder såkaldt "oxidativt stress", jf. omtalen af Yakymenko (2015) ovenfor.

Gennemgangen viste, at der i 180 af de 200 undersøgelser (90 %) var konstateret statistisk signifikante effekter, medens der i de sidste 20 (10 %) ikke var reporteret nogen statistisk signifikant effekt.

Martin Pall 2018[10] konstaterede maj 2018, at der på det tidspunkt eksisterede minimum 21 videnskabelige undersøgelser (siden 1971), som dokumenterede DNA-skader ved radiofrekvent elektromagnetisk stråling, og at disse førte til kromosomskader og andre mutationer.

Endvidere konstaterede han, at der var minimum 19 studier (siden 1981), som dokumenterede, at denne stråling fremkaldte frie radikaler og oxidativt stress[11].

REFLEX-studiet (2004) blev gennemført af 12 forskningsinstitutioner på vegne af EU, med et budget på 3 mio. euro. Blandt resultaterne var, at der ved en stråleabsorptionsrate (herefter forkortet "SAR") på 1,3 W/kg (d.v.s. under de af ICNIRP anbefalede grænseværdier på 2,0 W/kg for krop og hovede, jf. pkt. 2.1. nedenfor) skete en betydelig forøgelse af DNA-skader (p. 109):

"RF-EMF exposure at a SAR of 1.0 W/kg and below had no effect on Comet formation in HL-60 cells (expressed as Olive Tail Moment OTM) as compared to control and sham-exposed cells. On the other hand RF-EMF at SAR of 1.3 W/kg and above caused a significant increase in DNA strand breaks. The maximum of this effect was observed at SAR 1.3 W/kg (OTM = 2.20 ± 0.16) and 1.6 W/kg (2.24 ± 0.10)."

Endvidere var denne strålingsstyrke den, som producerede den største effekt på DNA (p. 119, gentaget p. 222):

"...were applied following RF-field exposure of HL-60 cells at that exposure condition with the most significant effect on DNA integrity (1800 MHz, continuous wave, 1.3 W/kg, 24h)."

Ibid., p. 223, afsnit 5.2.1., laboratoriedeltager 2, konklusion 9:

"Within the investigated SAR energy ranges RF-EMF under the in-vitro conditions used are genotoxic in HL-60 cells without affecting cell-cycle distribution cell proliferation or cell progression."

Ibid., konklusion 10:

10 PhD, prof.emeritus i biokemi og Basic Medical Sciences, Martin L. Pall - *"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"*, p. 6 – 8.

11 Ibid., p. 11 – 12.

"The partial-body SAR for any 10-gram tissue like for example the head as exposed region to mobile phone electromagnetic fields should not exceed 2 W/kg according to the Radio-Radiation Protection Guidelines. Notably, our findings on genotoxic effects of RF-fields in HL-60 cells have been shown for SAR levels below these acceptable partial-body SAR levels."

Ibid., p. 223, afsnit 5.2.2., laboratoriedeltager 3:

"Our results imply a genotoxic action of RF-EMFs below proposed radiation safety levels."

Det blev dog tillige samlet set konkluderet (p. 226), at eftersom der "alene" var tale om laboriatorie-forsøg, var REFLEX-studiet ikke i sig selv nok til at konkludere, at de (fortsat) gældende grænseværdier medførte fare for menneskers helbred, men at forsøget gjorde en sådan konklusion mere nærliggende. Endvidere konkluderedes, at:

"Furthermore, there exists no justification anymore to claim, that we are not aware of any pathophysiological mechanisms which could be the basis for the development of functional disturbances and any kind of chronic diseases in animal and man."

Udover REFLEX-studiet har der ifølge i øvrigt tilgængelige oplysninger været udført mere end 40 studier, som viser DNA-skader ved eksponering for radiofrekvent elektromagnetisk stråling[12].

Disse omfatter bl.a.:

Burlaka et al (2013), *"Overproduction of free radical species in embryonal cells exposed to low intensity radiofrequency radiation."*[13], p. 223:

"In conclusion,the exposure of developing quail[14] *embryos in ovo to extremely low intensity RF-EMR of GSM 900MHz during at least one hundred and fifty-eight hours discontinuously leads to the significantly increased rates of superoxide and nitrogen oxide generation in embryo cells. This was accompanied by a significantly increased level of lipid peroxidation,a depression of key antioxidant enzymes activity,and significantly,2–3-fold,increased level of oxidative damage of DNA in embryo cells."*

Blank og Goodman (2011), *"DNA is a fractal antenna in electromagnetic fields."*[15], p. 411:

"Since DNA can interact with EMF over a wide range of frequencies, and does not appear to be limited to an optimal frequency, it has the functional properties of a fractal antenna.
…
From the above analysis of the effect of EMF on the stress response, DNA strand breaks and cancer epidemiology, the fractal property of DNA is apparent in the ELF and RF ranges.
…
Electron transfer is a plausible mechanism for EMF interactions with DNA at higher frequencies

12 Dokumentationsliste vedhæftes responsummet som **bilag 1**.

13 Offentliggjort i det videnskabelige tidsskrift "International Journal of Radiation Biology" vol. 87, no. 4, 2011, pp. 409-15.

14 Det er almindeligt at anvende dyr til at evaluere helbredsrisici for mennesker, og at anvende sådanne undersøgelser som basis for retningslinjer og grænseværdier, jf. f.eks. Engels et al (2014), *"Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird"* (Nature 2014, vol. 509), p. 354:*"...animal studies are commonly used to evaluate human health risks and have contributed to guidelines for human exposures..."* Det foreligger oplyst, at Miljøstyrelsen i skriftligt svar af 20. februar 2019 har oplyst tilsvarende og henvist til European Chemicals Agency med linket https://echa.europa.eu/da/information-on-chemicals/biocidal-active-substances

15 Offentliggjort i det videnskabelige tidsskrift "Experimental Oncology", vol. 35, no. 3, pp. 219 – 225.

where higher energies are involved. The damage due to DNA strand breaks that occur at higher frequencies, including ionising radiation, is generally attributed to oxidation, another chemical name for electron transfer. Because of the greater energy at higher frequencies, reactive oxygen species, such as peroxides, contribute to the DNA damage. However, DNA strand breaks occur over a wide range of frequencies, and do not demonstrate frequency optima related to molecular reaction kinetics." (understreget her)

Det hedder videre om de p.t. anvendte grænseværdier for menneskers eksponering overfor radiofrekvent elektromagnetisk stråling (jf. pkt. 2.1 nedenfor) p. 413:

"...The existing 100 mT ELF exposure limit set by ICNIRP (International Commission for Non-Ionizing Radiation Protection) is many times higher than the 0.4 mT where a doubling of childhood leukemia risk is widely acknowledged. It has also been pointed out that the specific absorption rate (SAR), the widely used thermal standard for EMF safety, does not relate at all to the biological thresholds of the stress response in the ELF and RF ranges, and that the threshold for the same biological process differs by many orders of magnitude in the two ranges (Blank and Goodman 2004)."

Philips et al (2009), *"Electromagnetic fields and DNA damage."*[16], p. 85:

"RFR exposure does indeed appear to affect DNA damage and repair, and the total body of available data contains clues as to conditions producing effects and methodologies to detect them.

…

The lack of a causal or proven mechanism(s) to explain RFR-induced effects on DNA damage and repair does not decrease the credibility of studies in the scientific literature that report effects of RFR exposure, because there are several plausible mechanisms of action that can account for the observed effects. The relationship between cigarette smoking and lung cancer was accepted long before a mechanism was established. ..."

Panagopolous (2019), *"Comparing DNA damage induced by mobile telephony and other types of* man-made electromagnetic fields*"*[17], p. 53 (resumé):

"The number of studies showing adverse effects on living organisms induced by different types of man-made Electromagnetic Fields (EMFs) has increased tremendously. Hundreds of peer reviewed published studies show a variety of effects, the most important being DNA damage which is linked to cancer, neurodegenerative diseases, reproductive declines etc. Those studies that are far more effective in showing effects employ real-life Mobile Telephony (MT) exposures emitted by commercially available mobile phones...." (understreget her)

Undersøgelsen konstaterer videre, at andre egenskaber end udelukkende signalstyrken er væsentlige årsager til skadevirkningerne, jf. ibid.:

"...The crucial parameter for the intense bioactivity seems to be the extreme variability of the polarized MT signals, mainly due to the large unpredictable intensity changes."

Tilsvarende fra konklusionen, ibid. p. 60:

"The importance of exposure variability shown in the present study implies the need to define EMF-exposures not only by frequency components and average intensity values, but by

16 Offentliggjort i det videnskabelige tidsskrift "Pathophysiology" nr. 16 (2009), p. 79–88.

17 Offentliggjort i det videnskabelige tidsskrift *"Mutation Research-Reviews in Mutation Research"* nr. 781, 2019, pp. 53–62.

reporting maximum and minimum intensity as well, frequency variations, pulsing or continuous wave, modulation, and - of course - polarization."

Ibid., p. 59 – 60 (konklusion):

"It comes that variability in the EMF exposure is an extremely important factor in order for the specific type of polarized EMF to be able to induce biological/health effects.
…
The extreme and unpredictable variability of the real-life MT signals that apparently seems to be the reason for the corresponding intense bioactivity, does not concern only the 2nd generation (GSM) MT signals tested in our experiments and in the present review, but all existing types of digital MT signals (2nd, 3rd, 4th generation), and all types of modern digital microwave telecommunication signals/EMFs (DECT phones, Wi-Fi routers, etc.), since they all operate under the same principles combining RF carrier signals with ELF pulsing and modulation of similar frequency bands, emitting variable information each moment which in turn makes the emission variable in intensity, frequency, waveform etc. In fact, with every new generation of telecommunication devices (e.g. 3rd, 4th, 5th generation mobile phones or base antennas) the amount of information transmitted each moment (speech, text, images, video, internet, etc.) is increased, resulting in higher variability and complexity of the signals with the living cells/ organisms even more unable to adapt. The result of the recent study that found a real 3rd generation (UMTS) MT EMF to be more bioactive than real 2nd generation (GSM) MT EMF emitted by the same device [36] is in line with this fact." (understreget her)

Studiet, D'Silva et al (2017)[18], omtalt som reference [36] i ovennævnte undersøgelse rummer følgende beskrivelse af sine resultater og konklusion, jf. det tilhørende resumé:

*"**Results:** In our study, the exposure of developing chick embryos to 2G and 3G cell phone radiations caused structural changes in liver in the form of dilated sinusoidal spaces with haemorrhage, increased vacuolations in cytoplasm, increased nuclear diameter and karyorrhexis and significantly increased DNA damage.*
***Conclusion:** The chronic exposure of chick embryo liver to RFR emitted from 2G and 3G cell phone resulted in various structural changes and DNA damage. The changes were more pronounced in 3G experimental group. Based on these findings it is necessary to create awareness among public about the possible ill effects of RFR exposure from cell phone."*

Om den anvendte metode er bl.a. oplyst følgende, ibid. p. 6:

"A popular brand cell phone hand set and a service provider were used for network connection for both 2G and 3G exposure. For exposure activation, the cell phone was rung from another cell phone for duration of three minutes each, every half an hour, with the first exposure given at 12th hour of incubation (4.30 am-4.30 pm). The total exposure for a 12 hour period was 75 minutes followed by 12 hour of exposure-free period. This was repeated daily up to 12th day of incubation."

Studiet refererede endvidere, at:

"Non-thermal stress is more deleterious than thermal stress and is known to cause oxidative stress [5], production of free radicals [6], structural changes in plasma membrane [7], changes in ionic transport [8] and also increased DNA damage [9]."

1.2.2.1.1. Delkonklusion.

Der foreligger klar videnskabelig dokumentation for, at radiofrekvent elektromagnetisk stråling, også under de i Danmark anvendte grænseværdier, jf. pkt. 2.1 nedenfor, forårsager DNA-skader på både mennesker og dyr.

18 Offentliggjort i det videnskabelige tidsskrift *"Journal of Clinical and Diagnostic Research"*, 2017 Jul, Vol-11(7), p. 5 – 9.

Panagopolous (2019) dokumenterer, at det ikke alene er strålestyrken, der har betydning for den forventelige skadevirkning. Derudover dokumenteres, at fundene p.g.a. teknologifællesskabet mellem generationerne også vil være gældende for 5G.

1.2.2.2. Kræft.

1.2.2.2.1. Klassificering.

IARC (International Agency for Research on Cancer) er WHOs agentur for kræftforskning.

Agenturet har i 2011 klassificeret elektromagnetisk stråling som "muligvis kræftfremkaldende for mennesker".[19]

En senere videnskabelig undersøgelse offentliggjort november 2018 konkluderede, at der i henhold til IARCs kriterier er grundlag for at klassificere elektromagnetisk stråling som "kræftfremkaldende for mennesker"[20], hvilken var begrundet således, med henvisning til gennemgang af en række undersøgelser foretaget forud herfor:

Miller et al november 2018[21], p. 674:

"...Analysis of a subset of cases (58% of all cases) based on operator-recorded information showed significant brain cancer risks for children with a significant trend of increase in risk with increasing years of use. Based on children's memory of both ipsilateral and contralateral use there were significant increased risk of brain cancer along with a marginal increase of risk with an increasing number of calls..."

Ibid., p. 675:

"Carlberg and Hardell (2013) also reported that persons diagnosed with a glioblastoma multiforme (GBM) exposed to RFR[22] emanating from WTDs[23] had a significantly shorter survival period than those without such exposures."

Ibid., p. 676:

"Coureau et al. (2014) reported on a French national study of mobile phone use and brain tumors (glioma and meningioma) between 2004 and 2006.
…
There was a marginal increase in risk with increasing hours of use (p_{trend}=0.07). A small number of urban users showed a significant 8-fold increased risk for brain tumors excluding temporal or frontal lobes (OR[24] 8.2. 1.37–49.07). The authors commented: 'Finally, we observed increased OR for urban use for gliomas, a result inconsistent with the hypothesis of a higher RF power output during calls in rural areas, documented by some Swedish study. However, our results are consistent with a recent international study showing no difference between rural and urban exposition in most countries except in Sweden, and a Hardell study when considering gliomas separately.'"

Ibid., p. 676:

"Momoli et al. (2017) undertook a re-analysis of the Canadian data from the 13-country case-

19 Jf. IARC monograph vol. 102 (2013), p. 419, pkt. 6.3.
20 En såkaldt "klasse 1-klassifikation" i IARCs system.
21 Offentliggjort i det videnskabelige tidsskrift "Environmental Research", 2018 nr. 167, p. 673 – 683.
22 Radiofrequency radiation, jf. ibid. p. 673.
23 Wireless Transmitter Devices, jf. ibid. p. 673.
24 Odds ratio, jf. ibid. p. 674.

control Interphone Study (2001–2004).
…
For glioma, when comparing those in the highest quartile of use (> 558 lifetime hours) to those who were not regular users, the odds ratio was 2.0 (95% confidence interval: 1.2, 3.4). After adjustment for selection and recall biases, the odds ratio was 2.2 (95% limits: 1.3, 4.1), thus allaying concerns that bias could explain the positive findings in the Interphone study."

Ibid., p. 676:

"Akhavan-Sigari et al. (2014) reported that patients with glioblastoma multiforme who had used cellphones≤3 h per day had better survival than those with cellphone use of ≥3 h per day.
…
This study shows that genetic changes, compatible with carcinogenic effects, result from higher exposure to RFR."[25]

Ibid., p. 676:

"Carlberg and Hardell (2015) performed a pooled analysis from 1997 to 2003 and 2007–2009 of the risk of meningioma from cell and cordless phone use. In total, 1625 meningioma cases and 3530 controls were analyzed. Overall no association with use of mobile or cordless phones was found. However, they reported an increased risk among heavy users of both mobile and cordless phones from various wireless phone types (wireless combines all phone types) (Table 11). The risk increased significantly per 100 h of use from four wireless phones categories."

Ibid., p. 677:

"Hardell et al. (2013a) pooled acoustic neuroma results from casecontrol studies conducted in 1997–2003 and 2007–2009, including 316 participating cases and 3530 controls. ... There is some evidence of a dose-response relationship is evident with mobile and cordless phones associated with ORs of 4.5 and 6.5 respectively for 20 or more years of use. There were similar results per cumulative hours of use (Table 12)."

Ibid., p. 677:

"Moon et al. (2014), in a matched case-control study from Korea examining 119 cases of vestibular schwannoma and 238 controls attending for routine examinations in the same institution found no difference between cases and controls in the duration, time of use or cumulative use of mobile phones. However, in a case-case analysis they found that vestibular Schwannoma tumor volume was greater in those with higher use compared to lower use of mobile phones and in those with regular compared to non-regular use (Table 13)."

Ibid., p. 678:

"Zada et al. (2012) examined data from three major U.S. cancer registries: Los Angeles County, California Cancer Registry, and the National Cancer Institute's Surveillance, Epidemiology and End Result for 12 U.S. states (SEER 12) from 1992. The APC for GBM (grade IV glioma) and Glioma was reported by brain region. Table 17 shows APC changes by cancer registry for GBM and for glioma located in three anatomical regions of the brain, showing significant increases compatible with increasing use of mobile phones.
Consistent with the study above, Cardis et al. (2011) reported that the combined percentage of the total radiation absorbed by the frontal lobe (19%), the temporal lobe (50%) and the cerebellum (18%) was 81% at 900 MHz and was 86% at 1800 MHz (frontal lobe 14%, temporal lobe 50%, cerebellum 13%)."

25 Patienterne i studiet (63 voksne, heraf 38 M 25 K) blev opereret for kræftsvulster år 2008 – 2011, jf. Akhavan-Sigari et al 2014, p. 117.

Ibid., p. 679:

"7. Case series

West et al. (2013) reported multiple[26] primary breast cancers in young women who had regularly placed a cellphone in their bras (Table 20). Tumors were reported to have occurred subcutaneously directly under the antennas of the phones. Subsequently, a number of other such cases have come to light with unusually located breast tumors relative to reported cell phone storage in the bra.
Peleg (2012) discussed a cancer cluster among young workers at an Israeli Antenna Range Facility. It was believed that significant RFR exposures took place as a result of workplace conditions. Five of about 30 workers were diagnosed with cancer. This was regarded as significantly greater than the expectation. Peleg et al. (2018) extended this analysis to 47 patients with cancer previously exposed to whole-body prolonged RFR, mainly from communication equipment and radar. They found that the percentage frequency of haemo-lymphatic (HL) cancers in the case series was very high, at 40% with only 23% expected for the series age and gender profile, 95% confidence interval: 26–56%, p < 0.01; 19 out of the 47 patients had HL cancers.
Stein et al. (2011) studied 56 cancers among 49 military personnel (47 male, 7 females) exposed to intense prolonged RFR between 1992 and 2011. Based on exposure information reconstructed from reported histories, it was assumed that significant RFR exposures took place as a result of workplace conditions. The average duration of exposure was 13 years; the average age at diagnoses was 43. There appeared to be an excess of both haemolymphatic and testicular cancers."

Ibid., p. 680 (diskussion af resultater):

"Nevertheless[27], recent case-control studies from Sweden and France corroborate findings of earlier studies in providing support for making a causal connection between cell phone use and brain cancer, as well as acoustic neuroma, also called Vestibular Schwannoma. Hardell and Carlberg (2013) concluded that the Bradford Hill criteria for causality have now been fulfilled. It is notable that three recent meta-analyses all confirm significant increased risk of glioma after 10 or more years of use of cell phones (Bortkiewicz et al., 2017; Prasad et al., 2017; Yang et al., 2017). The Aydin et al. (2011) data that relied on billing records along with children's recall of their uses of phones approaches and in some instances met conventional tests of statistical significance and indicated that four years or more of heavy cell phone radiation causes glioma in children. This finding is consistent with that of Hardell and Carlberg (2015) who showed that those who began using cell phones and/or cordless phones regularly as children had between 4 and 8-fold increased risk of glioma as adults."

Ibid., p. 680 (diskussion af resultater):

"Potential cancer sites and other outcomes for consideration in new studies include... Other sites than brain and acoustic neuroma could potentially increase in incidence when untested whole-body exposure occurs, this may be the case with several evolving technologies....other possible sources of exposures that have not been evaluated include areas close to cellular base station antennas, the yet-to-be introduced 5 G communication systems, and rapidly evolving occupational exposure and novel systems for Wi-Fi (Peleg, 2009)."

