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June 23, 2022

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC
V6Z 2N3

Attention: Mr. Patrick Wruck, Commission Secretary

Dear Mr. Wruck:

Re: FortisBC Energy Inc. (FEI)

Application for a Certificate of Public Convenience and Necessity (CPCN) for Approval of the Advanced Metering Infrastructure (AMI) Project (Application) ~ Project 1599211

FEI Rebuttal Evidence to Coalition of the Reduction of Electropollution (CORE)

Pursuant to the Regulatory Timetable established by Order G-92-22 (as corrected by Order G-95-22), FortisBC Energy Inc. (FEI) respectfully submits for filing the enclosed Rebuttal Evidence. The Rebuttal Evidence is comprised of two parts: rebuttal evidence from FEI itself and separate rebuttal evidence from FEI's expert consultant, Exponent.

In filing the enclosed Rebuttal Evidence, FEI should not be taken as accepting or agreeing that all of the evidence filed by the Coalition to Reduce Electropollution (CORE), either in its witness statements and related materials (Exhibits C7-12 and C7-12-1) or in its responses to Information Requests (Exhibits C7-13 to C7-17), (collectively, the CORE Evidence), is within the scope of the proceeding to address FEI's CPCN Application, within the scope of the BCUC's order granting leave for CORE and associated interveners to intervene and file intervener evidence (Exhibits A-11, A-12 and A-14, and Appendix B to Order G-92-22), or otherwise admissible or deserving of weight in the BCUC's consideration of the Application.

In FEI's view, various portions of the CORE Evidence are objectionable on the above-noted grounds. FEI reserves the right to make submissions on the admissibility and/or weight of certain portions of the CORE Evidence either in final written argument or in an oral hearing phase, if the BCUC orders such an oral hearing (FEI expects its position will be that an oral hearing is not necessary or warranted in this proceeding). FEI notes the following examples:

- In the expert report of Dr. Paul Héroux, Appendix B to Exhibit C7-12-1, at page 27, Dr. Héroux states the following:

> The design of the FortisBC meter deployment goes beyond its stated objectives. This is deception (claiming one objective to hide another). Beyond gathering billing information, the system steals data from customers, and sets an infrastructure for large future increases in the RF exposures of one million customers by adhering to an irrational IoT philosophy. Acquiring data beyond what is necessary for the legitimate operations of billing is equivalent to placing a surveillance device in a home, without the owners consent.

Dr. Héroux has no evidentiary basis for making the claim that FEI's intended deployment of AMI gas meters "goes beyond its stated objectives" or that FEI's system "steals data from customers". Further, this and related passages of Dr. Héroux's report relate to customer privacy and system security matters that are beyond Dr. Héroux's area of expertise and which the BCUC ruled were not within CORE's scope of intervention and that CORE was not permitted to file intervener evidence on such topics.

- In the expert report of Dr. Anthony Miller, Appendix C to Exhibit C7-12-1, Dr. Miller discusses the "As Low As Reasonably Achievable" principle. Dr. Miller opines that if the AMI meters are not designed to reduce radiofrequency radiation exposure in compliance with this principle and "if an inhabitant of the home were to develop a cancer, the BCUC would be liable for the injury caused to the affected inhabitant of the home". To FEI's knowledge Dr. Miller does not have any legal training or expertise and is not therefore qualified to give opinion evidence on matters of legal liability arising from the BCUC's consideration of the Application. Further, such matters of legal liability were not with the scope of Dr. Miller's anticipated expert evidence as described in CORE's Submissions on the Scope of Proposed Evidence, dated March 3, 2022 (Exhibit C7-11), nor were they within the scope of the topics concerning which the BCUC granted CORE leave to file intervener evidence in Order G-92-22.

- In the expert report of Dr. Magda Havas, Appendix D to Exhibit C7-12-1, Dr. Havas, at page 76, states that, "I have been informed that these proposed 'smart' gas meters also work in conjunction with WiFi hubs and towers. If this is indeed the case, then people will be expose to additional, unnecessary radiation non-consensually, they are not informed of the risk". Dr. Havas does not provide the source of her information for this hearsay statement or state that she believes it to be true. There is no evidentiary foundation for the related opinion.