Ibid., p. 681 (diskussion af resultater):

"There are indications particularly from the Ramazzini animal studies that other environmental exposures might make people more susceptible to a combination of exposures (Falcioni et al., 2018). This combinatorial issue been noted in studies of occupational exposure to chemicals,

26 Der var tale om 4 patienter i aldrene 21, 21, 33 og 39, jf. ibid. tabel 20.

27 Citatet er i artiklen efterstillet en gennemgang af sædvanlige forbehold i forbindelse med anvendelse af de forskellige, gængse forskningsmetoder, som ligeledes har været anvendt i de i artiklen omhandlede studier.

metals and electromagnetic fields (Navas-Acien et al., 2002). Separately, no effects were observed but when combined with EMF strong results were found. In the Ramazzini studies finding a synergistic interaction between RFR and ionizing radiation, RFR served as a promoter while in the NTP animal studies RFR served as a direct carcinogen and genotoxic agent (National Toxicology Program, a, b, 2018.).”

Ibid., p. 681 (diskussion af resultater):

”Individual hypersensitivity to electric and radiofrequency fields (EHS) is a relatively newly reported phenomenon in the west, although cases of radiation sickness have been found in the former Soviet literature from the 1960s and 1970s. Case studies and individual reports together identify a population which would benefit from RFR exposure reduction (Davis et al., 2017). Because of serious methodological difficulties in operationalizing the concept and a lack of investment in research, definitive epidemiological studies of EHS have not yet been conducted.”

Ibid., p. 681 (diskussion af resultater):

”However, non-cancer outcomes such as sperm damage, hearing loss and loss of visual acuity are likely to be more commonly linked to mobile phone use.”

Ibid., p. 681 (konklusioner):

”The Epidemiological studies reported since the 2011 IARC Working Group meeting are adequate to consider RFR as a probable human carcinogen (Group 2 A). However, they must be supplemented with the recently reported animal data as performed at the Ramazzini Institute and the US National Toxicology Program as well as by mechanistic studies. <u>These experimental findings together with the epidemiology reviewed here are sufficient in our opinion, to upgrade the IARC categorization of RFR to Group 1, carcinogenic to humans.</u>
…
In light of the evolving science concerning mobile phone and screen time exposures and the longer-term risk of cancer established by both epidemiological and toxicological studies, current evidence is strong enough to go from precaution concerning possible risk to prevention of known risks.
…
The precautionary principle should be applied now and suitable warning messages provided to adults and critically to children and their parents.
…
experimental evaluations and modeling are essential before distributing newer systems (e.g. 5 G) for which no safety data have been obtained. The absence of systematic testing of such technologies should not be confused with proof of safety.
…
In the meantime, the evidence amassed thus far from epidemiology strengthens the case for instituting the precautionary principle with respect to exposures to RFR, especially to young children and men and women that wish to reproduce. … Where studies have been carried out on human sperm quantity and quality there are increasing indications of serious human health impacts. To ignore those findings and subject humans to unevaluated novel RFR frequencies places current and future generations at risk.” (understreget her)

<u>1.2.2.1.2. Øvrigt.</u>

En lang række øvrige videnskabelige studier bekræfter, at udsættelse for radiofrekvent elektromagnetisk stråling (også under de p.t. i Danmark anvendte grænseværdier, jf. pkt. 2.1 nedenfor) kan være kræftfremkaldende. En række af dem er:

Blank og Goodman (2011), *"DNA is a fractal antenna in electromagnetic fields."*[28], p. 411:

"Regarding the connection between EMF and the incidence of cancer, the different EMF energy levels in the non-ionising and ionising ranges all involve interaction with and activation of DNA and induction of protein synthesis. The ability of EMF to cause DNA strand breaks and damage to proteins in the non-ionising range is similar to the destructive effects on DNA of the much more energetic X-rays and gamma rays in the ionising ranges, where it is generally acknowledged that the cancers are due to DNA damage. The recent epidemiology studies in the non-ionising range link EMF-caused changes in DNA with cancer. Additional support comes from the study showing that the absence of DNA repair genes is associated with a greater incidence of leukemia from exposure to low frequency EMF (Yang et al. 2008)." (understreget her)

Lerchl et al (2015), *"Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans"*, p. 585 (resumé):

"...Since many of the tumor-promoting effects in our study were seen at low to moderate exposure levels (0.04 and 0.4 W/kg SAR), thus well below exposure limits for the users of mobile phones, further studies are warranted to investigate the underlying mechanisms. Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones."

Yakymenko et al 2015, jf. pkt. 1.2.1. ovenfor, viste bl.a., at lav-intensitets RFR kunne medføre kræft (p. 196).

Prasad et al (2017), *"Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes."*[29], p. 808 (konklusion):

"In our review of the literature and meta-analysis of case–control studies, we found evidence linking mobile phone use and risk of brain tumours especially in long-term users (>10 years). We also found a significantly positive correlation between study quality and outcome in the form of risk of brain tumour associated with use of mobile phones. Higher quality studies show a statistically significant association between mobile phone use and risk of brain tumour. Even the source of funding was found to affect the quality of results produced by the studies."

Der er tale om et systematisk, videnskabeligt review af den foreliggende forskning, som altså fandt klar basis for at kæde brugen af mobiltelefoner sammen med kræftsvulster i hjernen.

Endvidere fandt det pågældende review, at de studier, der havde den bedste videnskabelige kvalitet, var de samme, som dem, der fandt den pågældende sammenhæng, og at finansieringskilden også havde spillet en rolle i studiernes kvalitet.

Det amerikanske National Institute of Health udgav november 2018 rapporten *"TOXICOLOGY AND CARCINOGENESIS STUDIES IN Hsd:SPRAGUE DAWLEY SD RATS EXPOSED TO WHOLE-BODY RADIO FREQUENCY RADIATION AT A FREQUENCY (900 MHz) AND MODULATIONS (GSM AND CDMA) USED BY CELL PHONES"*, hvoraf fremgår p. 125 - 126 (konklusioner):

28 Offentliggjort i det videnskabelige tidsskrift "Experimental Oncology", vol. 35, no. 3, pp. 219 – 225.
29 Offentliggjort i det videnskabelige tidsskrift "Neurological Sciences", 2017, vol. 38, pp. 797 – 810.

*"**GSM-Modulated RFR***
Under the conditions of this 2-year whole-body exposure study, there was clear evidence of carcinogenic activity[30] of GSM-modulated cell phone RFR at 900 MHz in male Hsd:Sprague Dawley SD rats based on the incidences of malignant schwannoma of the heart. The incidences of malignant glioma of the brain and benign, malignant, or complex pheochromocytoma (combined) of the adrenal medulla were also related to RFR exposure. The incidences of benign or malignant granular cell tumors of the brain, adenoma or carcinoma (combined) of the prostate gland, adenoma of the pars distalis of the pituitary gland, and pancreatic islet cell adenoma or carcinoma (com-bined) may have been related to RFR exposure. There was equivocal evidence of carcinogenic activity of GSM-modulated cell phone RFR at 900 MHz in female Hsd:Sprague Dawley SD rats based on the incidences of schwannomas of the heart.*
…
CDMA-Modulated RFR
Under the conditions of this 2-year whole-body exposure study, there was clear evidence of carcinogenic activity of CDMA-modulated cell phone RFR at 900 MHz in male Hsd:Sprague Dawley SD rats based on the incidences of malignant schwannoma of the heart. The incidences of malignant glioma of the brain were also related to RFR exposure. The incidences of adenoma of the pars distalis of the pituitary gland and adenoma or carcinoma (combined) of the liver may have been related to RFR exposure. There was equivocal evidence of carcinogenic activity of CDMA-modulated cell phone RFR at 900 MHz in female Hsd:Sprague Dawley SD rats based on the incidences of malignant schwannoma of the heart, malignant glioma of the brain, and benign, malignant, or complex pheochromocytoma (combined) of the adrenal medulla. Increases in nonneoplastic lesions of the heart, brain, and prostate gland in male rats, and of the brain in female rats occurred with exposures to CDMA-modulated RFR at 900 Mhz." (understreget her)

Om den umiddelbare overførlighed af disse resultater på mennesker hedder det, ibid. p. 125:

"The malignant schwannomas of the heart observed in male rats in the current studies and the malignant gliomas observed in the brain of male rats, arise from the same cell type as the acoustic neuromas (vestibular schwannomas) observed in humans, though in a different location. This lends credence to the possible association of these tumors with cellular phone use. The cellular origin of malignant gliomas in the rat brain is unclear, but they do arise from glial cells (support cells in the brain), as do human glioblastomas, so it is possible that such an association exists for these tumors as well. However, the interpretation of these findings with respect to specific risks to humans from cellular telephone use is beyond the scope of the current studies. Further efforts to characterize the molecular basis by which RFR elicits its effects in rats, and a more complete assessment of the exposure conditions in the current studies in relation to exposures to humans from cellular telephone technologies should provide con-text to aid understanding of the implications of the current findings to human health." (understreget her)

Falcioni et al. (2018), *"Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission"*[31], p. 496 (resumé):

30 Asterisken refererer til undersøgelsens p. 16, hvor de forskellige bevisstandarder er nærmere defineret. "Clear evidence" er defineret som: *"...studies that are interpreted as showing a dose-related (i) increase of malignant neoplasms, (ii) increase of a combination of malignant and benign neoplasms, or (iii) marked increase of benign neoplasms if there is an indication from this or other studies of the ability of such tumors to progress to malignancy."*

31 Offentliggjort i det videnskabelige tidsskrift "Environmental Research", 2018, vol. 165, pp. 496 – 503.

"The RI[32] findings on far field exposure[33] to RFR are consistent with and reinforce the results of the NTP study[34] on near field exposure, as both reported an increase in the incidence of tumors of the brain and heart in RFR-exposed Sprague-Dawley rats. These tumors are of the same histotype of those observed in some epidemiological studies on cell phone users. These experimental studies provide sufficient evidence to call for the reevaluation of IARC conclusions regarding the carcinogenic potential of RFR in humans." (understreget her)

Uddybende er konstateret, jf. ibid. p. 501:

"...The statistically significant increase in the incidence of heart Schwannomas observed in male rats in the late part of their life, both in the RI and NTP studies, are consistent with the epidemiological findings, where the highest increase in risk of vestibular Schwannoma among humans exposed to RFR was observed in men over 50 years of age with the highest cumulative exposure (Hardell et al., 2013, 2003)."

Forsøget blev gennemført således, at de eksponerede dyr blev udsat for en stråleabsorption på estimeret 0,001 til 0,3 W/kg (jf. p. 499), hvilket er betydeligt lavere end den anvendte grænseværdi i Danmark, på 2 W/kg, jf. pkt. 2.1 nedenfor.

De statistisk signifikante resultater fremkom i den gruppe af rotter, som var blevet udsat for en feltstyrke på 50 V/m. Dette er under grænseværdien på 58,34 V/m, som anvendes i Danmark for en frekvens på 1,8 GHz, jf. pkt. 2.1 nedenfor.

Martin Pall 2018[35] konstaterede maj 2018, at der på det tidspunkt eksisterede minimum 35 videnskabelige undersøgelser (siden 1978), som dokumenterede, at radiofrekvent elektromagnetisk stråling var kræftfremkaldende.

Panagopolous (2019), jf. pkt. 1.2.1. ovenfor, henviste ligeledes til "hundreder af peer reviewed-artikler", som viste en række effekter fra elektromagnetiske felter, inkl. kræft (p. 53).

Sundhedsministeren har i sin besvarelse af 12. april 2019 af spørgsmål 693 i Folketingets Sundheds- og Ældreudvalg fremlagt en opgørelse fra Sundhedsdatastyrelsens cancerregister, som viser en klar stigning i registrerede tilfælde af kræft i form af glioblastom indenfor de sidste 20 år.

Stigningen er særligt markant fra 2005 til 2006 i aldersgruppen >30 år, og viser gennemsnitligt set en fordobling af tilfældene i denne aldersgruppe i perioden 2006 til 2017, set i forhold til den forudgående periode 1995 til 2006.

Samlet ses en stigning på 80 % i forekomsten i de senere år 2015 – 2017, sammenlignet med det generelle niveau før 2006.

32 RI står for "Ramazzini Institute", som var det forskningsinstitut, hvor undersøgelsen blev foretaget.

33 Far field exposure indebærer i dette tilfælde, at undersøgelsen genskabte forholdene for bestråling med en 1.8 GHz mobilmast, jf. ibid. p. 497, pkt. 2.1.

34 "NTP-studiet" er det umiddelbart ovenfor omtalte fra det amerikanske National Health Institute.

35 PhD, prof.emeritus i biokemi og Basic Medical Sciences, Martin L. Pall - *"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"*, p. 15 – 16.

Tabel 1 Antal incidente tilfælde af Glioblastom, 1995-2017

Kilden : Cancerregisteret			
Udtrækskriterier :			
Der er trukket på :			
Glioblastom ICD03-morfologi = 94403			
og Giant cell glioblastom ICD03-morfologi =			
	Antal		
aar	**<= 30 år**	**>30 år**	**I alt**
1995	9	143	152
1996	11	133	144
1997	<5	176	
1998	8	200	208
1999	8	169	177
2000	<5	173	
2001	6	156	162
2002	9	163	172
2003	<5	185	
2004	7	174	181
2005	<5	174	
2006	<5	221	
2007	<5	196	
2008	6	237	243
2009	<5	252	
2010	<5	271	
2011	<5	253	
2012	9	250	259
2013	7	280	287
2014	<5	292	
2015	10	311	321
2016	7	300	307
2017	<5	288	

Kilde: Cancerregisteret, 2019

Anm.: Tal under fem er angivet med < 5 af hensyn til diskretionering og summen for i alt er i disse tilfælde fjernet

Anm.: Opdelt i kolloner mindre eller lige end 30 år, større end 30 år og i alt

Den samme fordoblingstendens er dokumenteret i England, jf. Philips et al (2018), *"Brain Tumours: Rise in Glioblastoma Multiforme Incidence in England 1995–2015 Suggests an Adverse Environmental or Lifestyle Factor"*[36], hvoraf fremgår følgende (p. 1, resumé):

*"*Results. *We report a sustained and highly statistically significant ASR*[37] *rise in glioblastomamultiforme (GBM) across all ages.The ASR for GBM more than doubled from 2.4 to 5.0, with annual case numbers rising from 983 to 2531. Overall, this rise is mostly hidden in the overall data by a reduced incidence of lower-grade tumours.* Conclusions. *The rise is of importance for clinical resources and brain tumour aetiology. The rise cannot be fully accounted for by promotion of lower–grade tumours, random chance or improvement in diagnostic techniques as it affects specific areas of the brain and only one type of brain tumour. Despite the large variation in case numbers by age, the percentage rise is similar across the age groups, which suggests widespread environmental or lifestyle factors may be responsible."* (understreget her)

I Holland er dokumenteret en stigning på 20 % over en 21-årig periode, fra 1989 til 2010, jf. Vincent et al (2014), *"Changing incidence and improved survival of gliomas"*[38], p. 2311:

"The incidence rate of glioma increased from 4.9 per 100,000 inhabitants in 1989 to 5.9 in 2010..."

36 Offentliggjort i det videnskabelige tidsskrift "Journal of Environmental and Public Health" 2018, art.ID 7910754.
37 Forkortelse for "Age Standardised Rate".
38 Offentliggjort i det videnskabelige tidsskrift "European Journal of Cancer", 2014, vol. 50, pp. 2309 – 2318.

1.2.2.1.3. Andre helbredsskader på mennesker.

Neufeld og Kuster (2018) har i artiklen *"SYSTEMATIC DERIVATION OF SAFETY LIMITS FOR TIME-VARYING 5G RADIOFREQUENCY EXPOSURE BASED ON ANALYTICAL MODELS AND THERMAL DOSE"* konstateret, at selv ved korte eksponeringer overfor stråling svarende til den planlagte 5G-stråling med højere frekvenser og/eller ændret modulation, m.v., jf. pkt. 1.1. ovenfor, vil der kunne ske vævsskader på mennesker, jf. p. 705, 706 og 711:

"Extreme broadband wireless devices operating above 10 GHz may transmit data in bursts of a few milliseconds to seconds. …these bursts may lead to short temperature spikes in the skin of exposed people. … To stay consistent with the current safety guidelines, safety factors of 10 for occupational exposure and 50 for the general public were applied. … The results also show that the peak-to-average ratio of 1,000 tolerated by the International Council on Non-Ionizing Radiation Protection guidelines may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines.
…
THE FIFTH generation of wireless communication technology (5G) promises to facilitate transmission at data rates up to a factor of 100 times higher than 4G. For that purpose, higher frequencies (including millimeter-wave bands), broadband modulation schemes, and thus faster signals with steeper rise and fall times will be employed, potentially in combination with pulsed operation for time domain multiple access. 5G is designed as a ubiquitous communication system spanning applications such as high-bandwidth mobile data and telephony, real-time machine-to-machine communication (e.g., autonomous mobility), and the Internet of Things (IoT). Exposure to radiofrequency (RF) radiation from wireless devices to large radar installations and medical equipment can result in increases in body core temperature or cause localized temperature rises, with the potential for adverse health effects. The thresholds for frequencies above 10 MHz set in current exposure guidelines (ICNIRP 1998; IEEE 2005, 2010) are intended to limit tissue heating.
…
However, short pulses can lead to important temperature oscillations, which may be further exacerbated at high frequencies (>10 GHz, fundamental to 5G), where the shallow penetration depth leads to intense surface heating and a steep, rapid rise in temperature...
…
The recommendations in the ICNIRP guidelines limit the power density during short pulses to 1,000 times the limit for the time-averaged incident power density. The IEEE standard limits the radiant exposure (energy absorption per unit area) during any 100 ms to one-fifth of the total radiant exposure for the whole averaging time. The physical or biological rationales for these limits, however, are not provided.
…
Laakso et al. (2017) … The authors conclude that the current guidelines do not adequately prevent excessive heating from pulsed exposure, as peak temperatures can easily exceed the mean temperature by more than a factor of 3 and suggest that radiant exposure limits be introduced.
Morimoto et al. (2017) … They conclude that the thermal time constants can be as short as 30 s for narrow-beam exposures and that short pulses can carry enough energy to cause injuries;
…
Another conclusion of this study is that the current ICNIRP (1998) and IEEE (2005, 2010) guidelines urgently need to be revised, as the duty cycle of 1,000 currently tolerated can produce unacceptable temperature increases that may result in permanent tissue damage. ..."
(understreget her)

Cindy Russell (2018), *"5 G wireless telecommunications expansion: Public health and environmental implications"*, p. 485:

"There are no long term exposure guidelines, nor are there guidelines for low level, non-thermal or biological effects considered in the International Commission on Non-Ionizing

Radiation Protection (ICNIRP) standards which are the basis for standards used worldwide..."

Videre ibid., p. 491:

"Although 5G technology may have many unimagined uses and benefits, it is also increasingly clear that significant negative consequences to human health and ecosystems could occur if it is widely adopted. Current radiofrequncy radiation wavelengths we are exposed to appear to act as a toxin to biological systems. A moratorium on the deployment of 5G is warranted, along with development of independent health and environmental advisory boards that include independent scientists who research biological effects and exposure levels of radiofrequency radiation.
…
Public health regulations need to be updated to match appropriate independent science with the adoption of biologically based exposure standards prior to further deployment of 4G or 5G technology."

Martin Pall 2018[39] konstaterede maj 2018, at der kunne påvises følgende yderligere skadevirkninger ved radiofrekvent elektromagnetisk stråling på mennesker:

- nedsat fertilitet og kønsdrift, øgede spontane aborter, m.v. (18 studier siden 1971),
- neurologiske/neorupsykiatriske effekter (25 studier siden 1966),
- apoptose/celledød (13 studier siden 1971),
- hormonelle effekter (12 studier siden 1971), og
- forøget niveau af calcium ioner intracellulært, hvilket forårsager en række sygdomme (15 studier siden 1988).

Pall anførte, ibid. p. 1 – 2:

"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 milion 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.
…
Obviously 4G and 5G will make the situation much worse." (understreget her)

1.2.2.1.4. Særligt vedr. børn og kræft eller andre helbredsskader.

Der findes en række undersøgelser, hvoraf visse tillige er omtalt ovenfor, som specifikt omtaler skadevirkninger og risici for kræft eller andre helbredsskader for børn, hvoraf fremhæves:

Divan et al (2012), *"Cell phone use and behavioural problems in young children"*[40], p. 524 (resumé):

39 PhD, prof.emeritus i biokemi og Basic Medical Sciences, Martin L. Pall - *"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"*, p. 8 - 15.

40 Offentliggjort i det videnskabelige tidsskrift "Journal of Epidemiology and Community Health", 2012, vol. 66, nr. 6, pp. 524 – 529.

"The findings of the previous publication were replicated in this separate group of participants demonstrating that cell phone use was associated with behavioural problems at age 7 years in children, and this association was not limited to early users of the technology. Although weaker in the new dataset, even with further control for an extended set of potential confounders, the associations remained."

Denne undersøgelse, som var en gentagelse af en tidligere undersøgelse foretaget af samme forskere, bekræftede, at der var en sammenhæng imellem adfærdsproblemer hos børn i 7-årsalderen og brug af mobiltelefoner hos moderen før fødslen samt børnenes egen brug efter fødslen, uden at det på baggrund af undersøgelsen med sikkerhed kunne lægges til grund, at der var en årsagsforbindelse, jf. p. 529. Undersøgelsen bekræftede således en mulig risiko.

Birks et al (2017), *"Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts"*[41], p. 1 (resumé, manuskriptudgave):

"Overall, 38.8% of mothers, mostly from the Danish cohort, reported no cell phone use during pregnancy and these mothers were less likely to have a child with overall behavioral, hyperactivity/inattention or emotional problems. Evidence for a trend of increasing risk of child behavioral problems through the maternal cell phone use categories was observed for hyperactivity/inattention problems (OR for problems in the clinical range: 1.11, 95%CI 1.01, 1.22; 1.28, 95%CI 1.12, 1.48, among children of medium and high users, respectively). This association was fairly consistent across cohorts and between cohorts with retrospectively and prospectively collected cell phone use data." (understreget her)

Ibid., p. 13 (konklusion, manuskriptudgave):

"Maternal cell phone use during pregnancy may be associated with an increased risk of behavioral problems, particularly hyperactivity/inattention problems, in the offspring. This is the largest study to date to evaluate these associations and to show mostly consistent results across cohorts with retrospectively and prospectively assessed maternal cell phone use. Still, the interpretation of these results is unclear and should take into consideration that uncontrolled confounding by social factors or maternal hyperactivity may influence both maternal cell phone use and child behavioral problems."

Der er således tale om et forbeholdende, men konsistent, resultat, som bekræfter, at der kan være en øget risiko for helbredsproblemer for børn ved mødres brug af mobiltelefon under graviditeten.

Sudan et al (2018), *"Maternal cell phone use during pregnancy and child cognition at age 5 years in 3 birth cohorts"*[42], p. 155 (resumé):

"We observed patterns of lower mean cognition scores among children in relation to high frequency maternal prenatal cell phone use. The causal nature and mechanism of this relationship remain unknown."

Der foreligger en række relaterede forsøg på dyrefostre, bl.a.:

41 Offentliggjort i det videnskabelige tidsskrift "Environment International", 2017, vol. 104, pp. 122 – 131.
42 Offentliggjort i det videnskabelige tidsskrift "Environment International", 2018, vol. 120, pp. 155 – 162.

Jing et al (2012), *"The influence of microwave radiation from cellular phone on fetal rat brain"*, p. 64:

"In order to protect human's health from the microwave damage, the relevant radiation limits have been given by many countries. The current limited guidelines for microwave from cellular phone in U.S. and Europe are 1.6 W/kg and 2.0 W/kg, respectively. New lower limits should also be used for children and/or pregnant women.
Due to the proximity of cellular phone antenna to the user's ear and head, the brain is inevitably exposed to EMFs with a relatively high specific absorption ratio (SAR), so the potentially danger from EMFs has been a concern of more and more people, especially by pregnant women.

…

As a whole, the results obtained in the present study indicate that exposure to EMFs of cellular phone (SAR 0.9 W/kg) could induce modifications in the fetal rat brain, not only oxidative stress system but also neurotransmitters. Because of the widespread use of cellular phones, further investigations with complementary techniques will be necessary to understand the mechanism of relation between EMFs of cellular phone and physiological implications."

Det bemærkes, at stråleabsorptionsraten ligger under den p.t. anvendte grænseværdi i Danmark, på 2 W/kg, jf. pkt. 2.1 nedenfor.

Megha et al (2015), *"Low intensity microwave radiation induced oxidative stress, inflammatory response and DNA damage in rat brain"*[43], p. 164 (konklusion):

"In conclusion, prolonged exposure to low intensity microwave radiation at frequencies 900, 1800 and 2450 MHz leads to oxidative stress and inflammatory imbalances which subsequently leads to DNA damage in brain. These findings suggest that microwave radiation induced oxidative stress and inflammatory imbalances may be the causative factors involved in causing DNA strand breaks in brain cells."

Aldad et al (2012), *"Fetal Radiofrequency Radiation Exposure From 800-1900 Mhz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice"*[44], p. 2 og 6:

"Overall, the mice exposed in-utero to radiation were hyperactive, had decreased memory, and decreased anxiety.
…
Our findings indicated significant electrophysiological and behavioral changes in mice exposed in-utero to radiation. The significant trend between the groups treated for 0, 9, 15, and 24 hours/day demonstrates that the effects are directly proportional to usage time, and suggests that safety limits, particularly for pregnant women, can be established. Though it is difficult to translate these findings to human risks and vulnerability, we identify a novel potential contribution to the increased prevalence in hyperactive children, one that is easily prevented. However, it is important to note that hyperactivity and anxiety are closely related and may confound one another.
...
In summary, we demonstrate that fetal radiofrequency radiation exposure led to neurobehavioral disorders in mice. We anticipate these findings will improve our understanding of the etiology of neurobehavioral disorders. The rise in behavioral disorders in developed countries may be, at least in part, due to a contribution from fetal cellular telephone radiation exposure. Further testing is warranted in humans and non-human primates to determine if the risks are similar and to establish safe exposure limits during pregnancy."

43 Offentliggjort i det videnskabelige tidsskrift "NeuroToxicology" 2015, vol. 51, pp. 158 – 165.
44 Offentliggjort i det videnskabelige tidsskrift "Nature Scientific Reports" 2, art.no. 312, 2012. Der er i 2013 udstedt en korrektion til artiklen, som ikke ændrer konklusionerne, der har art.nr. 1320.

Buchner og Eger (2011), *"Changes of Clinically Important Neurotransmitters under the Influence of Modulated RF Fields—A Long-term Study under Real-life Conditions"*[45], p. 1 (oversat fra tysk):

"Since the 1960s, occupational studies on workers with continuous microwave radiation exposures (radar, manufacturing, communications) in the Soviet Union have shown that RF radiation exposures below current limits represent a considerable risk potential. A comprehensive overview is given in the review of 878 scientific studies by Prof. Hecht, which he conducted on behalf of the German Federal Institute of Telecommunications (contract no. 4231/630402) (2, 3).
As early as the 1980s, US research projects also demonstrated in long-term studies that rats raised under sterile conditions and exposed to "low-level" RF radiation showed signs of stress by increased incidences of endocrine tumors..."

Endvidere p. 9 (summary of results):

"...dopamine levels decrease substantially after the exposure begins. Even after one and a half years, the initial levels are not restored. Six months after the activation of the transmitter, PEA levels decrease continuously over the entire exposure period. Only in the exposure group above 100 µW/m2 is this effect observed immediately. All findings were observed well below current exposure limits (14)." [46]

Tillige p. 12 (epidemiological evidence):

"As part of the German Mobile Telecommunication Research Programme, approximately 3000 children and adolescents were studied in Bavaria for their individual cell phone radiation exposure levels in relation to health problems. Among the various data sets, the data set regarding behavioral problems showed a significant increased risk for both adolescents (OR: 3.7, 95%-CI: 1.6-8.4) and also children (OR: 2.9, 95%-CI: 1.4-5.9) in the highest exposure group (56). For the first time, the "Rimbach Study" provides a model of explanation in biochemical terms. "

Sudan et al (2012), *"Prenatal and Postnatal Cell Phone Exposures and Headaches in Children."* [47], p. 1 (resumé, manuskriptudgave):

"In this study, cell phone exposures were associated with headaches in children, but the associations may not be causal given the potential for uncontrolled confounding and misclassification in observational studies such as this. However, given the widespread use of cell phones, if a causal effect exists it would have great public health impact."

Byun et al (2013), *"Mobile Phone Use, Blood Lead Levels, and Attention Deficit Hyperactivity Symptoms in Children: A Longitudinal Study"* [48], p. 1:

"The results suggest that simultaneous exposure to lead and RF from mobile phone use was associated with increased ADHD symptom risk, although possible reverse causality could not be ruled out."

45 Oprindeligt offentliggjort på tysk i det videnskabelige tidsskrift "Umwelt-Medizin-Gesellschaft", 2011, vol. 24, nr. 1, pp. 44 – 57.
46 (14) er forskernes henvisning til ICNIRP-grænseværdierne, jf. pkt. 2.1. nedenfor.
47 Offentliggjort i det videnskabelige tidsskrift "The Open Pediatric Medicine Journal" 2012, nr. 6, pp. 46 – 52.
48 Offentligt i det videnskabelige onlineskrift "PLOS One" d. 21. marts 2013.

Herbert og Sage (2013), *"Autism and EMF? Plausibility of a pathophysiological link part II "*, p. 211 (resumé):

"Autism spectrum conditions (ASCs) are defined behaviorally, but they also involve multileveled disturbances of underlying biology that find striking parallels in the physiological impacts of electromagnetic frequency and radiofrequency radiation exposures (EMF/RFR).
…
Brain oxidative stress and inflammation as well as measures consistent with blood–brain barrier and brain perfusion compromise have been documented. Part II of this paper documents how behaviors in ASCs may emerge from alterations of electrophysiological oscillatory synchronization, how EMF/RFR could contribute to these by detuning the organism, and policy implications of these vulnerabilities. It details evidence for mitochondrial dysfunction, immune system dysregulation, neuroinflammation and brain blood flow alterations, altered electrophysiology, disruption of electromagnetic signaling, synchrony, and sensory processing, detuning of the brain and organism, with autistic behaviors as emergent properties emanating from this pathophysiology.
…
All of these phenomena also occur with EMF/RFR exposure that can add to system overload ('allostatic load') in ASCs by increasing risk, and can worsen challenging biological problems and symptoms; conversely, reducing exposure might ameliorate symptoms of ASCs by reducing obstruction of physiological repair.
…
With dramatic increases in reported ASCs that are coincident in time with the deployment of wireless technologies, we need aggressive investigation of potential ASC—EMF/RFR links. The evidence is sufficient to warrant new public exposure standards benchmarked to low-intensity (non-thermal) exposure levels now known to be biologically disruptive, and strong, interim precautionary practices are advocated." (understreget her)

Wiart et al (2008)[49] konstaterede, baseret på modeller af hoveder, at børns hoveder absorberede omkring 2 gange så meget stråling som voksne, jf. p. 3693:

"...The comparisons have also shown that the maximum SAR in 1 g of peripheral brain tissues of child models aged between 8 and 15 is comparable to the maximum SAR in 1 g of peripheral brain tissues of adult models while it is about two times higher for child models aged between 5 and 8. This is certainly due to the smaller thicknesses of pinna, skin and skull. … The results obtained in this study need to be confirmed since they have been derived from data sets of limited size. Nevertheless these results are comparable to those obtained in other studies involving several phantoms (Beard et al 2006, Kainz et al 2005). ..."

Hardell et al (2011), *"Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects"* [50], p. 1465 (resumé) fandt:

"...an increased risk was found for glioma and use of mobile or cordless phone. The risk increased with latency time and cumulative use in hours and was highest in subjects with first use before the age of 20."

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49 Offentligt i det videnskabelige tidsskrift "Physics in Medicine & Biology" 2008, vol. 53, nr. 13, pp. 3681 – 3695.
50 Offentligt i det videnskabelige tidsskrift "International Journal of Oncology" 2011, vol. 38, nr. 5, pp. 1465 – 1474.

Fra Miller et al november 2018, p. 676 – 677:

"In a population-based case-control study of children Li et al. (2012) included 939 leukemia and 394 brain neoplasm[51] *cases newly diagnosed between 2003 and 2007, aged 15 years or less.*

…

They reported that a higher than median averaged APD[52] *was significantly associated with an increased Adjusted Odds Ratio (AOR) for all neoplasms (1.13; 1.01–1.28), and for leukemia (1.23; 0.99–1.52), but not for all brain neoplasms (1.14, 0.83–1.55). They did not specifically analyze data on gliomas."*

Ibid., p. 681 (konklusioner):

"The precautionary principle should be applied now and suitable warning messages provided to adults and critically to children and their parents. Until technology has been devised that substantially lowers exposures, special efforts should be advanced to ensure that the exposures of children are limited to those deemed essential. Children should be encouraged to text to reduce their exposure to RFR, while every attempt should be made to reduce exposure to RFR in schools, as well as homes."

1.2.2.1.4. Delkonklusion.

Det fremgår klart og videnskabeligt veldokumenteret, at eksponering for radiofrekvent elektromagnetisk stråling (også under de p.t. i Danmark anvendte grænseværdier, jf. pkt. 2.1 nedenfor) kan være kræftfremkaldende, og i så henseende udgør en helbredsfare for mennesker, der kan udvikle sig livstruende.

Dertil kommer den af Pall 2018 opsummerede videnskabelige dokumentation for en række andre skader, inkl. nedsat fertilitet, spontane aborter, neurologiske/neuropsykiatriske effekter, m.v.

Endvidere må det lægges til grund, at børn er særligt sårbare, og adskillige undersøgelser peger på en mulig forbindelse mellem eksponering for radiofrekvent elektromagnetisk stråling og adfærdsvanskeligheder, autisme, forståelsesevner, m.v.

51 Neoplasmer er abnormale væv, som kan udvikle sig til svulster, og i værste fald ondartede kræftsvulster.

52 Står for "Average Power Density", jf. ibid. p. 677.

1.2.3. Dyr.

Overordnet kan om dyr henvises til f.eks. Alfonso Balmoris gennemgang af den videnskabelige litteratur i *"Electromagnetic pollution from phone masts. Effects on wildlife"*[53], p. , hvor konklusionerne (der vedrører både fugle, pattedyr og insekter):

"This literature review shows that pulsed telephony microwave radiation can produce effects especially on nervous, cardiovascular, immune and reproductive systems [111]:

- Damage to the nervous system by altering electroencephalogram, changes in neural response or changes of the blood–brain barrier.
- Disruption of circadian rhythms (sleep–wake) by interfering with the pineal gland and hormonal imbalances.
- Changes in heart rate and blood pressure.
- Impairment of health and immunity towards pathogens, weakness, exhaustion, deterioration of plumage and growth problems.
- Problems in building the nest or impaired fertility, number of eggs, embryonic development, hatching percentage and survival of chickens.
- Genetic and developmental problems: problems of locomotion, partial albinism and melanism or promotion of tumors.

In the light of current knowledge there is enough evidence of serious effects from this technology to wildlife. For this reason precautionary measures should be developed, alongside environmental impact assessments prior to installation, and a ban on installation of phone masts in protected natural areas and in places where endangered species are present. Surveys should take place to objectively assess the severity of effects."

1.2.3.1. Fugle.

Der findes en større mængde videnskabelige undersøgelser, som dokumenterer direkte skadevirkning eller risiko herfor på fugle (og følgelig også deres levesteder, hvis f.eks. en mast er placeret tilstrækkeligt nært).

I det følgende gennemgås en række heraf, med fokus på dokumentation for skadevirkninger eller risici:

Balmori (2005), *"Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (Ciconia ciconia)"*[54], p. 109 og 113 – 114:

"Monitoring of a white stork population in Valladolid (Spain) in the vicinity of Cellular Phone Base Stations was carried out, with the objective of detecting possible effects.
…
Birds are especially sensitive to the magnetic fields [48]. The white stork (Ciconia ciconia) build their nests on pinnacles and other very high places with high electromagnetic contamination (exposed to the microwaves). Also, they usually live inside the urban environment, where the electromagnetic contamination is higher, and remain in the nest a lot of the time, for this reason the decrease on the brood can be a good biological indicator to detect the effects of these radiations. The results indicate a difference in total productivity but not in partial productivity between the near nests and those far from the antennae. This indicate the existence of nests without chicks, or the death of young in their first stages in the nests near cellsites (40% of nest without young, compared to 3.3% in nests further 300 m).
…
The faithfulness of the white stork to nest sites can increase the effects of the microwaves.

53 Offentligt i det videnskabelige tidsskrift *"Pathophysiology"*, 2009, vol. 16.
54 Offentligt i det videnskabelige tidsskrift "*Electromagnetic Biology and Medicine"*, 2005, vol. 24, pp. 109 – 119.

…
Other studies find a decrease of fertility, increase of deaths after the birth in rats and dystrophic changes in their reproductive organs [16]. A recent study shows a statistically significant high mortality rate of chicken embryos subjected to the radiation from a cellphone, compared to the control group [43]. ...”

Den hvide stork er optaget på fuglebeskyttelsesdirektivets ”bilag I”, og hører således til de arter, for hvem der skal træffes ”særlige beskyttelsesforanstaltninger”, jf. pkt. 2.3.2. nedenfor.

Balmori og Hallberg (2007), *”The Urban Decline of the House Sparrow (Passer domesticus): A Possible Link with Electromagnetic Radiation”*[55], p. 141 (resumé):

”During recent decades, there has been a marked decline of the house sparrow (Passer domesticus) population in the United Kingdom and in several western European countries. The aims of this study were to determine whether the population is also declining in Spain and to evaluate the hypothesis that electromagnetic radiation (microwaves) from phone antennae is correlated with the decline in the sparrow population.
Between October 2002 and May 2006, point transect sampling was performed at 30 points during 40 visits to Valladolid, Spain. At each point, we carried out counts of sparrows and measured the mean electric field strength (radiofrequencies and microwaves: 1MHz–3GHz range). Significant declines (P=0.0037) were observed in the mean bird density over time, and significantly low bird density was observed in areas with high electric field strength. The logarithmic regression of the mean bird density vs. field strength groups (considering field strength in 0.1V/m increments) was R = −0 87 P = 0 0001.
The results of this article support the hypothesis that electromagnetic signals are associated with the observed decline in the sparrow population. We conclude that electromagnetic pollution may be responsible, either by itself or in combination with other factors, for the observed decline of the species in European cities during recent years. The appearently strong dependence between bird density and field strength according to this work could be used for a more controlled study to test the hypothesis”

Uddybende i forhold til de fortsat anvendte grænseværdier, jf. pkt. 2.1. nedenfor, konstateredes p. 145 – 146:

”According to this calculation, no sparrows would be expected to be found in an area with field strength >4V/m. ... In monitored Area 14, Plaza de la Libertad, a picocell was installed at the beginning of January 2005 and removed at the end of March 2005. Between January and March 2005, the mean field strength was greater than 3V/m, and the number of sparrows decreased drastically (generally, the number of sparrows increases towards a midwinter peak). In April 2005, after the picocell was removed, the sparrows became abundant again.”

Disse elektriske feltstyrker (V/m) ligger under de af ICNIRP anbefalede og i Danmark anvendte grænseværdier, jf. pkt. 2.1. nedenfor.

Cucurachi et al (2012)[56], *”A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)”*, p. 122:

”Balmori (2005) monitored the variation of a population of white storks (Ciconia ciconia) in the vicinity of a GSM base station i.e. 900–1800 MHz with 217 Hz modulation) in search of possible effects from the exposure. Total productivity within 200 m was on average 46% less than that found at a distance greater than 300 m from the emitting station. An analogous significant difference was found in the breeding success: in 40% more of the cases no new-born chicks were found in the nest.
…

55 Offentligt i det videnskabelige tidsskrift ”*Electromagnetic Biology and Medicine”*, 2007, vol. 26, pp. 141 – 151.
56 Offentligt i det videnskabelige tidsskrift ”Environment International”, 2013, vol. 51, p. 116-140.

Amongst the more recent laboratory studies, evidence of an effect of RF-EMF on mortality and development of embryos was in all cases found at both high and low dosages. In all the five field studies found a significant effect of RF-EMF on breeding density, reproduction or species composition. Field observations give a closer representation of real-life exposure, thus RF-EMF, especially in the 900 MHz GSM band could be a certain factor influencing the ecology of birds."

Burlaka et al (2013), p. 223:

"In conclusion, the exposure of developing quail embryos in ovo to extremely low intensity RF-EMR of GSM 900MHz during at least one hundred and fifty-eight hours discontinuously leads to the significantly increased rates of superoxide and nitrogen oxide generation in embryo cells. This was accompanied by a significantly increased level of lipid peroxidation, a depression of key antioxidant enzymes activity,and significantly, 2–3-fold, increased level of oxidative damage of DNA in embryo cells." (understreget her)

Alfonso Balmori (2015), *"Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation"*[57], p. 59:

Low-voltage electricity current-generated electromagnetic field can produce a significantly negative effect on the breeding success of birds (Ciconia ciconia) nesting directly on electricity lines (Vaitkuvienė and Dagys, 2014) and these same results have been found in nests exposed to radiofrequency radiation near phone masts (Balmori, 2005)."