Further, in what CORE expressly acknowledges in Exhibits C7-11 and C7-12-1 is the "non-expert" witness statement of CORE's Hans Karow, Mr. Karow makes various allegations that are not supported by the evidence, or alternatively by any expert evidence, and that are in some cases outside the scope of CORE's sought and permitted intervention. The evidentiary issues are illustrated by Mr. Karow's statement on page 2 of Appendix A to Exhibit C7-12-1 that, "CORE members are concerned with the AMI Project's use of Tadiran batteries. CORE is of the view that the use of Tadiran batteries poses safety issues. Further, FEI has provided no evidence that the battery has been certified as 'intrinsically safe' so that it can be worked on in the presence of a possible methane atmosphere". When the Commercial Energy Consumers Association of British Columbia (CEC) asked in its IR1 5.1 that CORE describe the "possible methane atmosphere" being referenced, CORE's response was that it was "unable to provide a response as the above IR raises technical matters that are not within the

scope of CORE's knowledge" (Exhibit C7-16). However, the topic of Tadiran batteries was not addressed by, nor is it within, the subject matter expertise of any of CORE's experts either.

The foregoing is not intended to be and is not exhaustive of the issues regarding the scope, admissibility, and/or weight to be given to the CORE Evidence, but is illustrative of the types of issues FEI reserves the right to raise in submissions.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.

Original signed:

Diane Roy

cc (email only): Registered Interveners

Part 1

REBUTTAL EVIDENCE OF FORTISBC ENERGY INC.

Advanced Metering Infrastructure Project Application for a Certificate of Public Convenience and Necessity

Rebuttal Evidence of FortisBC Energy Inc. (FEI)

to the Intervener Evidence filed by the Coalition to Reduce Electropollution (CORE)

June 23, 2022

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List of Appendices

1.0 INTRODUCTION

Q1: What is the purpose of this Rebuttal Evidence?

A1: The purpose of this Rebuttal Evidence is to provide FEI's response to aspects of the evidence of Hans Karow, Dr. Paul Heroux, and Dr. Magda Havas on behalf of CORE (Exhibits C7-12 and C7-12-1).

FEI has not sought to reply to every matter, particularly where matters have already been addressed in FEI's application and in its responses to information requests (IRs). FEI's silence should not be construed as agreement.

Exponent has provided separate rebuttal to CORE's evidence.

2.0 FEI'S RESPONSE TO CORE'S EVIDENCE

2.1 SAFETY AND OPERATION OF THE SYSTEM

Q2: On page 2 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **The Sensus Sonix IQ contains a lithium battery which Sensus warns can explode if heated to 212 degrees Fahrenheit. Gas and exploding batteries are a highly lethal combination. CORE is concerned that in British Columbia interior areas, if the meter is in the sun and exposed to excessive heat, it is not unlikely that temperature extremes could result in lithium batteries exploding.**

In response to BCUC IR No. 1.2 on CORE's Evidence, asking for evidence regarding the potential for the meter temperature to reach 212 degrees Fahrenheit, Mr. Karow provides a link to a news article dated June 29, 2021 regarding record setting temperatures in Lytton, BC of 49.5 degrees Celsius.

How do you respond to these statements?

A2: FEI's proposed advanced meter is powered by a lithium thionyl chloride battery. This battery is encased in a gel-filled container, ensuring oxygen cannot reach the battery thereby eliminating risk of ignition. The meters are designed, tested, and certified to meet Canadian Standards Association requirements.

This battery technology has been used safely by gas utilities across North America for over 30 years, including in many existing FEI gas meters and other field devices.[1]

This type of battery (not, as referenced in Exhibit C7-12-1,Tadiran, which is a name brand) is used extensively in measurement equipment. FEI has more than 10,000 devices that have been in operation for the last 20 years that use a combination of integral (non-changeable) and field changeable batteries. FEI has not had batteries in its own measurement equipment fail in an unsafe manner in that time.

[1] Exhibit B-22 - FEI's response to CORE IR2 7.a.

Q3: On page 2 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **CORE members are concerned with the AMI Project's use of Tadiran batteries. CORE is of the view that the use of Tadiran batteries poses safety issues. Further, FEI has provided no evidence that the battery has been certified as "intrinsically safe" so that it can be worked on in the presence of a possible methane atmosphere. CORE members are concerned that FEI has not produced evidence of a peer reviewed safety report. Additionally, CORE is concerned that fires may be sparked if the gas measured by the AMI Meters is not turned off during a battery replacement. [Underlining added.]**

CEC IR1 5.3 on CORE's Evidence asks CORE to elaborate on the circumstances that an AMI meter would not be turned off during battery replacement and how often a battery replacement could be expected to occur. In response, CORE notes that these technical matters are outside its scope of knowledge and then goes on to state that an analog meter has a 30-40 year lifespan.