Yakymenko et al (2015), p. 194:

"We could ascertain the signaling effects of moderate levels of free radicals from our experiments in quail embryos irradiated with the commercial cell phone. Thus, we were able to show that the prolonged exposures of embryos in ovo led to robust repression of their development (Tsybulin et al., 2013), which was concomitant with significant overproduction of superoxide radical and NO radical, increased rates of lipid peroxidation and oxidative damage of DNA (Burlaka et al., 2013; Tsybulin et al., 2012)." (understreget her)

Shende et al (2015), *"Electromagnetic Radiations: A Possible Impact on Population of House Sparrow (Passer Domesticus)"*[58], p. 45:

"By monthly monitoring in urban and rural area, it is found that the population of house sparrow is declining in the urban area, where cell phone towers are more as compared to the rural area in every season."

Et særligt fokusområde i den videnskabelige litteratur udgøres af undersøgelser af radiofrekvent elektromagnetisk strålings virkning på fugles biologisk determinerede muligheder for at orientere sig.

Fugle er – ligesom en række andre dyr, jf. pkt. 1.2.3.2. nedenfor – født med, hvad der kan beskrives som en art indbygget, magnetisk baseret kompas, som indebærer, at de kan finde vej til og fra sydligere områder (set i forhold til Danmark).

Der kan bl.a. henvises til Alfonso Balmori (2015), *"Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation"*[59], p. 58 – 59:

"Radio frequency fields in the MHz range disrupt birds' orientation interfering directly with the primary processes of magnetoreception and therefore disable the avian compass as long as

57 Offentligt i det videnskabelige tidsskrift "Science of the Total Environment" 2015, pp. 58 – 60.
58 Offentligt i det videnskabelige tidsskrift "Engineering International", 2015, vol. 3, nr. 1, pp. 45 – 52.
59 Offentligt i det videnskabelige tidsskrift "Science of the Total Environment" 2015, pp. 58 – 60.

they are present (Wiltschko et al., 2014). Ritz et al. (2004 & 2009) reported the sensitivity for orientation of European robins (Erithacus rubecula) to radiofrequency magnetic fields. The orientation of migratory birds is disrupted when very weak high-frequency fields (broadband field of 0.1–10 MHz of 85 nT or a 1.315 MHz field of 480 nT) are added to the static geomagnetic field of 46.000 nT (Thalau et al., 2006). It was convincingly demonstrated that robins are unable to use their magnetic compass in the presence of urban electromagnetic radiofrequency noise in the frequency range of 2 kHz–5 MHz (Engels et al., 2014). Therefore, electrosmog scrambles birds' magnetic sense and this finding could inform policies written to protect the habitats of endangered species.(understreget her)

Balmori (2005), *"Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (Ciconia ciconia)"*[60], p. 115:

"... The perception to the terrestrial magnetic field can be altered by the electromagnetic radiation from the antennae. The reports of carrier pigeons losing direction in the vicinity of cellsites are numerous, and more investigation is necessary. ..."

Det EU-baserede forskningsprojekt EKLIPSE udgav v/ Malkemper et al i 2018 en rapport med titlen *" The impacts of artificial ElectromagneticRadiation on wildlife (flora and fauna).Current knowledge overview: a background document to the web conference",* hvoraf bl.a. fremgår s. 15:

"...It is established that the magnetic compass of migratory birds can be disrupted by the weak RF background in larger cities (nT-intensities) but it is currently unclear which exact frequencies are most effective. ..."

Ang. denne effekt henvises endvidere til Engels et al (2014), *"Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird"*[61], p. 353 (resumé):

"...Here we show that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise. When European robins, Erithacus rubecula, were exposed to the background electromagnetic noise present in unscreened wooden huts at the University of Oldenburg campus, they could not orient using their magnetic compass. Their magnetic orientation capabilities reappeared in electrically grounded, aluminium-screened huts, which attenuated electromagnetic noise in the frequency range from 50 kHz to 5 MHz by approximately two orders of magnitude. When the grounding was removed or when broadband electromagnetic noise was deliberately generated inside the screened and grounded huts, the birds again lost their magnetic orientation capabilities. The disruptive effect of radiofrequency electromagnetic fields is not confined to a narrow frequency band and birds tested far from sources of electromagnetic noise required no screening to orient with their magnetic compass. These fully double-blinded tests document a reproducible effect of anthropogenic electromagnetic noise on the behaviour of an intact vertebrate." (understreget her)

1.2.3.1.1. Delkonklusion.

Ligesom tilfældet er i forhold til helbredsskader og risici herfor på mennesker, forekommer det særdeles videnskabeligt veldokumenteret, at radiofrekvent elektromagnetisk stråling, også den som holder sig indenfor de af myndighederne fastlagte grænseværdier, henholdsvis er og kan være helbredsskadeligt for fugle og (in extenso) deres levesteder.

Dertil kommer det særlige forhold ved fugle i forhold til mennesker, at deres evner til orientere sig til dels er baseret på interaktion med jordens naturligt forekommende magnetfelter. Radiofrekvent elektromagnetisk strålings virkning på fugles biologisk determinerede muligheder for at orientere sig kan være ødelæggende for bevarelsen af arten, herunder i de

60 Offentligt i det videnskabelige tidsskrift "*Electromagnetic Biology and Medicine"*, 2005, vol. 24, pp. 109 – 119.
61 Offentligt i det videnskabelige tidsskrift "Nature" 2014, nr. 509, pp. 353 – 356.

dertil særligt udpegede beskyttede yngleområder.

1.2.3.2. Andre dyr.

For så vidt angår insekter kan bl.a. henvises til Alfonso Balmori (2015), *"Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation"*[62], p. 59:

"As with birds, radio frequency magnetic fields disrupt magnetoreception in insects. The geomagnetic field reception in American cockroach is sensitive to weak radio frequency field causing a disruptive effect (Vacha et al., 2009), so these authors suggest that electromagnetic smog will have to be taken more seriously in animal magnetoreception experiments. In an experimentally-generated electromagnetic field of about 1 V/m with a realistic (and even lower) power intensity similar to those surrounding communication masts, the results and observations suggest that GSM (Global System for Mobile communications) 900 MHz radiation might have a severe impact on the nerve cells of exposed ants, especially affecting the visual and olfactory memory, causing the loss of their ability to use visual cues and suggesting that electromagnetic radiation may have an impact on the orientation behaviour and navigation of animals that use magnetic fields to find their way (Cammaerts et al., 2012, 2014). Honeybees are sensitive to pulsed electromagnetic fields generated by mobile phones and observable changes in the bee behaviour could be one explanation for the loss of colonies (Favre, 2011). Magnetoreception system in Monarch butterfly orientation (Guerra et al., 2014) may be also suffering interference with anthropogenic radio frequency magnetic fields and this, together with other factors (Brower et al., 2012), may be a cause of their population decline." (understreget her)

Tilsvarende i Cucurachi et al (2012)[63], p. 116:

"Information was collected from 113 studies from original peer-reviewed publications or from relevant existing reviews… The majority of the studies were conducted in a laboratory setting on birds (embryos or eggs), small rodents and plants. In 65% of the studies, ecological effects of RF-EMF (50% of the animal studies and about 75% of the plant studies) were found both at high as well as at low dosages. ..."

Ibid., p. 122 – 123:

"It has been demonstrated that insects can sense magnetic fields as a means for navigation and orientation (Abraçado et al., 2005; Kirschvink et al., 2001; Liedvogel and Mouritsen, 2010; Wajnberg et al., 2010; Winklhofer, 2010). Magneto-reception has been associated with the use of ferromagnetic iron oxide particles embedded in tissue or through pairs of molecules with unpaired electrons (known as radical pairs) that are associated with a light sensitive photoreceptor (Ritz et al., 2002; Knight, 2009; Vácha et al. 2009). The exposure to RF-EMF might disrupt this magneto-reception mechanism, which could in turn affect the survival of insects. The most commonly studied species are the honey bee (A. mellifera) and the fruit fly (Drosophila melanogaster)."

Og p. 129:

"The studies analysing the effects of RF-EMF on fruit flies found in all cases a significant effect. Results of one study show an increased reproductive success after exposure. The remaining studies, which were conducted by the same research institute in Greece, found in all cases a significant depression of growth and reproduction at both 900 and 1800 MHz. Two studies on the American cockroach and a species of ant analysed the effects of exposure to RF-EMF on the magneto-reception and orientation of the insects. The behaviour of target systems was disrupted by the exposure to RF-EMF."

62 Offentligt i det videnskabelige tidsskrift "Science of the Total Environment" 2015, pp. 58 – 60.
63 Offentligt i det videnskabelige tidsskrift "Environment International", 2013, vol. 51, p. 116-140.

Samt p. 136 (konklusioner):

"...The effects of RF-EMF on different biological groups were investigated. With reference to the groups under investigations in the selected studies (i.e. birds, honeybees, mammals, plants, Drosophila and others) there is ecologically relevant evidence that the RF-EMF caused an effect in about 50% of the animalstudies and about 90% of the plant studies. ..."

Kumar et al (2011), *"Exposure to cell phone radiations produces biochemical changes in worker honey bees"*[64], (resumé, resultater og diskussion):

"The present study was carried out to find the effect of cell 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.
…
Very little work has been done on biochemical, metabolic and physiological influences of cell phone radiations pertaining to health risk in man.[8] Therefore, the present investigations on the influence of cell phone radiations on some biochemical and physiological aspects of honeybee biology were undertaken. That the behavior of honeybee is altered to some extent by high or low energy fields or electromagnetic radiations has been known for quite some time.[9]
During the present investigation, it was observed that there was an increase in concentration of total carbohydrates in the bees exposed to cell phone radiation for 10 min as compared to unexposed or control bees. Increasing the exposure time to 20 min resulted in further increase in the concentration, while an exposure of 40 min had a reverse effect and there was a decline in carbohydrate concentration, though it was still higher as compared to control. Hemolymph glycogen and glucose content also showed the same trend, i.e., there was increase in content up to 20 min exposure after which there was a slight decline in the concentration which remained more than the control. Sharma[10] had also reported increase in glycogen and glucose levels in the exposed pupa of A. mellifera.
Lipids are the major energy reserves of insects. Certain lipid classes are structure components of membranes while others are raw materials for a variety of hormones and pheromones. Estimation of total lipids and cholesterol during the present study showed that the trend was similar to that of carbohydrates. After an initial increase in concentration at the 10 and 20 min exposure period, a decline was observed in the concentration of total lipids and cholesterol at 40 min exposure.
It was interesting to note that during the present study as the exposure time increased, it appeared that the bees having assessed the source of the disturbance decided to move and a large scale movement of the workers toward the talk-mode (not toward the listening mobile) was observed. Also, the bees became slightly aggressive and started beating their wings in agitation. This mobility of the bees could be responsible for increase utilization of energy sources and consequent decrease in concentration of carbohydrates and lipids in the 40 min exposed sample." (understreget her)

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64 Offentligt i det videnskabelige tidsskrift "Toxicology International", 2011, vol. 18, nr. 1, p. 70 – 72.

Margaritis et al (2014), *"Drosophila oogenesis as a bio-marker responding to EMF sources"*[65], p. 165 (resumé):

"A total of 280 different experiments were performed using newly emerged flies exposed for short time daily for 3–7 d to various EMF sources including: GSM 900/1800 MHz mobile phone, 1880–1900 MHz DECT wireless base, DECT wireless handset, mobile phone-DECT handset combination, 2.44 GHz wireless network (Wi-Fi), 2.44 GHz blue tooth, 92.8 MHz FM generator, 27.15 MHz baby monitor, 900 MHz CW RF generator and microwave oven's 2.44 GHz RF and magnetic field components.

…

All EMF sources used created statistically significant effects regarding fecundity and cell death-apoptosis induction, even at very low intensity levels (0.3 V/m blue tooth radiation), well below ICNIRP's guidelines, suggesting that Drosophila oogenesis system is suitable to be used as a biomarker for exploring potential EMF bioactivity. Also, there is no linear cumulative effect when increasing the duration of exposure or using one EMF source after the other (i.e. mobile phone and DECT handset) at the specific conditions used. ..."

Studiet blev udført på bananfluer, og det blev på baggrund af fundene anbefalet, at dette insekt fremover anvendes som biologisk markør ved undersøgelser af effekter af radiofrekvent elektromagnetisk stråling.

Som det fremgår, opstod der celledød endog ved meget lave intensiteter af stråling, helt ned til 0,3 V/m fra Blue Tooth-produkter.

Undersøgelsen viser, at udstyr som ligger indenfor de af ICNIRP anbefalede grænseværdier (f.eks. 61 V/m for udstyr på med et frekvensområde på 2 – 300 GHz), jf. også pkt. 2.1 nedenfor, må forventes at være stærkt skadeligt for insekter.

Visse insekter er omfattet af EU's habitatdirektivbeskyttelse, jf. pkt. 2.3.3. nedenfor.

Dertil kommer, at fugle, der lever af insekter, ligeledes vil få ødelagt deres levesteder. For indholdet EU's fuglebeskyttelsesdirektiv henvises til pkt. 2.3.2. nedenfor.

Cammaerts og Johansson (2014), *"Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus"*[66], p. 286, pkt. 3:

"All radiating sources tested in this study on the ants demonstrated clear and statistically significant effects. It was already known that a mobile phone in standby mode affects living organisms (e.g. see Cammaerts et al.,2011; Favre, 2011; Panagopoulos et al., 2004; Sharma and Kumar, 2010). In this study, we showed that a common mobile phone has an effect while in standby mode and even in off-condition. Of course, when activated, the effect of a mobile phone is stronger. Without its battery, such a phone has no longer an effect. Our ants demonstrated that a modern smartphone and even more so a DECT phone do affect living organisms. Furthermore, the electromagnetic waves generated by a WiFi router impact our ants and such an effect increases during the course of the exposure time. Persons working in rooms provided with wireless equipment should note this result. A modern personal computer also generates electromagnetic waves. This is due to the PC WiFi function, which is automatically activated. Based on these results, we advice users to deactivate the WiFi function of their PC as long as they do not use it. This can also be deduced from the study related in http://bigbrouser.blog.lemonde.fr/2011/12/01/microonde-le-wi-fi-tueur-de-spermatozoı¨des/." (understreget her)

65 Offentligt i det videnskabelige tidsskrift "Electromagnetic Biology and Medicine", 2014, vol 33, nr. 3, pp. 165 – 189.

66 Offentligt i det videnskabelige tidsskrift "Electromagnetic Biology and Medicine", 2014, vol 33, nr. 4, pp. 282 – 288.

Særligt for så vidt angår bestøvere skal henvises til Lázaro et al (2016), *"Electromagnetic radiation of mobile telecommunication antennas affects the abundance and composition of wild pollinators"*[67], p. 322 (konklusion):

"Electromagnetic radiation from telecommunication antennas affected the abundance and composition of wild pollinators in natural habitats....Pollinators and their host plants constitute pollination networks. Although the architecture of these mutualistic networks can increase the capacity of pollinator populations to persist under harsh conditions, once a tipping point in human-induced environmental change is reached, pollinator populations may collapse simultaneously (Lever et al. 2014). Therefore, these changes in the composition of pollinator communities associated with electromagnetic smog may have important ecological and economic impacts on the pollination service that could significantly affect the maintenance of wild plant diversity, crop production and human welfare."

Studiet viser således en sammenhæng mellem stråling fra mobilmaster og antallet af (flyvende) insekter.

Sammensætningen af bestøvere må anses for et vigtigt økologisk element og vigtig økonomisk parameter for produktion af afgrøder, menneskets velfærd samt for biodiversiteten generelt.

Vilic et al (2017), *"Effects of short-term exposure to mobile phone radiofrequency (900 MHz) on the oxidative response and genotoxicity in honey bee larvae"*[68], p. 430 (resumé):

"Exposure of different animal species to radiofrequency electromagnetic fields (RF-EMF) could cause various biological effects such as oxidative stress, genotoxic effects and dysfunction of the immune system. However, there are a lack of results on oxidative stress response and genotoxicity in the honey bee (Apis mellifera) after exposure to RF-EMF. This study was performed to investigate the effects of exposure to RF-EMF on the activity of catalase, superoxide dismutase, glutathione S-transferase, lipid peroxidation level and DNA damage in honey bee larvae. Honey bee larvae were exposed to RF-EMF at 900 Mhz and field levels of 10, 23, 41 and 120 V m−1 for 2 h. At a field level of 23 V m−1 the effect of 80% AM 1 kHz sinusoidal and 217 Hz modulation was investigated as well. Catalase activity and the lipid peroxidation level decreased significantly in the honey bee larvae exposed to the unmodulated field at 10 V m−1 compared to the control. Superoxide dismutase and glutathione S-transferase activity in the honey bee larvae exposed to unmodulated fields were not statistically different compared to the control. DNA damage increased significantly in honey bee larvae exposed to modulated (80% AM 1 kHz sinus) field at 23 V m−1 compared to the control and all other exposure groups. These results suggest that RF-EMF effects in honey bee larvae appeared only after exposure to a certain EMF conditions. The increase of the field level did not cause a linear dose-response in any of the measured parameters. Modulated RF-EMF produced more negative effects than the corresponding unmodulated field. Although honey bees in nature would not be exposed to such high field levels as used in our experiments, our results show the need for further intensive research in all stages of honey bee development." (understreget her)

Ibid., p. 437 (konklusion):

"In conclusion, the results of our study showed that effects of RF-EMF at 900 MHz in honey bee larvae appeared only after exposure to the certain EMF conditions. RF-EMF modulated at 1 kHz showed an increase of DNA damage, while unmodulated RF-EMF produced alteration in

67 Offentligt i det videnskabelige tidsskrift "Journal of Insect Conservation", 2016, vol. 20, nr. 2, 315 – 324.
68 Offentligt i det videnskabelige tidsskrift "Journal of Apicultural Research", 2017, vol. 56, nr. 4, p. 430 – 438.

catalase activity and lipid peroxidation at the lowest field level of 10 V m−1. Evidently, the increase of the field level did not cause a linear dose-response relationship in any of the measured parameters. Although honey bees in nature would not be exposed to such high field levels as used in our experiments, our results show the need for further intensive research in all stages of honey bee development, as well as the intensive research on the possible existence of a "window" effect under natural conditions during the annual cycling of bees."

Thielens et al (2018), *"Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz"*, p. 9 (konklusion, manuskriptudgave):

"The insects show a maximum in absorbed radio frequency power at wavelengths that are comparable to their body size. They show a general increase in absorbed radio-frequency power above 6 GHz (until the frequencies where the wavelengths are comparable to their body size), which indicates that if the used power densities do not decrease, but shift (partly) to higher frequencies, the absorption in the studied insects will increase as well. A shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%. This could lead to changes in insect behaviour, physiology, and morphology over time due to an increase in body temperatures, from dielectric heating. The studied insects that are smaller than 1 cm show a peak in absorption at frequencies (above 6 GHz), which are currently not often used for telecommunication, but are planned to be used in the next generation of wireless telecommunication systems. At frequencies above the peak frequency (smaller wavelengths) the absorbed power decreases slightly."

Som de fremgår af de sidste, understregne linjer, vedrører denne undersøgelse tillige de højere frekvenser over 6 GHz, som vil blive taget i anvendelse ved 5G.

Studier ang. radiofrekvent elektromagnetisk strålings effekt på flagermus[69] er gennemført i bl.a. Nicholls og Racey (2009), *"The Aversive Effect of Electromagnetic Radiation on Foraging Bats—A Possible Means of Discouraging Bats from Approaching Wind Turbines",* hvori der bl.a. findes som følger, jf. p. 1 (resumé):

"Large numbers of bats are killed by collisions with wind turbines and there is at present no accepted method of reducing or preventing this mortality. Following our demonstration that bat activity is reduced in the vicinity of large air traffic control and weather radars, we tested the hypothesis that an electromagnetic signal from a small portable radar can act as a deterrent to foraging bats. From June to September 2007 bat activity was compared at 20 foraging sites in northeast Scotland during experimental trials (radar switched on) and control trials (no radar signal). Starting 45 minutes after sunset, bat activity was recorded for a period of 30 minutes during each trial and the order of trials were alternated between nights. From July to September 2008 aerial insects at 16 of these sites were sampled using two miniature light-suction traps. At each site one of the traps was exposed to a radar signal and the other functioned as a control. Bat activity and foraging effort per unit time were significantly reduced during experimental trials when the radar antenna was fixed to produce a unidirectional signal therefore maximising exposure of foraging bats to the radar beam. However, although bat activity was significantly reduced during such trials, the radar had no significant effect on the abundance of insects captured by the traps." (understreget her)

Tilsvarende i Balmori (2009), *"Electromagnetic pollution from phone masts. Effects on wildlife"*[70], p. 4:

69 15 arter af flagermus er omfattet af habitatdirektivets bestemmelser om særlige beskyttelsesforanstaltninger, jf. pkt. 2.3.3. nedenfor.

70 Offentligt i det videnskabelige tidsskrift "Pathopsyiology", 2009,

"Electromagnetic radiation can exert an aversive behavioral response in bats. Bat activity is significantly reduced in habitats exposed to an electromagnetic field strength greater than 2 V/m [73]. During a study in a free-tailed bat colony (Tadarida teniotis) the number of bats decreased when several phone masts were placed 80m from the colony [74]."

Ang. padder kan bl.a. henvises til Alfonso Balmori (2010), *"Mobile Phone Mast Effects on Common Frog (Rana temporaria) Tadpoles: The City Turned into a Laboratory"*[71], p. 35:

"...Most prevailing hypotheses suggest that a field acts to directionally guide the growth and migration of some embryonic cells (Hotary and Robinson, 1992).
Strong magnetic fields (1.74–16.7T) disrupt cell division of exposed frog eggs (Xenopus laevis) (Denegre et al., 1998). Valles (2002) proposed a model to explain their influence.
Several studies on effects of electromagnetic fields on amphibians have been conducted in laboratories. When amphibian eggs and embryos of Ambystoma maculatum and Rana sylvatica were exposed to high magnetic fields (6.3 103 G), a brief treatment of early embryos produced several types of abnormalities, incuding microcephaly, retarded (abnormal) growth, edema, and scoliosis (Levengood, 1969).
Adult newts (Notophthalmus viridescens) exposed to a pulsed electromagnetic field (1 T and 0.15 V/m, approx.) for the first 30 days post forelimbs were amputated and produced more abnormalities in their skeletal patterns than the native limbs or the normal regenerates. Twelve percent exhibited unique abnormalities not observed in either the native or regenerate limb population. These forelimbs demonstrated one or more of the following gross defects: acheiria (lack of carpus and digits), aphalangia, or oligodactylia (loss of digits) as well as carpal bone and long bone (radius and ulna) abnormalities (Landesman and Douglas, 1990).
Exposed frog tadpoles (Rana temporaria) developed under electromagnetic field (50Hz, 260A/m) show an increase in mortality. Exposed tadpoles developed more slowly and less synchronously than control tadpoles and remained at the early stages for longer. Tadpoles developed allergies and EMF caused changes in their blood counts (Grefner et al., 1998). These results are consistent with the observations of this work.
Deformities and disappearance of amphibians and other organisms is part of the global biodiversity crisis (Blaustein and Johnson, 2003). Some authors consider that the electromagnetic pollution is destroying nature (Warnke, 2007; Firstenberg, 1997).
Balmori (2006) proposed that electromagnetic pollution (in the microwave and radiofrequency range) along with other environmental factors is a possible cause for decline and deformations of some wild amphibian populations exposed. The results of this experiment conducted in a real situation in the city of Valladolid (Spain) indicate that the tadpoles that live near such facilities, exposed to relatively low levels of environmental electromagnetic fields (1.8–3.5V/m) may suffer adverse effects (low coordination of movements, asynchronous growth, and high mortality), and this may be a cause (together with other environmental factors) of decline of amphibian populations." (understreget her)

Studiet er således udført på hvad der måske er Danmarks mest almindelige frø, butsnudet frø. Dyret er optaget på bilag II til EU's habitatdirektiv, og er således omfattet af særlige beskyttelsesforanstaltninger, jf. pkt. 2.3.3. nedenfor.

Undersøgelsen påpeger, udover indikation for mutationer og en lang række sundhedsskader på padder, at den elektromagnetiske forurening fra selv relativt svage elektromagnetiske felter, miljøet udsættes for, er en mulig årsag (sammen med andre mlijømæssige faktorer) til tabet af krybdyrspopulationer.

På mus kan bl.a. henvises til følgende, udover de i øvrigt i responsummet omtalte artikler:

Magras og Xenos (1997), *"RF Radiation–Induced Changes in the Prenatal Development of Mice"*, p. 455:

"The possible effects of radiofrequency (RF) radiation on prenatal development has been

71 Offentligt i det videnskabelige tidsskrift "Electromagnetic Biology and Medicine", 2010, vol. 29, p. 31 – 35.

investigated in mice. This study consisted of RF level measurements and in vivo experiments at several places around an "antenna park." At these locations RF power densities between 168 nW/cm2 and 1053 nW/cm2 were measured. Twelve pairs of mice, divided in two groups, were placed in locations of different power densities and were repeatedly mated five times. One hundred eighteen newborns were collected. They were measured, weighed, and examined macro- and microscopically. A progressive decrease in the number of newborns per dam was observed, which ended in irreversible infertility. The prenatal development of the newborns, however, evaluated by the crown-rump length, the body weight, and the number of the lumbar, sacral, and coccygeal vertebrae, was improved." (understreget her)

Mekanismen for den observerede sterilitet hos musene er forklaret således i Shahin et al (2017), *"Mobile phone (1800 MHz) radiation impairs female reproduction inmice, Mus musculus, through stress induced inhibition of ovarian anduterine activity"*, p. 41 (resumé):

"Present study investigated the long-term effects of mobile phone (1800 MHz) radiation in stand-by, dialing and receiving modes on the female reproductive function (ovarian and uterine histo-architecture, andsteroidogenesis) and stress responses (oxidative and nitrosative stress). We observed that mobile phone radiation induces significant elevation in ROS, NO, lipid peroxidation, total carbonyl content and serumcorticosterone coupled with significant decrease in antioxidant enzymes in hypothalamus, ovary anduterus of mice. Compared to control group, exposed mice exhibited reduced number of developing and mature follicles as well as corpus lutea. Significantly decreased serum levels of pituitary gonadotrophins(LH, FSH), sex steroids (E2 and P4) and expression of SF-1, StAR, P-450scc, 3 -HSD, 17 -HSD, cytochrome P-450 aromatase, ER- and ER- were observed in all the exposed groups of mice, compared to control. These findings suggest that mobile phone radiation induces oxidative and nitrosative stress, which affects the reproductive performance of female mice." (understreget her)

Videre hedder det ibid., p. 57:

"...Mobile phone radiation may result in ovarian and uterine dysfunction by increasing ROS and RNS production and disturbing antioxidant status. Oxidative and nitrosative stress created at the hypothalamus and peripheral level (ovary and uterus) as a consequence of long-term mobile phone exposure may severely reduce both steroidogenesis and folliculogenesis in the ovary as well as the structural and functional status of the uterus. These results led us to conclude that chronic exposure to long-term mobile phone radiation may severely affect the ovarian and uterine activity of female mice and thus may lead to infertility. ..."

1.2.3.2. Delkonklusion.

Det forekommer videnskabeligt veldokumenteret, at radiofrekvent elektromagnetisk stråling, også den som holder sig indenfor de af myndighederne fastlagte grænseværdier, henholdsvis er og kan være helbredsskadeligt for insekter.

Dertil kommer det særlige forhold, at også insekternes evner til orientere sig til dels er baseret på interaktion med naturligt forekommende felter i f.eks. de blomster, som skal bestøves. Radiofrekvent elektromagnetisk strålings virkning på insekters biologisk determinerede muligheder for at orientere sig kan være ødelæggende for bevarelsen af arten.

Dertil kommer, at insekters forsvinden fra et område kan have afgørende betydning for insektædende fugles muligheder for at overleve som arter.

1.2.4. Yderligere om leveområder, samt planter.

En del af den i pkt. 1.2.3. ovenfor omtalte forskning omhandler leveområder (habitatområder), idet den angår undersøgelser af strålings påvirkning af dyr i de områder, hvor de har deres

reder, jagtområder, o.s.v., eller belyser, hvad effekten er i også disse områder.

Dertil kan føjes videnskabelige undersøgelser foretaget af radiofrekvent elektromagnetisk stråling på planter, herunder træer:

Magone (1996), *"The effect of electromagnetic radiation from the Skrunda Radio Location Station on Spirodela polyrhiza (L.) Schleiden cultures"*[72], p. 75 (resumé):

"The effect of electromagnetic radiation from the Skrunda Radio Location Station was studied on the vegetative growth and morphology of the duckweed Spirodela polyrhiza (L.) Schleiden plant in the next generation. The impact of plant development stage and length of the exposure period were examined. The effect of short-term (5-day) exposures of Spirodela cultures depended on the stage of development at the time of exposure. Generally, the vegetative reproduction rate was accelerated in the first 20 days after the end of exposure. Exposure of plants just beginning formation lowered the vegetative growth rate. Eighty-eight-hour exposure caused the appearance of some abnormal individuals after 30 days of growth. At 55 days, various morphological and developmental abnormalities appeared in 6–10 daughter plants from 10 exposed mother plants, compared with 0.1 plants per 10 in the control condition. Plants developed completely to daughter fronds under exposure from the electromagnetic field had a shorter life-span (67 days compared to 87 days in the control) and fewer subsequent daughters (total eight compared to 10 in the control group)." (understreget her)

Undersøgelsen vedrørte andemad.

Katie Haggerty (2010), *"Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations"*[73], p. :

"The results of this preliminary experiment indicate that the RF background may be adversely affecting leaf and shoot growth and inhibiting fall production of anthocyanins associated with leaf senescence in trembling aspen seedlings. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of aspen populations. Further studies are underway to test this hypothesis in a more rigorous way."

Undersøgelsen vedrørte poppeltræer.

Waldman et al (2016), *"Radiofrequency radiation injures trees around mobile phone base stations"*, p. 554 – 555 (resumé):

"...detailed long-term (2006–2015) field monitoring study was performed in the cities of Bamberg and Hallstadt (Germany). During monitoring, observations and photographic recordings of unusual or unexplainable tree damage were taken, alongside the measurement of electromagnetic radiation. In 2015 measurements of RF-EMF (Radiofrequency Electromagnetic Fields) were carried out. A polygon spanning both cities was chosen as the study site, where 144 measurements of the radiofrequency of electromagnetic fields were taken at a height of 1.5 m in streets and parks at different locations.
...
The measurements of all trees revealed significant differences between the damaged side facing a phone mast and the opposite side, as well as differences between the exposed side of damaged trees and all other groups of trees in both sides. Thus, we found that side differences

72 Offentligt i det videnskabelige tidsskrift "Science of The Total Environment", 1996, vol. 180, nr. 1, pp. 75 – 80.
73 Offentligt i det videnskabelige tidsskrift "International Journal of Forestry Research" 2010, Article ID 836278.

in measured values of power flux density corresponded to side differences in damage. The 30 selected trees in low radiation areas (no visual contact to any phonemast and power flux density under 50 μW/m2) showed no damage. Statistical analysis demonstrated that electromagnetic radiation from mobile phone masts is harmful for trees. These results are consistent with the fact that damage afflicted on trees by mobile phone towers usually start on one side, extending to the whole tree over time." (understreget her)

Malka Halgamuge (2017), *"Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants"*[74], p. 213 (resumé):

"Subject and methods: In this study, we performed an analysis of the data extracted from the 45 peer-reviewed scientific publications (1996–2016) describing 169 experimental observations to detect the physiological and morphological changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation. Twenty-nine different species of plants were considered in this work. Results: Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, p < 0.001). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies, especially the frequencies between (i) 800 and 1500 MHz (p < 0.0001), (ii) 1500 and 2400 MHz (p < 0.0001) and (iii) 3500[75] *and 8000 MHz (p = 0.0161)."* (understreget her)

1.2.4.1. Delkonklusion.

Det forekommer videnskabeligt veldokumenteret, at radiofrekvent elektromagnetisk stråling, også den som holder sig indenfor de af myndighederne fastlagte grænseværdier, henholdsvis er og kan være skadeligt for planter.

Dertil kommer, at planters forsvinden fra et område kan have afgørende betydning for fugles og insekters muligheder for at overleve som arter.

74 Offentligt i det videnskabelige tidsskrift "ELECTROMAGNETIC BIOLOGY AND MEDICINE", 2017, vol. 36, nr. 2, pp. 213 – 235.

75 3,5 GHz er blandt de frekvenser, der ifølge Energistyrelsens handlingsplan af februar 2019 for 5G er afsat til dette system, jf. https://ens.dk/sites/ens.dk/files/Tele/5g-handlingsplan_for_danmark.pdf, s. 10.

1.3. Overordnet delkonklusion.

Det ovenfor gennemgåede forskningsmateriale dokumenterer efter min opfattelse en klar og bastant underbygget årsagssammenhæng imellem udsættelse af mennesker og dyr for radiofrekvent elektromagnetisk stråling på den ene side og en række skadevirkninger samt mulige skadevirkninger på begge grupper, herunder livstruende.

Der foreligger tillige en velunderbygget årsagssammenhæng for så vidt angår skader på planter.

Dette gør sig også gældende under de p.t. fastsatte grænseværdier, jf. også pkt. 2.1. nedenfor.

2. Jus.

2.1. De i Danmark anvendte grænseværdier for eksponering overfor radiofrekvent elektromagnetisk stråling.

Sundhedsstyrelsen anvender grænseværdier som anbefalet i 1998[76] (gentaget i 2009[77]) af organisationen ICNIRP (International Commission on Non-Ionizing Radiation Protection). Tillige opereres med en SAR-grænseværdi på 2 W/kg for producenter af trådløst udstyr. Disse grænseværdier vil ligeledes blive anvendt i forhold til 5G[78]. En særlig grænseværdi for fuldkropsbestråling er på gennemsnitligt 0,08 W/kg.

Grænseværdierne er baseret på termisk opvarmning o.lign. kortsigtede og umiddelbare effekter, medens en række af de i pkt. 1.2 ovennævnte forskningsresultater dokumenterer, at radiofrekvent elektromagnetisk stråling er skadeligt uden termisk opvarmning[79], medens andre sandsynliggør dette. Det hedder i ICNIRPs retningslinjer, p. 496:

*"**BASIS FOR LIMITING EXPOSURE***
These guidelines for limiting exposure have been developed following a thorough review of all published scientific literature. The criteria applied in the course of the review were designed to evaluate the credibility of the various reported findings (Repacholi and Stolwijk 1991; Repacholi and Cardis 1997); only established effects were used as the basis for the proposed exposure restrictions. Induction of cancer from long-term EMF exposure was not considered to be established, and so these guidelines are based on short-term, immediate health effects such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conducting objects, and elevated tissue temperatures resulting from absorption of energy during exposure to EMF. In the case of potential long-term effects of exposure, such as an increased risk of cancer, ICNIRP concluded that available data are insufficient to provide a basis for setting exposure restrictions, although epidemiological research has provided suggestive, but unconvincing, evidence of an association between possible carcinogenic effects and exposure at levels of 50/60 Hz magnetic flux densities substantially lower than those recommended in these guidelines.
..." (understreget her)

Sundhedsstyrelsen anfører nærmere om 5G på sin hjemmeside bl.a.:

"...Helt overordnet er det Sundhedsstyrelsens vurdering, at der ikke er grund til at være bekymret for, at der skulle være en sundhedsrisiko forbundet med 5G. Målinger viser, at den samlede stråling fra mobiltelefoner, wifi og andet apparatur, som i dag udsender ikke-ioniserende stråling, er svag, og ligger langt under grænseværdierne for, hvad der er sundhedsskadeligt. Baseret på den tilgængelige viden har vi ingen grund til at tro, at 5G vil ændre på det.
I lovgivningen om radioudstyr er der fastsat regler om, at radioudstyr skal være konstrueret, så det sikrer menneskers sundhed. Det betyder, at antenner mv. til 5G skal følge de samme fælleseuropæiske grænseværdier som alt andet nuværende udstyr til telekommunikation. ..."

Ved sammenholdelsen mellem den i pkt. 1.2. ovenfor omtalte forskning og de af Sundhedsstyrelsen anvendte grænseværdier er beregningerne i følgende skema lagt til grund[80]:

76 "ICNIRP guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 Ghz)", offentliggjort i det videnskabelige tidsskrift "Health Physics" (1998) nr. 74, p. 494 – 522.

77 "ICNIRP statement on the 'guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 Ghz)'", offentliggjort i det videnskabelige tidsskrift "Health Physics" (2009) nr. 97, p. 257 – 258.

78 Jf. Energi-, Forsynings- og Klimaministerens svar af 1. april 2019 på spørgsmål 226 i samme folketingsudvalg, samt Sundhedsstyrelsens hjemmeside: https://www.sst.dk/da/straalebeskyttelse/mobiltelefoni,-traadloese-netvaerk-med-mere/5g

79 Se f.eks. Philips et al (2009), p. 83, med referencer til to studier.

80 Kilden er Rådet for Helbredssikker Telekommunikation.

ICNIRP 1998 grænser

(frekvens) MHz	(feltstyrke) V/m	(effekttæthed) µW/m2	mW/m2	W/m2	
10	28,00	2.079.575,60	2079,58	2,08	→ 10 – 400MHz defineret som 28 V/m (ICNIRP har vist rundet op)
400	27,50	2.005.968,17	2005,97	2,01	
450	29,17	2.256.999,73	2257,00	2,26	
500	30,75	2.508.123,34	2508,12	2,51	
550	32,25	2.758.786,47	2758,79	2,76	
600	33,68	3.008.865,78	3008,87	3,01	
650	35,06	3.260.487,00	3260,49	3,26	
700	36,38	3.510.621,75	3510,62	3,51	
750	37,66	3.762.004,24	3762,00	3,76	
800	38,89	4.011.756,23	4011,76	4,01	
850	40,09	4.263.151,46	4263,15	4,26	
900	41,25	4.513.428,38	4513,43	4,51	
950	42,38	4.764.096,55	4764,10	4,76	
1000	43,48	5.014.616,45	5014,62	5,01	
1050	44,56	5.266.826,53	5266,83	5,27	I dette interval er grænsen frekvensafhængig Udregnes som: $1.375\,x10^{-3}\sqrt{frekvens}$
1100	45,60	5.515.543,77	5515,54	5,52	
1150	46,63	5.767.524,93	5767,52	5,77	
1200	47,63	6.017.551,46	6017,55	6,02	
1250	48,61	6.267.724,40	6267,72	6,27	
1300	49,58	6.520.361,80	6520,36	6,52	
1350	50,52	6.769.948,01	6769,95	6,77	
1400	51,45	7.021.492,04	7021,49	7,02	
1450	52,36	7.272.067,90	7272,07	7,27	
1500	53,25	7.521.385,94	7521,39	7,52	
1550	54,13	7.772.034,22	7772,03	7,77	
1600	55,00	8.023.872,68	8023,87	8,02	
1650	55,85	8.273.799,73	8273,80	8,27	
1700	56,69	8.524.551,99	8524,55	8,52	
1750	57,52	8.775.995,76	8776,00	8,78	
1800	58,34	9.027.998,94	9028,00	9,03	→ Her rammer vi 9 mio µW/m2 ved 1800 MHz som var den højeste GSM frekvens i anvendelse omkring 98'
1850	59,14	9.277.293,37	9277,29	9,28	
1900	59,93	9.526.803,45	9526,80	9,53	
1950	60,72	9.779.624,40	9779,62	9,78	
2000	61,49	10.029.231,03	10029,23	10,03	
300000	61,00	9.870.027,00	9870,03	9,87	→ 2 – 300GHz defineret som 61 V/m (ICNIRP har vist rundet ned)

En række af de i pkt. 1.2 – 1.4 ovennævnte forskningsresultater dokumenterer, at stråling under de pågældende grænseværdier kan være helbredsskadelig for mennesker og/eller dyr, bl.a.:

Balmori og Hallberg 2007, p. 145 – 146.
Blank og Goodman 2011, p. 413.
Jing et al 2012, p. 64.
REFLEX-studiet p. 109 og 223.
Yakymenko et al 2015, p. 186.
Lerchl et al 2015, p. 585.
Falcioni et al. 2018, p. 499.
Russell 2018, p. 485.
Neufeld og Kuster 2018, p. 711.

Dertil kommer, at en række studier er udført med kommercielt tilgængelige produkter inkl. følgende fra pkt. 1.2 – 1.4 ovenfor:

D'Silva et al 2017, p. 6.
Panagopolous 2019, p. 55 (v.sp., nederst).

Pr. 1. september 2018 havde 244 forskere fra over 40 lande, som tilsammen havde offentliggjort over 2.000 forskningsartikler om elektromagnetiske felter, underskrevet en appel til FN og WHO, hvori de opfordrede til, at der etableres en bedre beskyttelse af menneskers (og dyrs) helbred i forhold til brugen af elektromagnetiske installationer såsom 5G.[81] Disse 244 forskere har i appellens afsnit med overskriften *"Inadequate non-ionizing EMF international guidelines"* anført som deres opfattelse, at:

"The various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.
...
It is our opinion that,because the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, they are insufficient to protect public health. "

De 244 forskeres *"...opfattelse..."* er spejlet i den i pkt. 1.2 ovenfor nævnte videnskabelige litteratur.