How do you respond to these statements?

A3: The Sonix IQ advanced meters are extensively tested by the manufacturer and by FEI and must be certified under CSA 12.22 no. 213 and ANSI/ISA 12.12.01 for intrinsic safety. In order to validate the safety of the Sonix IQ meter design, Sensus has had the device certified as intrinsically safe for Class I, II, III, Division 2, Group D, F, G, T4 in accordance with ANSI/IAS 16 12.12.01/CSA C22.2 No 213 *Nonincendive Electrical Equipment for Use in Class I and II, Division 17 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*. This means the meters are designed and tested to ensure they will not ignite a fire, even in hazardous areas where flammable gases are present.[2]

With respect to CORE's claim that advanced meter batteries "will be worked on in the presence of a possible methane atmosphere", FEI can confirm this will never happen. The advanced meter batteries are hermetically sealed so they cannot be replaced in the field. In the unlikely event an advanced meter battery were to fail while in service, FEI will always replace the advanced meter because these meters are not field serviceable.

Knowing the advanced meter battery cannot be replaced in the field also addresses CORE's unwarranted concern that "fires may be sparked if the gas measured by the AMI Meters is not turned off during a battery replacement".

Finally, with respect to CORE's suggestion that the diaphragm meter has a 30-40 year lifespan, FEI confirms that its diaphragm meters have an average service life of 18 years,

[2] Exhibit B-13 - FEI Response to RCIA IR1 24.1 and Exhibit B-10 – FEI Response to CORE IR1 2.1.

in accordance with its 2017 Depreciation Study filed as part of FEI's 2020-2024 Multi-Year Ratemaking Plan (2020-24 MRP).[3]

Q4: On pages 2 and 3 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **Older gas appliances still in use today do not have a gas valve that automatically closes when the pilot light goes out. With a remote disconnection, gas would continue to flow from fireplaces, stoves, water heaters, or other appliances which could result in homes being filled with gas, fires or explosions, thereby putting lives at risk when the pilot light has not been re-lit manually. CORE is concerned that there is no indication in the AMI Project Application (Exhibit B-1) that FEI has considered this potential effect of having gas shut off remotely.**

Mr. Karow elaborates on how he believes remote disconnection could result in gas continuing to flow in customer premises in his responses to CEC IR1 5.5, RCIA IR1 2.2 and 2.2.1 on CORE's Evidence.

How do you respond to these statements?

A4: FEI agrees that defective gas appliance safety valves can fail and potentially allow gas to enter a premises. During service calls to customer premises, FEI has red tagged/ shutoff a number of appliances that exhibit this safety deficiency.[4] When an appliance is 'red tagged', the owner is prohibited from relighting the appliance until the appliance is repaired or replaced. FEI also agrees that gas cooktops and other similar gas appliances that do not have gas safety valves and automatic ignition systems can be left in the 'on' position and allow gas to flow into a premises.

These potential safety issues are addressed pursuant to BC's, Gas Safety Regulation, B.C. Reg. 103/2004 (GSR), which is enforced by Technical Safety BC. Section 53 of the GSR states as follows:

> 53 (1) A person must not turn off a gas supply unless there is an imminent safety hazard and the person notifies all affected consumers.

[3] Exhibit B-13 - FEI Responses to RCIA IR1 32.2 and 32.2.1, Exhibit B-8 – FEI Response to CEC Confidential IR1 101.2.

[4] Please also refer to the response to Q20 in FEI's rebuttal evidence to RCIA in the Tilbury Certificate of Public Convenience and Necessity for the Tilbury Liquefied Natural Gas Storage Expansion Project (TLSE Project) proceeding (Exhibit B-46-1), https://docs.bcuc.com/Documents/Proceedings/2022/DOC_66753_B-46-1-FEI-RebuttalEvidence-RCIA-Evidence-Redacted.pdf.

> (2) If a gas supply has been turned off, a person must not turn the supply on again until the person
>
> (a) notifies all affected consumers, and
>
> (b) carefully checks all outlets and pilots to ascertain that they are relighted or turned off. [Underlining added.]