Pall 2018 konkluderede i sin gennemgang bl.a. følgende om ICNIRPs grænseværdier:

"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." (understreget her)

Europarådet har i resolution 1815 af 2011, pkt. 8.1.2. anbefalet medlemsstaterne følgende:

"8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA[82] principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;"

81 Jf. https://emfscientist.org/index.php/emf-scientist-appeal
82 Står for "As Low As Reasonably Achievable".

2.2. Retsbeskyttelsen af mennesker (menneskerettigheder).

2.2.1. Den Europæiske Menneskerettighedskonvention (EMRK).

Konventionen blev inkorporeret direkte i dansk ret ved lov nr. 285 af 1992, og er således en del af "almindelig" national ret, som kan påberåbes direkte for de danske domstole.

Dertil kommer, at den ifølge Højesterets praksis anvendes på den måde, at andre lovbestemmelser "fortolkes i lyset af" konvention og den dertilhørende praksis.

Det er et generelt fortolkningsprincip ved anvendelsen af bestemmelserne i konventionen, at de skal fortolkes således, at rettighederne indeholdt heri er praktisk anvendelige og effektive, jf. f.eks. Storkammerdom af 27. september 1995 i sagen McCann m.fl. mod Storbritannen, præmis 146:

"146. The Court's approach to the interpretation of Article 2 (art. 2) must be guided by the fact that the object and purpose of the Convention as an instrument for the protection of individual human beings requires that its provisions be interpreted and applied so as to make its safeguards practical and effective (see, inter alia, the Soering v. the United Kingdom judgment of 7 July 1989, Series A no. 161, p. 34, para. 87, and the Loizidou v. Turkey (Preliminary Objections) judgment of 23 March 1995, Series A no. 310, p. 27, para. 72)."

2.2.1.1. Art. 2 – retten til livet og statens positive forpligtelser.

EMRK art. 2 lyder:

*"**Artikel 2.** Ethvert menneskes ret til livet skal beskyttes ved lov. Ingen må forsætligt berøves livet undtagen ved fuldbyrdelse af en dødsdom, afsagt af en domstol i tilfælde, hvor der ved lov er fastsat dødsstraf for den pågældende forbrydelse.*
Stk. 2. Berøvelse af livet betragtes ikke som sket i modstrid med denne artikel, når den er en følge af magtanvendelse, der ikke gå ud over det absolut nødvendige:
a) for at forsvare nogen mod ulovlig vold;
b) for at iværksætte en lovlig anholdelse eller forhindre flugt
fra lovlig frihedsberøvelse;
c) for lovligt at undertrykke optøjer eller opstand."

Det er således alene stk. 1, 1. pkt. samt 2. pkt., 1. led, der har betydning for den retlige problemstilling i nærværende responsum.

EMD har i sin praksis fortolket bestemmelsen således, at den rummer en række materielle, positive forpligtelser (d.v.s.: handlepligter), bl.a. under visse betingelser at hindre, at mennesker dør som følge af forurening, der har været tilladt eller ikke hindret af staten.

Forpligtelserne i henhold til art. 2 skal – henset til vigtigheden af den rettighed, den skal beskytte – fortolkes strengt, jf. f.eks. Storkammerdom af 27. september 1995 i sagen McCann m.fl. mod Storbritannen, præmis 147:

"147. It must also be borne in mind that, as a provision (art. 2) which not only safeguards the right to life but sets out the circumstances when the deprivation of life may be justified, Article 2 (art. 2) ranks as one of the most fundamental provisions in the Convention - indeed one which, in peacetime, admits of no derogation under Article 15 (art. 15). Together with Article 3 (art. 15+3) of the Convention, it also enshrines one of the basic values of the democratic societies making up the Council of Europe (see the above-mentioned Soering judgment, p. 34, para. 88). As such, its provisions must be strictly construed."

I relation til nærværende responsums emne bør sagen Öneryildiz mod Tyrkiet, Storkammerdom af 30. november 2004, fremhæves[83].

Sagen drejede sig om en dødelig eksplosion på en losseplads, der kostede i alt 39 mennesker livet, inkl. flere af klagerens nære familiemedlemmer.

Det blev bl.a. statueret, at staten har en positiv forpligtelse til at opstille retlige og administrative rammer, som er designet til at medføre et effektivt værn imod livsfare.

Præmis 89 – 90 (med yderligere praksishenvisninger):

*"**(a) General principles applicable in the present case**(i) Principles relating to the prevention of infringements of the right to life as a result of dangerous activities: the substantive aspect of Article 2 of the Convention*

89. The positive obligation to take all appropriate steps to safeguard life for the purposes of Article 2 (see paragraph 71 above) entails above all a primary duty on the State to put in place a legislative and administrative framework designed to provide effective deterrence against threats to the right to life (see, for example, mutatis mutandis, Osman, cited above, p. 3159, § 115; Paul and Audrey Edwards, cited above, § 54; İlhan v. Turkey [GC], no. 22277/93, § 91, ECHR 2000-VII; Kılıç v. Turkey, no. 22492/93, § 62, ECHR 2000-III; and Mahmut Kaya v. Turkey, no. 22535/93, § 85, ECHR 2000-III).

90. This obligation indisputably applies in the particular context of dangerous activities, where, in addition, special emphasis must be placed on regulations geared to the special features of the activity in question, particularly with regard to the level of the potential risk to human lives. They must govern the licensing, setting up, operation, security and supervision of the activity and must make it compulsory for all those concerned to take practical measures to ensure the effective protection of citizens whose lives might be endangered by the inherent risks.

Among these preventive measures, particular emphasis should be placed on the public's right to information, as established in the case-law of the Convention institutions. The Grand Chamber agrees with the Chamber (see paragraph 84 of the Chamber judgment) that this right, which has already been recognised under Article 8 (see Guerra and Others, cited above, p. 228, § 60), may also, in principle, be relied on for the protection of the right to life, particularly as this interpretation is supported by current developments in European standards (see paragraph 62 above).

In any event, the relevant regulations must also provide for appropriate procedures, taking into account the technical aspects of the activity in question, for identifying shortcomings in the processes concerned and any errors committed by those responsible at different levels." (understreget her)

Der skal således være effektive hindringer imod trusler overfor retten til livet, inkl. farlige aktiviteter, såsom den i sagen omhandlede drift af losseplads.

Når der er tale om farlige aktiviteter, skal der lægges særligt vægt på regler, som er egnede til de særlige forhold, som den pågældende aktivitet frembyder, og da især under hensyntagen til den potentielle fare for menneskeliv.

Det er således ikke et krav i art. 2s forstand, at der kan påvises en sikker skadevirkning, som kan være eller med sikkerhed er livstruende. Det er tilstrækkeligt for, at den pågældende adfærd falder ind under beskyttelsen af retten til livet, at der kan påvises en risiko for fare for menneskeliv.

Staten skal pålægge aktørerne, og herunder således dem der måtte ønske at opføre den relevante infrastruktur, at der foretages praktiske foranstaltninger, som effektivt beskytter imod de fareelementer, som kan koste mennesker livet.

83 Der kan tillige henvises til f.eks. Kolyadenko m.fl. mod Rusland, præmis 157 – 161.

Henset til det foreliggende forskningsmateriale, jf. pkt. 1.2. ovenfor, er det min vurdering, at staten klart ikke på nuværende tidspunkt har efterkommet sine forpligtelser til at opstille relevante grænseværdier, endsige forbyde aktiviteter, som indebærer en klart dokumenteret risiko for fare for menneskeliv.

Art. 2 finder ikke kun anvendelse, hvor der er tale om en pludselig hændelse, som resulterer i dødsfald. Udsættelse for forurening over en længere periode er også omfattet.

EMD bringer bestemmelsen i anvendelse, uanset om klager er afgået ved døden eller "blot" er i alvorlig livsfare.[84]

Det er ikke afgørende, om det er en offentlig eller privat forurener.

Hvor det må lægges til grund, at det er denne forurening, der har medført dødsfaldet eller livsfaren, og hvor staten ikke har handlet overfor en kendt fare (f.eks. fordi forureningen ikke har været i strid med gældende, national ret, herunder grænseværdier), vil det som udgangspunkt udgøre en krænkelse af retten til livet, jf. i det hele f.eks. dom af 24. juli 2014 i sagen Brincat m.fl. mod Malta, præmis 79 – 81 og 83 (med yderligere praksishenvisninger):

"79. The Court reiterates that Article 2 does not solely concern deaths resulting from the use of unjustified force by agents of the State but also, in the first sentence of its first paragraph, lays down a positive obligation on States to take appropriate steps to safeguard the lives of those within their jurisdiction (see, for example, L.C.B. v. the United Kingdom, 9 June 1998, § 36, Reports 1998-III, and Paul and Audrey Edwards, cited above, § 54).

80. This obligation is construed as applying in the context of any activity, whether public or not, in which the right to life may be at stake, and a fortiori in the case of industrial activities which by their very nature are dangerous, such as the operation of waste-collection sites (see Öneryıldız v. Turkey [GC], no. 48939/99, §71, ECHR 2004-XII) or nuclear testing (see L.C.B. cited above, § 36) or cases concerning toxic emissions from a fertiliser factory (see Guerra and Others v. Italy, 19 February 1998, §§ 60 and 62, Reports 1998-I, although in this case the Court found that it was not necessary to examine the issue under Article 2, it having been examined under Article 8).

81. The Court considers that the same obligations may apply in cases, such as the present one, dealing with exposure to asbestos at a workplace which was run by a public corporation owned and controlled by the Government.

82. The Court reiterates that it has applied Article 2 both where an individual has died (see, for example, Öneryıldız, cited above) and where there was a serious risk of an ensuing death, even if the applicant was alive at the time of the application. Examples include cases where the physical integrity of an applicant was threatened by the action of a third party (see Osman v. the United Kingdom, 28 October 1998, §§ 115-122, Reports 1998-VIII) or as a result of a natural catastrophe which left no doubt as to the existence of a threat to the applicants' physical integrity (see Budayeva and Others v. Russia, nos. 15339/02, 21166/02, 20058/02, 11673/02 and 15343/02, § 146, ECHR 2008 (extracts)). More particularly, the Court has repeatedly examined complaints under Article 2 from persons suffering from serious illnesses. Such cases include G.N. and Others v. Italy (no. 43134/05, 1 December 2009) in which the applicants suffered from the potentially life-threatening disease hepatitis C; L.C.B. v. the United Kingdom (cited above), where the applicant suffered from leukaemia diminishing her chances of survival, Hristozov and Others v. Bulgaria, nos. 47039/11 and 358/12, ECHR 2012 (extracts), concerning applicants suffering from different types of terminal cancer; Karchen

84 Udover Brincat m.fl. mod Malta kan f.eks. henvises til Vilnes m.fl. mod Norge, præmis 220: *"...the applicant was found to be the victim of conduct which by its very nature had put his life at risk, even though he survived. The Court found there that Article 2 was applicable and sees no reason for arriving at a different conclusion in the present case."*

and Others v. France ((dec.), no. 5722/04, 4 March 2008) and Oyal v. Turkey (no. 4864/05, 23 March 2010), in which the applicants had been infected with the HIV virus, which endangered their life; Nitecki v. Poland ((dec.), no. 65653/01, 21 March 2002), in which the applicant suffered from amyotrophic lateral sclerosis; Gheorghe v. Romania ((dec.), no. 19215/04, 22 September 2005), in which the applicant suffered from haemophilia; and De Santis and Olanda v. Italy ((dec.), 35887/11, 9 July 2013) in which the applicant – who was severely disabled – suffered a cerebral haemorrhage as a consequence of an infection acquired in hospital.

83. The medical certification indicated that Mr Attard's death was likely to be a result of asbestos exposure; malignant mesothelioma is known to be a rare cancer associated with asbestos exposure. The Court observes that it has not been contested or denied that Mr Attard worked at Malta Drydocks for more than a decade (1959-1974), during which time he was repeatedly exposed to asbestos. Neither has it been shown that Mr Attard could have been contaminated elsewhere or that he was affected by other factors that could have led to the disease. In these circumstances, and given that Mr Attard has died as a result of his cancer, the Court considers that Article 2 is applicable to the complaint brought by the applicants in application no. 62338/11 relating to the death of the said Mr Attard." (understreget her)

2.2.1.1.1. Delkonklusion.

Set på baggrund af de i pkt. 1.2 ovenfor gennemgåede forskningsresultater er der efter min vurdering ikke nogen rimelig tvivl om, at 5G-systemet udgør en industriel aktivitet, som er farlig for mennesker.

Så længe de nuværende grænseværdier (som meddelt af Sundhedsstyrelsen, jf. pkt. 2.1 ovenfor) anvendes, må livstruende helbredstilstande forårsaget af radiofrekvent elektromagnetisk stråling ved iværksættelse af 5G-systemet ganske klart forventes, hvilket vil være i strid med den danske stats positive forpligtelser efter EMRK art. 2.

Da det må lægges til grund, at risikoen er velkendt af den danske stat, er det endvidere oplagt, at der i relation til 5G-systemet[85] vil skulle indtræde ansvar efter EMRK art. 2, senest når de livstruende helbredstilstande viser sig.

2.2.1.2. Art. 8 – retten til respekt for privat- og familieliv.

EMRK art. 8 lyder:

*"**Artikel 8.** Enhver har ret til respekt for sit privatliv og familieliv, sit hjem og sin korrespondance.*

Stk. 2. Ingen offentlig myndighed må gøre indgreb i udøvelsen af denne ret, medmindre det sker i overensstemmelse med loven og er nødvendigt i et demokratisk samfund af hensyn til den nationale sikkerhed, den offentlige tryghed eller landets økonomiske velfærd, for at forebygge uro eller forbrydelse, for at beskytte sundheden eller sædeligheden eller for at beskytte andres rettigheder og friheder."

Alvorlig miljøforurening kan påvirke individers velbefindende og forhindre dem i at udøve deres privat- og familieliv. En sådan tilstand vil udgøre et indgreb i borgernes rettigheder efter EMRK art. 8, jf. f.eks. Guerra m.fl. v. Italien, Storkammerdom af 19. februar 1998[86].

Præmis 60:

85 Det falder udenfor området for nærværende responsum at fremkomme med tilsvarende vurderinger ang. 2G, 3G og 4G, m.v.

86 Fordi Storkammeret fandt en krænkelse af art. 8, var det ikke nødvendigt at vurdere en klage over krænkelse af retten til livet, jf. EMRK art. 2, p.g.a. de samme kræftdødsfald.

"60. The Court reiterates that severe environmental pollution may affect individuals' well-being and prevent them from enjoying their homes in such a way as to affect their private and family life adversely (see, mutatis mutandis, the López Ostra judgment cited above, p. 54, § 51). In the instant case the applicants waited, right up until the production of fertilisers ceased in 1994, for essential information that would have enabled them to assess the risks they and their families might run if they continued to live at Manfredonia, a town particularly exposed to danger in the event of an accident at the factory.
The Court holds, therefore, that the respondent State did not fulfil its obligation to secure the applicants' right to respect for their private and family life, in breach of Article 8 of the Convention.

There has consequently been a violation of that provision."

De positive forpligtelser i så henseende overlapper i vidt omfang de ovenfor nævnte efter art. 2, jf. f.eks. dom af 20. marts 2008 i sagen Budayeva m.fl. mod Rusland, præmis 133 og dom af 28. februar 2012 i sagen Kolyadenko m.fl. mod Rusland, præmis 216.

Retten til beskyttelse af privat- og familielivet kan bringes i anvendelse, hvor en sygdomstilstand ikke har udviklet sig livsfarligt og heller ikke nødvendigvis gør det. I denne sammenhæng anvendes bestemmelsen af EMD som en slags "mindre i det mere" i forhold til art. 2, jf. ovenfor.

Dette blev f.eks. fremgangsmåden for alle undtagen én klager i dom af 24. juli 2014 i sagen Brincat m.fl. mod Malta, præmis 85:

"85. However, in the context of dangerous activities, the scope of the positive obligations under Article 2 of the Convention largely overlaps with that of those under Article 8 (see Öneryıldız, cited above, §§ 90 and 160). The latter provision has allowed complaints of this nature to be examined where the circumstances were not such as to engage Article 2, but clearly affected a person's family and private life under Article 8 (see López Ostra v. Spain, 9 December 1994, Series A no. 303-C and Guerra and Others, cited above). The Court therefore considers it appropriate to examine the complaints in respect of the remaining applicants under Article 8, which is applicable in the present case (see also Roche v. the United Kingdom [GC], no. 32555/96, §§ 155-156, ECHR 2005-X)."

Der skal foreligge en sygdomstilstand, som har en sådan karakter, at den vil udgøre et indgreb i vedkommendes privat- eller familieliv. Sygdomme som nødvendiggør f.eks. langvarige eller hyppige hospitalsindlæggelser, varige og indgribende funktionsnedsættelser (herunder lidelser såsom EHS, der indebærer overfølsomhed overfor udstyr, der afgiver elektromagnetisk stråling, evt. også i meget små doser), markant nedsat fertilitet eller spontane aborter, m.v., kunne være egnede eksempler.

Hvor en begivenhed eller tilstand indtræffer, som gør indgreb i retten til privat- eller familielivet, vil EMD kunne forventes at påse, om f.eks. de tekniske forudsætninger var til stede for, at begivenheden eller tilstanden ikke indtraf, og om dette burde have været forudset af staten.

Finder EMD, at dette er tilfældet, vil det som udgangspunkt udgøre en krænkelse af statens positive forpligtelser efter art. 8. Der kan fra praksis henvises til dom af 28. februar 2012 i sagen Kolyadenko m.fl. mod Rusland, præmis 215 – 216 (sagen drejede sig om brud på et vandreservoir, som medførte livsfare og skader på menneskers hjem):

"215. The Court further notes that the Government seem to have argued, with reference to the findings of the domestic courts in the applicants' civil cases, that the alleged infringements of their rights under Article 8 and Article 1 of Protocol No. 1 were the result of a natural disaster, in the form of exceptionally heavy rain, which could not have been foreseen, and could therefore not be imputed to the State. The Court cannot accept this argument. It

reiterates in this connection that, being sensitive to the subsidiary nature of its role and cautious about taking on the role of a first-instance tribunal of fact, the Court nevertheless is not bound by the findings of domestic courts and may depart from them where this is rendered unavoidable by the circumstances of a particular case (see, for example, Matyar v. Turkey, no. 23423/94, § 108, 21 February 2002). In the present case, the Court has established in paragraphs 162-165 above that the flooding of 7 August 2001 occurred after the urgent large-scale evacuation of water from the Pionerskoye reservoir, the likelihood and potential consequences of which the authorities should have foreseen. The Court has furthermore established that the main reason for the flood, as confirmed by the expert reports, was the poor state of repair of the Pionerskaya river channel because of the authorities' manifest failure to take measures to keep it clear and in particular to make sure its throughput capacity was adequate in the event of the release of water from the Pionerskoye reservoir. The Court has concluded that this failure as well as the authorities' failure to apply town planning restrictions corresponding to the technical requirements of the exploitation of the reservoir put the lives of those living near it at risk (see paragraphs 168-180 and 185 above).

216. The Court has no doubt that the causal link established between the negligence attributable to the State and the endangering of the lives of those living in the vicinity of the Pionerskoye reservoir also applies to the damage caused to the applicants' homes and property by the flood. Similarly, the resulting infringement amounts not to "interference" but to the breach of a positive obligation, since the State officials and authorities failed to do everything in their power to protect the applicants' rights secured by Article 8 of the Convention and Article 1 of Protocol No. 1 (see Öneryıldız, cited above, § 135). Indeed, the positive obligation under Article 8 and Article 1 of Protocol No. 1 required the national authorities to take the same practical measures as those expected of them in the context of their positive obligation under Article 2 of the Convention (see, mutatis mutandis, Öneryıldız, cited above, § 136). Since it is clear that no such measures were taken, the Court concludes that the Russian authorities failed in their positive obligation to protect the applicants' homes and property.

217. There has, accordingly, been a violation of Article 8 of the Convention and Article 1 of Protocol No. 1 to the Convention in the present case."

EMD foretog ikke en udtrykkelig proportionalitetsafvejning i den pågældende sag, hvilket synes at være konsekvensen af, at staten intet havde foretaget sig, uanset den burde have forudset den skadegørende hændelse og kunne have handlet til afværgelse heraf.

2.2.1.2.1. Delkonklusion.

Der gælder i det væsentlige de samme positive forpligtelser efter art. 8 som art. 2 m.h.t. beskyttelse af mennesker overfor forurening, jf. pkt. 2.2.1.1.1. Allerede derfor må iværksættelsen af 5G-netværket, ved brug af de nugældende grænseværdier, klart forventes at medføre sådanne forstyrrelser af borgeres privat- og familieliv p.g.a. sygdomme, at der tillige vil ske en krænkelse af disse menneskers rettigheder i henhold til art. 8.