FEI always follows the requirements of GSR section 53(2). At present, to meet the requirements of GSR section 53(2)(b), FEI never opens the meter set valve after the valve has been closed during a service visit without also performing a dial check.[5]

The AMI Project does not change FEI's responsibility to meet GSR section 53(2)(b), which again requires FEI not to turn the gas back on to a premises unless the appliances are immediately relit or are turned off. As stated in FEI's IR responses in this proceeding and in its response to RCIA IR1 8.15 in the TLSE Application process, the AMI remote reconnect process has not been finalized, but the possible steps under consideration are:

- FEI gains verbal confirmation from the customer that all appliance feed valves have been positioned in the off position;
- FEI then remotely opens the internal valve within the advanced meter;
- The advanced meter would monitor for any gas flow for the next three minutes;
- If gas flow is detected by the advanced meter during this three-minute dial check, the meter would automatically close its internal valve and send a signal back to the FEI employee, indicating the situation is not safe to perform the appliance relight(s).

  At this step in the process, the potential of a leaking gas safety valve or a gas cooktop that was left 'on' would be quickly identified and the advanced meter's firmware would automatically stop the remote reconnect process by closing its internal valve.

- If the advanced meter does not detect gas flow during these three minutes, then the remote dial check has confirmed it is safe to relight the appliance(s) and the

[5] A dial check consists of monitoring the premises' gas meter to ensure no gas is unexpectedly flowing into a premises through a failed appliance gas safety valve or an appliance that does not have a safety valve and has been left in the 'on' position. If the dial check indicates there is gas flowing through the meter, prior to relighting the customer's appliances, the technician will immediately enter the customer's premises and investigate the source of the unexpected gas flow. Before relighting the appliances, the technician will resolve the issue, which could include 'red tagging' the customer's appliance(s). If the dial check shows no flow is occurring through the meter, the technician will immediately enter the premises and relight the customer's appliances.

FEI employee will inform the customer they can proceed and relight their appliance(s).

- FEI could offer the customer the option of having a qualified person remotely support (via a video link) the customer during the relight, or, if necessary, an FEI Customer Service Technician could provide onsite support.

As has been outlined in this response, today FEI meets the requirements of GSR section 53(2)(b) by performing a dial check immediately after manually opening the meter set valve. With the implementation of AMI, FEI will continue to meet its responsibilities under section 53(2) of the GSR by having the advanced meter perform a dial check and automatically close its internal valve if an unexpected flow occurs as a result of a defective gas safety valve or a gas cooktop (or similar appliance) being left in the 'on' position.

2.2 SECURITY, PRIVACY, AND OPERATION OF THE SYSTEM

Q5: CORE's evidence and responses to IRs question the security and privacy of customer information collected by FEI's advanced meters.

In particular, on page 4 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **CORE members are additionally concerned about public safety issues arising from the ability of smart meters to gather personal data not required for billing purposes. CORE is concerned that the availability of hourly consumption data from customers betrays their assurances about the minimal quantity transmissions from each meter, and presents a marketing opportunity FEI may take advantage of. Current marketing practices can and often do involve selling data to third parties without permission being sought from, or granted by, first parties.**

And:

> **CORE asserts that there is a distinct possibility that the data can, and will reside in offshore jurisdictions not subject to Canadian Laws & practices, as this is common practice for other Telecoms, utilities, and banks.**

And in response to CEC IR1 14.1 to CORE requesting confirmation that gathering of customer information is governed by privacy legislation, Dr. Heroux states:

> **This legislation relies heavily on the judgment of a "reasonable person", presumably, or at least temporarily, an employee of FortisBC.**

How do you respond to these statements?

A5: As required under FEI's Customer Privacy Policy,[6] unless FEI has a customer's explicit consent to do so, FEI will not sell their personal information to third parties and disclosure of customer information is limited to that which is permitted or required by privacy legislation.

With respect to the location of data storage, FEI follows the directives as set out in BCUC Order G-161-15, including annual reporting to the BCUC on data and servers located outside of Canada.

FEI takes its obligation to protect the personal information of its customers seriously and is committed to complying with the requirements under PIPA. As stated in FEI's Customer Privacy Policy, FortisBC's Privacy Officer is accountable for ensuring compliance with privacy legislation and FortisBC privacy policies.

2.3 CUSTOMER SERVICE

Q6: On page 4 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **One such option is having the customer provide the reading. This could be accomplished by having the customer take a photo of the meter on a specific date and emailing it to FEI. Customers without the capability of sending a photo could, as has been done in Manitoba, transcribe the readings on a postcard and mail in.**

How do you respond to these statements?

A6: FEI has previously stated in its responses to information requests (specifically RCIA IR1 13.3 and 23.3) the following:

- FEI is obligated to provide meter reading processes, as set out in the approved General Terms and Conditions within the FEI Tariff, not FEI's customers; and

[6] Available here: FortisBC Privacy Policy

- FEI does not believe that the customer should be responsible for the provision of timely and accurate meter reading.

FEI also notes that the suggestions Mr. Karow offers for how customers could provide their meter reading require customers to have access to a camera, a way of transmitting the photo to FEI (either electronically or as a hard copy), or a supply of postcards and stamps and a way of posting the readings. The suggestions do not take into account timeliness or the processes that would need to be put into place from FEI's perspective to receive these materials, verify them (in the event that information like meter number, date of the reading, etc.) is missing, and transcribe them into the customer's account.

FEI notes a manual process for handling customer-submitted meter readings is currently in place. Customers can either phone FEI's customer contact centre with a reading or send their reading in via their online account, which can be accessed through the FortisBC web site. With either method, an FEI employee will enter the readings into the system. This process is intended only for ad-hoc readings supplied by customers due to estimated reading concerns, or the verification of a reading originally obtained by a meter reader. It is not intended to handle the large volume of regular meter readings performed by meter readers, and there is no system in place to automatically enter customer-supplied meter readings into the billing system. If a customer supplies a meter reading, this reading can only be used to calculate an estimate of the customer's natural gas usage during the applicable billing period. If this is the case, the customer-supplied meter reading is shown as an estimate on the bill. As with other estimated readings, charges for actual natural gas usage are then reconciled on the next bill that is associated with an actual read provided by a meter reader.

2.4 PROJECT ALTERNATIVES

Q7: On page 5 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **CORE submits that the deserved savings and benefits could be achieved through wired gas meters which connect via cables already in place, including phone lines or fiber optic cable that is being laid for the internet.**

On page 74 of Appendix E to Exhibit C7-12-1, Dr. Havas states:

> **This doesn't necessarily result in any hardships for the utility as analogue meters do not emit RFR and last for decades (as has been the case in Canada). Furthermore, if "smart" meters are required (i.e., "smart" refers to 2-way communication) they can be wired and do not**

> **need to be wireless. Stationary devices that need to communicate (like smart meters) should be wired since they are not going anywhere. The need for wireless is only with mobile technology like cell phones.**

And on page 79 of Appendix E to Exhibit C7-12-1, Dr. Havas states:

> **Two alternatives to *wireless* smart meters is to keep the *current meters*, especially for those who have developed an intolerance to RFR or to provided *wired smart meters* rather than wireless. [Italics in original.]**

And in response to FEI's IR No. 1.2.1 on CORE's Evidence, in which FEI requested details of the manufacturer that provides wired advanced gas meters, Mr. Karow provides a link to the ZG-D-Y wired gas smart meter manufactured by Willfar Information Technology Company Ltd. (Willfar).[7]

How do you respond to these statements?

A7: The analysis of a wired AMI solution was provided in FBC's responses to information requests in its 2012 application for a CPCN for its AMI Project. Although FBC's AMI project was for the installation of electric AMI meters, the challenges and costs associated with a wired AMI meter option are similar and relevant to FEI's AMI Project. In response to the Citizens for Safe Technology (CSTS)'s IR1 12.5 in that proceeding, FBC set out a cost analysis for fibre optic alternatives. While the cost analysis is limited to FBC's service territory, the considerations are relevant to FEI. While fibre infrastructure is often already in place throughout urban areas "to the curb" or "to the neighbourhood", it is likely that a small length of fibre cable to the customer's gas meter is still needed. FEI would be required to enter into agreements for leasing this existing fibre network.

In more rural areas, it has been cost prohibitive to extend fibre networks, and this option likely does not exist for FEI's rural customers.[8] FEI would be required to build fibre in order to access those meters.

All of the above also assumes that a feasible wired AMI gas meter option even exists, which is not the case. The example put forward by Mr. Karow is not a feasible option for FEI for a number of reasons. As shown in the meter specifications on the webpage provided by Mr. Karow, the Willfar ZG-D-Y Wired Smart Gas Meter has a working life of only 10 years, and a temperature rating of -10 to 40 degrees Celsius. Most importantly,

[7] Wired Smart Gas Meter | Smart Meter System | Willfar (willfar-power.com)
[8] FBC Advanced Metering Infrastructure Project CPCN Application, Exhibit B-11 - FBC Response to Andy Shadrack IR1 Q4, https://docs.bcuc.com/Documents/Proceedings/2012/DOC_32388_B-11_FBC-Responses-Intervener-IR1.pdf.