2.2.2. FNs børnekonvention.

Konventionen af 20. december 1989 om barnets rettigheder blev ratificeret ved kgl. resolution af 5. juli 1991. Den er ikke inkorporeret i dansk ret, og gældende ret skal så vidt muligt fortolkes i overensstemmelse med de forpligtelser, Danmark har valgt at påtage sig ved ratifikationen (Dette gælder, så længe det ikke er nødvendigt direkte at tilsidesætte en lovbestemmelse i national ret.)

Art. 24, stk. 1 og 2, litra (c), i konventionen lyder:

*"**1.** Deltagerstaterne anerkender barnets ret til at nyde den højest opnåelige sundhedstilstand, adgang til at få sygdomsbehandling og genoprettelse af helbredet. Deltagende stater skal stræbe mod at sikre, at intet barn fratages sin ret til adgang til at opnå sådan behandling og pleje.*

***2.** Deltagerstaterne skal arbejde for fuld gennemførelse af denne ret og især tage passende forholdsregler for:*

- *...*
- *(c) at bekæmpe sygdom og underernæring, herunder inden for rammerne af den primære sundhedspleje, blandt andet ved anvendelse af let tilgængelig teknologi og gennem ydelse af tilstrækkelig og nærende mad og rent drikkevand under hensyntagen til de farer og risici, der er knyttet til forurening af miljøet;*
- *..."*

Statens egentlige forpligtelse går ud på, at den skal "stræbe mod at sikre" sådan behandling og pleje, og at "arbejde for fuld gennemførelse" barnets ret til den højest opnåelige sundhedstilstand.

Den højest opnåelige sundhedstilstand kan ikke indebære, at staten tillader børn (som tilhører en særligt sårbar gruppe også i denne henseende) blive udsat for stråling af helbredsskadelig karakter eller styrke.

Der foreligger videnskabelig dokumentation for, at en etablering af 5G-systemet, der vil indebære udsættelse for dels kraftigere og dels mere farlig[87] radiofrekvent elektromagnetisk stråling end de allerede etablerede 2G-, 3G- og 4G-systemer (som ifølge den foreliggende dokumentation i sig selv er skadegørende eller indebærer en risiko herfor), i sin nuværende form, jf. pkt. 1.1. ovenfor, klart forventeligt vil være direkte helbredsskadelig og indebære risiko for skader, og som sådan i strid med Danmarks forpligtelser efter art. 24 i FNs børnekonvention.

FNs børnekomité, som også træffer afgørelse i konkrete klagesager, har udstedt en "general comment" nr. 15 i 2013, som er retningslinjer for, hvorledes komitéen fortolker konventionens art. 24.

Det fremgår pkt. III.A, om artiklens normative indhold, at:

"The notion of "the highest attainable standard of health" takes into account both the child's biological, social, cultural and economic preconditions and the State's available resources, supplemented by resources made available by other sources, including nongovernmental organizations, the international community and the private sector.

Children's right to health contains a set of freedoms and entitlements. ... The entitlements include access to a range of facilities, goods, services and conditions that provide equality of opportunity for every child to enjoy the highest attainable standard of health." (understreget

87 Dele af den stråling, der ifølge det foreliggende vil blive udsendt fra 5G-systemet, vil have en mindre styrke, men vil p.g.a. den øvrige karakteristika ikke desto mindre være farligere end den nuværende fra 2G-, 3G- og 4G-systemerne. Se Kuster et al (2018) i pkt. 1.2.2.1.3. ovenfor.

her)

Teleselskaberne har i forvejen stillet effektive kommunikationsmidler til rådighed, som ikke indebærer en implementering 5G-systemet.

Yderligere om stk. 2, litra (c), ang. forurening af miljøet har komitéen anført følgende, jf. ibid., s. 6 – 7:

"States should take measures to address the dangers and risks that local environmental pollution poses to children's health in all settings. ... States should regulate and monitor the environmental impact of business activities that <u>may</u> compromise children's right to health,..." (understreget her)

Formuleringen "may compromise" indikerer kraftigt, at komitéen anvender et forsigtighedsprincip, og at konstateringen af en risiko er tilstrækkelig til at staten skal regulere og monitorere sådanne aktiviteter.

Ud fra en formålsfortolkning må dette indebære, at hensynet til børns helbred (der i sig selv må antages at veje særdeles tungt, særligt overfor økonomiske interesser) skal føre til, at staten forbyder former for forurening, som kan skade børns helbred. Dette vil i henhold til den foreliggende videnskabelige dokumentation indebære, at børnekonventionen er til hinder for iværksættelse af 5G-systemet, hvis det blot skal overholde de af ICNIRP anbefalede grænseværdier.

Der foreligger kun én afgørelse fra FNs børnekomité, der vedrører art. 24 (kommunikésagsnr. 35/2017). Sagen, der ikke er indholdsmæssigt beskrevet på komitéens hjemmeside, ses ikke ud fra de sparsomme beskrivelser (flygtningebarn) at have relevans for nærværende responsums emne.

Der er ikke taget stilling til spørgsmålet i national, dansk ret.

Der er således ikke en autoritativ retskilde, som kan bekræfte ovenstående fortolkning.

<u>2.2.2.1. Delkonklusion.</u>

Ud fra en fortolkning af FNs børnekonventions ordlyd og formål, sammenholdt med den foreliggende videnskabelige dokumentation for såvel skadevirkninger som skaderisici, er det min vurdering, at en aktivering af 5G-systemet, som det foreligger beskrevet, jf. pkt. 1.1. ovenfor, vil være i strid med den danske stats forpligtelser efter konventionens art. 24.

2.3. Miljøretlige regler.

2.3.1. Forsigtighedsprincippet i EU-retten.

Det EU-retlige forsigtighedsprincip er i dag at finde i Traktaten om den Europæiske Unions Funktionsmåde (TFEU) art. 191, stk. 2:

"Unionens politik på miljøområdet tager sigte på et højt beskyttelsesniveau under hensyntagen til de forskelligartede forhold, der gør sig gældende i de forskellige områder i Unionen. Den bygger på forsigtighedsprincippet og princippet om forebyggende indsats , ..."

I henhold til Europa-Kommissionens meddelelse af 20. februar 2000 om forsigtighedsprincippet, s. 9 – 10, kan det anvendes, *"...hvor de videnskabelige data er utilstrækkelige, foreløbige eller usikre, og den indledende objektive videnskabelige undersøgelse tyder på, at der er rimelig grund til bekymring for, at mulige farlige følger for miljø samt menneskers, dyrs og planters sundhed ikke stemmer overens med det valgte beskyttelsesniveau."*

For så vidt angår nærværende responsums emneområde, vil princippet klart være relevant at bringe i anvendelse, hvis det måtte lægges til grund, at der ikke foreligger tilstrækkelig videnskabelig sikkerhed for at konkludere, at radiofrekvent elektromagnetisk stråling indenfor de p.t. anvendte grænseværdier, jf. pkt. 2.1. ovenfor, vil være helbredsskadeligt for (in casu) fugle, dyr og planter omfattet af de i det følgende behandlede miljøretlige direktiver.

2.3.2. Fuglebeskyttelsesdirektivet.

EU-direktivet "om beskyttelse af vilde fugle", kodificeret udgave af 30. november 2009, indeholder en række forpligtelser for EU-lande til at "træffe alle nødvendige foranstaltninger" til "beskyttelse" (herunder bevarelse) af fugle, deres æg, reder og levesteder, jf. art. 1.

De for nærværende responsums problemstilling relevante bestemmelser i direktivet er på det foreliggende grundlag følgende (understregninger indsat her), hvortil der er indsat løbende kommentarer:

Art. 1:

"1. Dette direktiv vedrører beskyttelse af alle de fuglearter, som i vild tilstand har deres naturlige ophold på medlemsstaternes område i Europa, hvor traktaten finder anvendelse. Det omhandler bevarelse, forvaltning og regulering af de pågældende arter og fastsætter regler for udnyttelse af de nævnte arter.
2. Dette direktiv gælder for fugle samt for deres æg, reder og levesteder."

Dette vil sige, at direktivbeskyttelsen omfatter enhver vild fugleart, og deres levesteder.

Art. 2:

"Medlemsstaterne træffer alle nødvendige foranstaltninger til at opretholde eller tilpasse bestanden af samtlige de i artikel 1 omhandlede arter på et niveau, som især imødekommer økologiske, videnskabelige og kulturelle krav og samtidig tilgodeser økonomiske og rekreative hensyn."

Art. 3, stk. 1:

"Medlemsstaterne træffer ud fra de i artikel 2 omhandlede hensyn alle nødvendige foranstaltninger for at beskytte, opretholde eller genskabe tilstrækkeligt forskelligartede og vidtstrakte levesteder for alle de i artikel 1 omhandlede fuglearter."

De i pkt. 1.2.3.1. ovenfor i øvrigt citerede undersøgelser kan i princippet være relevante på samtlige fugle omfattet af direktivet.

Henvisningen til art. 2 giver medlemsstaterne en vis skønsmæssig beføjelse til, hvorledes hensynene i art. 3 skal varetages, uanset det er klart udtrykt i art. 2, at de økonomiske hensyn ikke må være de mest tungtvejende.

Det mest sandsynlige baseret på den i pkt. 1.2.3.1. ovenfor gennemgåede forskning er, at en indførelse af 5G-systemet i områder, hvor fuglene har deres levesteder, vil udgøre en overtrædelse af denne bestemmelse.

Art. 4, stk. 1 og 4:

"1. For arter, som er anført i bilag I, træffes der særlige beskyttelsesforanstaltninger med hensyn til deres levesteder for at sikre, at de kan overleve og formere sig i deres udbredelsesområde.
I denne forbindelse tages der hensyn til:

a) arter, der trues af udslettelse

b) arter, der er følsomme over for bestemte ændringer af deres levesteder

…

4. Medlemsstaterne træffer egnede foranstaltninger med henblik på i de i stk. 1 og 2 nævnte beskyttede områder at undgå forurening eller forringelse af levestederne samt forstyrrelse af fuglene, i det omfang en sådan forurening, forringelse eller forstyrrelse har væsentlig betydning for formålet med denne artikel. Medlemsstaterne bestræber sig på at undgå forurening eller forringelse af levesteder også uden for disse beskyttede områder."

Der er tale om en vidtfavnende beskyttelse, som bl.a. omfatter den hvide stork, der var genstand for den videnskabelige undersøgelse, der er refereret til ovenfor pkt. 1.2.3.1. (Balmori 2005). Undersøgelsen påviste bl.a., at der var forskelle i mængden af afkom, og at der var en sammenhæng med nærheden til telemaster, og at nogle reder således var helt uden afkom. Undersøgelsens resultater var endvidere underbygget af eksperimentelle studier på fugleæg.

De i pkt. 1.2.3.1. ovenfor i øvrigt citerede undersøgelser kan i princippet være relevante på samtlige fugle omfattet af bilag I.

Da undersøgelserne samtidig udgør en bastant, videnskabelig dokumentation for, at radiofrekvent elektromagnetisk stråling både kan reducere afkommet, mutere det og påføre skader på levende fugle, herunder hindre deres navigationsevne, er det min vurdering, at der ved indførelsen af den påtænkte 5G-system sker en overtrædelse af Danmarks forpligtelser i henhold til fuglebeskyttelsesdirektivets art. 4, stk. 1, idet det ikke "sikres", at de beskyttede fugle kan overleve og formere sig.

Danmark vil ligeledes heller ikke have truffet egnede foranstaltninger til at undgå forurening eller forringelse af fuglenes levesteder eller forstyrrelse af fuglene, uanset dette vil have væsentlig betydning for formålet art. 4.

Der vil heller ikke være sket nogen bestræbelse på at undgå forurening eller forringelse af levesteder for disse fugle også uden for de beskyttede områder, jf. stk. 4, in fine.

Væsentlig nedbringelse af bestanden af dyr, som insektædende fugle skal kunne leve af, jf. pkt. 1.2.3.2. ovenfor, må ligeledes forventes at have den betydning, at fuglenes levesteder forstyrres i en sådan grad, at det vil have væsentlig betydning for deres overlevelsesmuligheder.

Art. 5, stk. 1, litra a), b) og d):

"Med forbehold af artikel 7 og 9 træffer medlemsstaterne de nødvendige foranstaltninger til at indføre en generel ordning til beskyttelse af alle de i artikel 1 omhandlede fuglearter, herunder især forbud mod:

a) forsætligt at dræbe eller indfange dem, uanset hvilken metode der anvendes

b) forsætligt at ødelægge eller beskadige deres reder og æg samt fjerne deres reder

...

d) forsætligt at forstyrre fuglene navnlig i yngletiden, i det omfang, en sådan forstyrrelse har væsentlig betydning for formålet med dette direktiv

..."

Artikel 7, der drejer sig om jagt, og artikel 9, der indeholder en række undtagelsesbestemmelser uden betydning for etablering af 5G-netværk, er ikke relevante i nærværende sammenhæng.

Artiklen forpligter medlemsstaterne til at etablere generelle beskyttelsesordninger til beskyttelse af de i artikel 1 omhandlede fugle, og det er særligt fremhævet, at der skal være forbud imod bl.a. forsætligt drab på fugle, uanset hvilken metode, der anvendes, og forsætligt at ødelægge eller beskadige reder og æg.

Uanset det ikke er formålet med opstillingen af f.eks. 5G-telemaster at dræbe fugle eller at ødelægge deres reder og æg, er dette en klar og forudsigelig effekt af, hvis de opstilles i tilpas nærhed af fuglenes levesteder.

Art. 8, stk. 1:

"For så vidt angår jagt på, fangst af eller drab på fugle i overensstemmelse med dette direktiv forbyder medlemsstaterne anvendelse af alle midler, indretninger eller metoder til massefangst eller -drab eller ikke-selektiv fangst eller drab, som kan medføre, at en art forsvinder lokalt; de forbyder herunder navnlig anvendelse af de i bilag IV, litra a), nævnte midler, indretninger og metoder."

Art. 8 omhandler alene drab, der i forvejen foretages i overensstemmelse med direktivet.

Det bemærkelsesværdige ved formuleringen er, at forbuddet omfatter ikke-selektiv drab, som kan medføre, at en art forsvinder lokalt. D.v.s. at bestemmelsen er risikobaseret, således at den blotte fare for, at indretningen eller metoden kan medføre, at en art forsvinder lokalt, er tilstrækkelig til, at den pågældende indretning eller metode skal forbydes. Der fremgår ikke en sådan direkte udtrykt risikobaseret beskyttelse af de i øvrigt ovenfor citerede artikler. I stedet

anvendes udtryk såsom ”beskyttelse”, ”alle nødvendige foranstaltninger”, ”sikre, at de kan overleve”, o.lign. Disse anderledes formuleringer lægger i større eller mindre grad op til, at der i disse andre bestemmelser ligeledes skal indfortolkes såvel en risikobaseret beskyttelse som anvendelse af forsigtighedsprincippet. Formuleringen af art. 8, der oven i købet vedrører arter omfattet af den lavere rangerende beskyttelse i direktivets ”bilag II”, underbygger en sådan fortolkning af de øvrige bestemmelser, hvilket endvidere vil være i god overensstemmelse med direktivets beskyttelsesformål.

2.3.2.1. Delkonklusion.

Det er på baggrund af den i pkt. 1.2 ovenfor refererede forskning min vurdering, at hvis 5G-systemet aktiveres, så vil det medføre eller kunne medføre væsentlig skade på de beskyttede vildfugle, der har deres levesteder tilstrækkeligt tæt på f.eks. en telemast.

Denne virkning vil blive forstærket af, at disse installationer påviseligt også har betydelig skadevirkning på de dyr, som insektædende fugle skal leve af, jf. pkt. 1.2.3.2. ovenfor.

Det må følgelig også være min vurdering, at aktiveringen heraf vil udgøre en overtrædelse af Danmarks forpligtelser efter fuglebeskyttelsesdirektivets art. 4 og 5, samt formentlig art. 3.

Hvis det lagdes til grund, at der fortsat består en videnskabelig usikkerhed, bør anvendelsen af forsigtighedsprincippet føre til samme delkonklusioner.

2.3.3. Habitat-direktivet

EU-direktivet "om bevaring af naturtyper samt vilde dyr og planter" af 21. maj 1992 indeholder en række forpligtelser for EU-lande til at "sikre" opretholdelse af gunstig bevaringsstatus for de af direktivet omfattede naturtyper og levesteder for beskyttede arter, og at "sikre sig" ikke at skade de beskyttede lokaliteters integritet eller at "forstyrre" arterne på en måde, som har betydelige konsekvenser for direktivets formål.

Det er således ikke alle dyr og planter, der er omfattet af beskyttelsen. Imidlertid kan den i pkt. 1.3. ovenfor omtalte forskning ikke tages til indtægt for, at den alene finder anvendelse på de specifikke undersøgte arter. Dette gør sig særligt gældende al den stund mange af dem vedrører forstyrrelse af almene mekanismer, ligesom det i flere tilfælde er udtrykkeligt anført, at de undersøgte arter (f.eks. bananfluer) vil udgøre "gode indikatorer".

De for nærværende responsums problemstilling relevante bestemmelser i direktivet er på det foreliggende grundlag følgende (understregninger indsat her), hvortil der er indsat løbende kommentarer:

Art. 2:

"1. Formålet med dette direktiv er at bidrage til at sikre den biologiske diversitet ved at bevare naturtyperne samt de vilde dyr og planter inden for det af medlemsstaternes område i Europa, hvor Traktaten finder anvendelse.

2. De foranstaltninger, der træffes efter dette direktiv, tager sigte på at opretholde eller genoprette en gunstig bevaringsstatus for naturtyper samt vilde dyre- og plantearter af fællesskabsbetydning.

3. De foranstaltninger, der træffes efter dette direktiv, tager hensyn til de økonomiske, sociale og kulturelle behov og til regionale og lokale særpræg."

Art. 3, stk. 1:

"Der oprettes et sammenhængende europæisk økologisk net af særlige bevaringsområder under betegnelsen Natura 2000. Dette net, der består af lokaliteter, der omfatter de naturtyper, der er nævnt i bilag I, og levesteder for de arter, der er nævnt i bilag II, skal sikre opretholdelse eller i givet fald genopretning af en gunstig bevaringsstatus for de pågældende naturtyper og levestederne for de pågældende arter i deres naturlige udbredelsesområde.

Natura 2000-nettet omfatter ligeledes de særligt beskyttede områder, som medlemsstaterne har udlagt i medfør af direktiv 79/409/EØF."

I henhold til denne bestemmelse skal staterne "sikre" opretholdelse/genopretning af en gunstig bevaringsstatus for levestederne for de af bilag II omfattede arter. Dette gælder bl.a. den hvide stork og de flagermus, som det fremgår af afsnit

Når der henses til den videnskabelige dokumentation for skadevirkningerne forekommer dette ikke at være muligt.

Dertil kommer, at en evt. (tilstrækkeligt videnskabeligt funderet) usikkerhed vil skulle afklares.

Art. 6, stk. 2 til 4:

"2. Medlemsstaterne træffer passende foranstaltninger for at undgå forringelse af naturtyperne og levestederne for arterne i de særlige bevaringsområder samt forstyrrelser af de arter, for hvilke områderne er udpeget, for så vidt disse forstyrrelser har betydelige konsekvenser for

dette direktivs målsætninger.

3. Alle planer eller projekter, der ikke er direkte forbundet med eller nødvendige for lokalitetens forvaltning, men som i sig selv eller i forbindelse med andre planer og projekter kan påvirke en sådan lokalitet væsentligt, vurderes med hensyn til deres virkninger på lokaliteten under hensyn til bevaringsmålsætningerne for denne. På baggrund af konklusionerne af vurderingen af virkningerne på lokaliteten, og med forbehold af stk. 4, giver de kompetente nationale myndigheder først deres tilslutning til en plan eller et projekt, når de har sikret sig, at den/det ikke skader lokalitetens integritet, og når de - hvis det anses for nødvendigt - har hørt offentligheden.

4. Hvis en plan eller et projekt, på trods af at virkningerne på lokaliteten vurderes negativt, alligevel skal gennemføres af bydende nødvendige hensyn til væsentlige samfundsinteresser, herunder af social eller økonomisk art, fordi der ikke findes nogen alternativ løsning, træffer medlemsstaten alle nødvendige kompensationsforanstaltninger for at sikre, at den globale sammenhæng i Natura 2000 beskyttes. Medlemsstaten underretter Kommissionen om, hvilke kompensationsforanstaltninger der træffes.
Hvis der er tale om en lokalitet med en prioriteret naturtype og/eller en prioriteret art, kan der alene henvises til hensynet til menneskers sundhed og den offentlige sikkerhed eller væsentlige gavnlige virkninger på miljøet, eller, efter udtalelse fra Kommissionen, andre bydende nødvendige hensyn til væsentlige samfundsinteresser."

Særligt ad stk. 3:

Forpligtelsen går ud på, at myndighederne skal sikre sig, at et projekt m.v. (f.eks. indførelse af 5G-systemet ved opførelse af nye telemaster eller opsættelse af 5G-sendere på eksisterende telemaster) ikke skader lokalitetens integritet.

Når der henses til den videnskabelige dokumentation for skadevirkningerne forekommer dette ikke at være muligt.

Dertil kommer, at en evt. (tilstrækkeligt videnskabeligt funderet) usikkerhed vil skulle afklares.

Særligt ad stk. 4:

I og med, at Sundhedsstyrelsen ikke anerkender henholdsvis skadevirkninger og -risici som gennemgået ovenfor, er der heller ikke grundlag for at antage, at staten har truffet "alle nødvendige kompensationsforanstaltninger", jf. stk. 4, hvis det må lægges til grund, at forskningen i pkt. 1.2 ovenfor er retvisende.

For så vidt angår lokaliteter med en prioriteret naturtype og/eller prioriteret art, finder ingen af de særlige undtagelser anvendelse. Etablering af et 5G-netværk har således ikke nogen væsentlig gavnlig virkning for menneskers sundhed, den offentlige sikkerhed eller miljøet, herunder når der sammenlignes med andre teknologiske muligheder. For så vidt angår hensynet til menneskers sundhed, er det tværtimod klart, at det vil have en skadelig virkning. Der foreligger heller ikke nogen udtalelse fra Kommissionen desangående.

Art. 7:

"Forpligtelserne i artikel 6, stk. 2, 3 og 4, i nærværende direktiv træder i stedet for forpligtelserne i artikel 4, stk. 4, første punktum, i direktiv 79/409/EØF, for så vidt angår de områder, der er udlagt som særligt beskyttede efter artikel 4, stk. 1, eller tilsvarende anerkendt efter artikel 4, stk. 2, deri, fra datoen for nærværende direktivs iværksættelse eller fra den dato, hvor en medlemsstat har udlagt eller anerkendt områderne efter direktiv 79/409/EØF, hvis denne dato er senere."

Direktiv 79/409/EØF er det ovenfor omtalte fuglebeskyttelsesdirektiv (nu: kodificeret ved direktiv 2009/147/EF). Det nye fuglebeskyttelsesdirektiv er også omfattet af henvisningsbestemmelsen i habitatdirektivets art. 7, jf. fuglebeskyttelsesdirektivets art. 18, stk. 2.

Art. 12, stk. 1, 3 og 4:

"1. Medlemsstaterne træffer de nødvendige foranstaltninger til at indføre en streng beskyttelsesordning i det naturlige udbredelsesområde for de dyrearter, der er nævnt i bilag IV, litra a), med forbud mod:
a) alle former for forsætlig indfangning eller drab af enheder af disse arter i naturen

b) forsætlig forstyrrelse af disse arter, i særdeleshed i perioder, hvor dyrene yngler, udviser yngelpleje, overvintrer eller vandrer

c) forsætlig ødelæggelse eller indsamling af æg i naturen

d) beskadigelse eller ødelæggelse af yngle- eller rasteområder.

...

3. Forbuddene i stk. 1, litra a) og b), samt stk. 2 gælder for alle livsstadier hos de dyr, der er omfattet af denne artikel.

4. Medlemsstaterne indfører en ordning med tilsyn med uforsætlig indfangning eller drab af de dyrearter, der er nævnt i bilag IV, litra a). På grundlag af de indhentede oplysninger gennemfører medlemsstaterne de yderligere undersøgelser eller træffer de bevaringsforanstaltninger, der er nødvendige for at sikre, at uforsætlig indfangning eller drab ikke får en væsentlig negativ virkning for de pågældende dyrearter."

Uanset det ikke er formålet med opstillingen af f.eks. 5G-telemaster at dræbe dyr eller at ødelægge deres reder og æg, er dette en klar og forudsigelig effekt af, hvis de opstilles i tilpas nærhed af de beskyttede dyrs levesteder.

Beskyttelsen i habitatdirektivet gælder udtrykkeligt for alle livsstadier hos de omfattede dyr, hvor det i fuglebeskyttelsesdirektivet er anført, at beskyttelsen gælder fugle, deres reder og æg. Der er næppe tilsigtet nogen forskellig anvendelse af bestemmelserne, henset til, at et "hul" i beskyttelsen af de pågældende arter ville kunne gøre reglerne ineffektive.

Art. 13, stk. 1, litra a) og stk. 2:

"1. Medlemsstaterne træffer de nødvendige foranstaltninger for at indføre en streng beskyttelsesordning for de plantearter, der er nævnt i bilag IV, litra b), med forbud mod:
a) forsætlig plukning, indsamling, afskæring, oprivning med rod eller ødelæggelse af disse vildtvoksende planter i naturen

¨...

2. Forbuddene i stk. 1, litra a) og b), gælder for alle livsstadier for de planter, der er omfattet af denne artikel."

Art. 15:

"Ved indfangning eller drab af de vilde dyrearter, som er nævnt i bilag V, litra a), og ved anvendelse efter artikel 16 af fravigelser i forbindelse med indsamling, indfangning eller drab af de arter, der er nævnt i bilag IV, litra a), forbyder medlemsstaterne anvendelse af alle ikke-selektive midler, der lokalt kan medføre, at bestande af en art forsvinder eller udsættes for

alvorlige forstyrrelser, navnlig
a) anvendelse af de indfangnings- og drabsmetoder, der er nævnt i bilag VI b)
...”

I bilag VI (rettelig er der tale om bilag VI a), ikke b)) er bl.a. nævnt *”...elektriske og elektroniske apparater, som kan dræbe eller lamme...”* Det er ikke afklaret, om der i denne definition kan inkluderes apparater såsom telemaster, antenner, m.v., som over en længere eller meget lang periode som kan gøre dødelig skade på de af direktivet omfattede dyr. Det kan ikke udelukkes, uanset der med selve formuleringen formentlig er ment apparater, som mere umiddelbart kan dræbe eller lamme. Med anvendelsen af udtrykket ”navnlig” i selve art. 15 anføres imidlertid, at de i bilag VI a) nævnte midler ikke er udtømmende, og at forbuddet omfatter ethvert middel, som lokalt vil kunne medføre, at en artsbestand forsvinder eller forstyrres alvorligt.

Det forekommer således oplagt, at påtænkte 5G-installationer er i strid med selve art. 15, uanset de evt. også kan henføres til de specifikke apparater i bilag VI a).

Art. 16, stk. 1, litra c):

”1. Hvis der ikke findes nogen anden brugbar løsning, og fravigelsen ikke hindrer opretholdelse af den pågældende bestands bevaringsstatus i dens naturlige udbredelsesområde, kan medlemsstaterne fravige bestemmelserne i artikel 12, 13, 14 og 15, litra a) og b):
...
c) af hensyn til den offentlige sundhed og sikkerhed eller af andre bydende nødvendige hensyn til væsentlige samfundsinteresser, herunder af social og økonomisk art, og hensyn til væsentlige gavnlige virkninger på miljøet
...”

Der findes andre, brugbare løsninger.

Dertil kommer, at det på baggrund af det i pkt. 1.2 behandlede forskningsmateriale må være min vurdering, at en fravigelse af beskyttelsen med stor sandsynlighed over tid vil kunne hindre opretholdelse af bestandene.

2.3.3.1. Delkonklusion.

Det er på baggrund af den i pkt. 1.2 ovenfor refererede forskning min vurdering, at hvis 5G-systemet aktiveres, så vil det medføre eller kunne medføre væsentlig skade på de beskyttede dyre- og plantearter, der har deres levesteder tilstrækkeligt tæt på f.eks. en telemast.

Denne virkning vil blive forstærket af, at disse installationer påviseligt også har betydelig skadevirkning på insektædere, jf. pkt. 1.2.3.2. ovenfor.

Det må følgelig også være min vurdering, at aktiveringen heraf vil udgøre en overtrædelse af Danmarks forpligtelser efter habitatdirektivets art. 6, stk. 2 – 4.

Hvis det lagdes til grund, at der fortsat består en videnskabelig usikkerhed, bør anvendelsen af forsigtighedsprincippet føre til samme delkonklusioner.

2.4. Bern-konventionen

Konvention af 19. september 1979 "om beskyttelse af Europas vilde dyr og planter samt naturlige levesteder" (herefter: *"Bern-konventionen"*) blev ratificeret af Danmark i henhold til kongelig resolution af 5. juli 1982. Den er ikke inkorporeret i dansk ret, og gældende ret skal så vidt muligt fortolkes i overensstemmelse med de forpligtelser, Danmark har valgt at påtage sig ved ratifikationen (Dette gælder, så længe det ikke er nødvendigt direkte at tilsidesætte en lovbestemmelse i national ret.)

Konventionen indeholder bl.a. en række bestemmelser, hvormed de kontraherende stater har forpligtet sig til at *"...sikre..."* beskyttelsen af en række vilde dyr og planter, således at bestanden opretholdes, samtidig med, at der "tages hensyn til de økonomiske behov", alt jf. art. 2.

De for nærværende responsums problemstilling relevante bestemmelser i konventionen er på det foreliggende grundlag følgende (understregninger indsat her), hvortil der er indsat løbende kommentarer:

Art. 2:
"De kontraherende parter skal træffe de nødvendige foranstaltninger for at opretholde bestanden af vilde dyr og planter på, eller at tilpasse den til, et niveau, som svarer til de særlige økologiske, videnskabelige og kulturelle behov, idet der samtidig tages hensyn til de økonomiske og rekreative behov og behov hos underarter, geografiske racer eller former, som trues lokalt."

Art. 3, stk. 2:
"Hver kontraherende part forpligter sig til i sin planlægnings- og egnsudviklingspolitik og i sine foranstaltninger mod forurening at tage hensyn til beskyttelsen af vilde dyr og planter."

Art. 4, stk. 1 til 3:
"1. Hver kontraherende part skal træffe passende og nødvendige lovgivningsmæssige og administrative foranstaltninger for at sikre beskyttelsen af levesteder for vilde dyre- og plantearter, navnlig de i liste I og II anførte, og beskyttelsen af truede naturlige levesteder.

2. De kontraherende parter skal i deres planlægnings- og egnsudviklingspolitik tage hensyn til beskyttelsesbehovene i de områder, som skal beskyttes i henhold til stk. 1, således at man undgår eller så vidt muligt begrænser en hvilken som helst forringelse af sådanne områder.

3. De kontraherende parter forpligter sig til at tage særligt hensyn til beskyttelsen af områder, som er af betydning for de migrerende arter, der er anført i liste II og III, og som har en passende beliggenhed i forhold til migrationsruter som overvintringsområder, rastepladser, fourageringspladser, yngleområder eller fældningsområder."

Art. 5, 1. pkt.:
"Hver kontraherende part skal træffe passende og nødvendige lovgivningsmæssige og administrative foranstaltninger for at sikre en særlig beskyttelse af de vilde plantearter, som er anført i liste I. ..."

Art. 6:
"Hver kontraherende part skal træffe passende og nødvendige lovgivningsmæssige og administrative foranstaltninger for at sikre en særlig beskyttelse af de vilde dyrearter, som er anført i liste II. Navnlig skal der i forbindelse med disse arter være forbud mod følgende:

-a.- alle former for forsætlig indfangning og fangenskabshold samt forsætlig ihjelslagning,

-b. forsætlig skade på eller ødelæggelse af yngle- og rastepladser,

-c.- forsætlig forstyrrelse af vilde dyr, i særdeleshed i perioder, når de yngler, udviser ynglepleje og overvintrer, for så vidt som forstyrrelsen måtte være væsentlig i forbindelse med denne konventions målsætninger,

…"

Art. 7, stk. 1 og 2:
"Hver kontraherende part skal træffe passende og nødvendige lovgivningsmæssige og administrative foranstaltninger for at sikre beskyttelse af de vilde dyrearter, som er anført i liste III.

Enhver udnyttelse af de vilde dyrearter, som er anført i liste III, skal under hensyntagen til bestemmelserne i artikel 2 reguleres med henblik på at forebygge, at bestandene bliver truet."

Til art. 4 til 7:

Den forudsatte "sikring" af beskyttelsen af de i liste I og II anførte arter er efter min vurdering på baggrund af den i pkt. 1.2. ovenfor gennemgåede forskning sammenholdt med de p.t. værende grænseværdier ikke mulig ved indførelsen af det påtænkte 5G-system.

Dette er særligt tydeligt for så vidt angår forpligtelsen i art. 4, stk. 2, til at undgå eller så vidt muligt begrænse en hvilken som helst forringelse af sådanne områder.

Art. 8:
"I forbindelse med indfangning eller ihjelslagning af de vilde dyrearter, som er anført i liste III, og i tilfælde af benyttelsen af undtagelser i medfør af artikel 9 på de arter, som er anført i liste II, skal de kontraherende parter forbyde anvendelsen af ikke-selektive fangst- og drabsmetoder og af alle midler, som vil kunne medføre, at bestande af en art forsvinder i et lokalt område eller forstyrres alvorligt, samt navnlig anvendelsen af de midler, som er opregnet i liste IV."

Bestemmelsen er formuleret som risikobaseret, således at forbuddet gælder den blotte mulighed for, at den ikke-selektive drabsmetode eller middel som vil kunne medføre bestandenes forsvinden. (Det er således særligt oplagt at bringe forsigtighedsprincippet i anvendelse, hvis det lægges til grund, at der fortsat foreligger videnskabelig uklarhed.)

Endvidere indeholder art. 8 en reference til en *"Liste IV"* med angivelse af forbudte midler og metoder til ihjelslagning, m.v., af vilde dyr omfattet af konventionens *"Liste III*" (jf. art. 7 ovenfor). Listen omfatter bl.a. et forbud imod at anvende *"Elektriske apparater, som kan dræbe eller lamme"* i forhold til både pattedyr og fugle. Det er ikke afklaret, om der i denne definition kan inkluderes apparater såsom telemaster, antenner, m.v., som over en længere eller meget lang periode som kan gøre dødelig skade på de i liste III omfattede dyr. Det kan ikke udelukkes, uanset der med selve formuleringen formentlig er ment apparater, som mere umiddelbart kan dræbe eller lamme. Med anvendelsen af udtrykket "navnlig" i selve art. 8 anføres imidlertid, at de i liste IV nævnte midler og metoder ikke er udtømmende, og at forbuddet omfatter ethvert middel, som vil kunne medføre at en artsbestand forsvinder eller forstyrres alvorligt i det lokale område.

Art. 9, stk. 1:
"Hver kontraherende part kan gøre undtagelser fra bestemmelserne i artiklerne 4, 5, 6 og 7, og fra forbudet mod anvendelse af de midler, der er nævnt i artikel 8, hvis der ikke findes andre tilfredsstillende løsninger, og hvis undtagelsen ikke er til skade for den berørte bestands overlevelse:

- for at beskytte dyr og planter,

- for at forhindre alvorlig skade på afgrøder, besætning, skove, fiskeri, vand og andre former for ejendom,

- af hensyn til den offentlige sundhed og sikkerhed, sikkerheden for luftfarten eller andre offentlige interesser, der måtte gå forud,

..."

Der findes andre tilfredsstillende løsninger.

Dertil kommer, at det på baggrund af det i pkt. 1.2 behandlede forskningsmateriale må være min vurdering, at en fravigelse af beskyttelsen med stor sandsynlighed vil være til skade for bestandenes overlevelse.

2.4.1. Delkonklusion.

Den forudsatte "sikring" af beskyttelsen af de i liste I og II anførte arter er efter min vurdering på baggrund af den i pkt. 1.2. ovenfor gennemgåede forskning sammenholdt med de p.t. værende grænseværdier ikke mulig ved indførelsen af det påtænkte 5G-system.

Det forekommer sandsynligt, at beskyttelsen efter art. 8 af "liste III-arter" ligeledes ikke vil blive respekteret ved etableringen af 5G-systemet sammenholdt med de p.t. værende grænseværdier.

2.5. Bonn-konventionen

Konvention af 23. juni 1979 "om beskyttelse af migrerende arter af vilde dyr" (herefter: *"Bonn-konventionen"*) blev ratificeret af Danmark i henhold til kongelig resolution af 5. juli 1982, samme dato som Bern-konventionen ovenfor. Den er ikke inkorporeret i dansk ret, og gældende ret skal så vidt muligt fortolkes i overensstemmelse med de forpligtelser, Danmark har valgt at påtage sig ved ratifikationen (Dette gælder, så længe det ikke er nødvendigt direkte at tilsidesætte en lovbestemmelse i national ret.)

Konventionen indeholder bl.a. en række bestemmelser, hvormed de kontraherende stater har forpligtet sig til "i passende omfang" at "tage skridt til" at bevare truede, migrerende dyrearter, samt deres bosteder, jf. art. 2, stk. 1.

De for nærværende responsums problemstilling relevante bestemmelser i konventionen er på det foreliggende grundlag følgende (understregninger indsat her), hvortil der er indsat løbende kommentarer:

Art. 2, stk. 1 og 2:

"1. The Parties acknowledge the importance of migratory species being conserved and of Range States agreeing to take action to this end whenever possible and appropriate, paying special attention to migratory species the conservation status of which is unfavourable, and taking individually or in co-operation appropriate and necessary steps to conserve such species and their habitat.

2. The Parties acknowledge the need to take action to avoid any migratory species becoming endangered." (understreget her)

Den forudsatte beskyttelse af migrerende arter er efter min vurdering på baggrund af den i pkt. 1.2. ovenfor gennemgåede forskning sammenholdt med de p.t. værende grænseværdier ikke mulig ved indførelsen af det påtænkte 5G-system.

Dertil kommer, at fastholdelsen af de nuværende grænseværdier efter min vurdering vil udelukke, at Danmark kan anses for at have taget "de nødvendige skridt" til opretholdelse af de migrerende arter.

Art. 3, stk. 4:

"Parties that are Range States of a migratory species listed in Appendix I shall endeavour:

a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;

b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and

c) to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species."

Formuleringen *"to the extent … appropriate"* (i passende omfang), som begrænser forpligtelsen i henhold til litra c, er ikke at finde i litra a og b.

Den forudsatte beskyttelse af migrerende arter er efter min vurdering på baggrund af den i pkt. 1.2. ovenfor gennemgåede forskning sammenholdt med de p.t. værende grænseværdier

ikke mulig ved indførelsen af det påtænkte 5G-system.

2.5.1. Delkonklusion.

Den forudsatte beskyttelse af migrerende arter er efter min vurdering på baggrund af den i pkt. 1.2. ovenfor gennemgåede forskning sammenholdt med de p.t. værende grænseværdier ikke mulig ved indførelsen af det påtænkte 5G-system.

3. Konklusion og afsluttende bemærkninger.

Det konkluderes i nærværende responsum, at etablering og aktivering af et 5G-netværk, således som det p.t. foreligger beskrevet, vil være i strid med gældende menneskeretlige og miljøretlige regler i EMRK, FNs børnekonvention, EU-regler og Bern- og Bonn-konventionerne.

Årsagen hertil er den meget betydelige, videnskabelige dokumentation, der foreligger for, at radiofrekvent elektromagnetisk stråling er helbredsskadeligt og -farligt for mennesker (og særligt for børn), dyr og planter.

Dette gælder også, når strålingen holder sig indenfor de retningslinjer, som anbefales af ICNIRP og som anvendes af Danmark og bredt i EU.

De nøjagtige helbredsmæssige skadevirkninger af 5G-systemet er ikke kendte, idet der ikke er tale om et eksakt defineret system, men det er på baggrund af den foreliggende forskning i radiofrekvent elektromagnetisk strålings påvirkninger af f.eks. menneskers og dyrs kroppe, herunder ved fremkaldelsen af DNA-skader og oxidativt stress, stærkt usandsynligt, at det ikke skulle medføre tilsvarende skadevirkninger som de hidtidige systemer, særligt al den stund det er baseret på samme grundlæggende stråling.

Den danske stat tjener betydelige beløb på at tillade oprettelse og drift af kommunikationssystemerne, bl.a. ved beskatning af overskud og auktioner over de frekvensbånd, som teleselskaber benytter til at opbygge den kommunikationsinfrastruktur, der kan indbringe selskaberne selv milliarder i overskud.

Alfonso Balmori er én blandt mange forskere, der har udtalt sig på følgende måde om den iboende interessekonflikt i dette strukturelle problem, jf. Balmori 2005 p. 116:

"Controversy is frequent when the scientists recognize serious effects on health and on the environment that cause high economic losses."

Holte, d. 4. maj 2019

Christian F. Jensen
advokat (L)