Willfar is only certified by the China Ministry of Construction standards and does not meet Measurement Canada's minimum accuracy standards.

2.5 LEGAL MATTERS

Q8: In Hans Karow's non-expert witness statement, Appendix A to Exhibit C7-12-1, on page 3, Mr. Karow states that, "CORE is concerned that FEI is rushing to get the AMI Project approved during a time where current standards related to radio frequency radiation EMF are being reconsidered". Mr. Karow cites in support of this statement, the District of Columbia Court of Appeals' decision in *Environmental Health Trust, et al. v. FCC & USA*, No. 20-1025.

In CORE's response to BCUC IR1 1.3, CORE states, in part, that:

> **To the best of best of CORE's knowledge, current standards are being reconsidered in the USA at this time. In fact, the FCC was ordered by court order to provide scientific evidence to support their current standards. Depending upon the result of the review, from CORE's perspective it is possible that Health Canada may review Safety Code 6 …**

What is FEI's understanding of the status of the Federal Communications Commissions (FCC) guidelines on radiofrequency (RF) radiation exposure limits in the U.S. in light of the court decision cited by CORE, as set out above?

A8: FEI's understanding is that the FCC's RF exposure guidelines remain in full force and effect. These guidelines are incorporated into the U.S. Code of Federal Regulations under Title 47 (specifically, 47 CFR § 1.1310 - Radiofrequency radiation exposure limits; available online at: https://www.law.cornell.edu/cfr/text/47/1.1310).

FEI addressed the U.S. court decision referred to by Mr. Karow and CORE in FEI's response to CORE IR 1.20 (Ex. B-10, p. 30-31). As noted in that IR response, the U.S. Court of Appeals for the District of Columbia held, on grounds of administrative law, that the FCC had not provided a sufficiently reasoned explanation for its determination that its existing guidelines for exposure to RF radiation adequately protect against the harmful effects of exposure to RF unrelated to cancer. The outcome of the case was that the Court remanded the matter to the FCC "to provide a reasoned explanation for its determination that its guidelines" provide adequate protection for health effects unrelated to cancer. The Court did not order the FCC to "reconsider", "review", or "provide scientific evidence in support of its current standards" as CORE and Mr. Karow characterize the decision.

Based on FEI's review of publicly available information, the FCC does not appear to have made any public statements in response to the referenced Court decision, nor has the FCC convened any new proceedings, hearings, or other public inquiries regarding its RF exposure guidelines. The Court's order does not impose a deadline for the FCC to provide the required "reasoned explanation" for its prior determination not to revise the RF exposure guidelines.

Q9: In CORE's response to BCSCEA IR1 2.1, CORE states that, "Safety Code 6 is not a health standard, but rather a guideline that applies to federally regulated sites, such as cell towers. Our homes are not federally regulated sites." (Ex. C7-15)

Similarly, in CORE's response to CEC IR1 3.2, CORE states that, "Safety Code [6] is not a law but rather is a guideline for federally regulated sites, such as cell towers". (Ex. C7-16)

In CORE's response to BCUC IR1 3.2, Dr. Heroux states that, "SC6 is a national recommendation not a requirement" (Ex. C7-13).

In CORE's response to BCUC IR1 4.2, Dr. Havas states that, "I don't understand why HC SC6 is being relied upon for RF exposure in this case or in any cases related to wireless radiation emissions". Among Dr. Havas' explanations for this statement is that Safety Code 6 "is a guideline rather than a standard and hence is voluntary".

Does FEI agree with the above descriptions of Safety Code 6?

A9: No, FEI does not agree with these characterizations of Safety Code 6 as being "voluntary", "not a health standard but rather a guideline", and being applicable only to "federally regulated sites" and not the "homes" of FEI's customers.

FEI addressed the applicability of Safety Code 6 to the AMI gas meters in its response to CORE IR 2.36.a.

To expand upon the discussion in that IR response, the federal *Radiocommunication Act*, R.S.C. 1985, c. R-2, governs, among other things, the manufacture, marketing, and operation of "radio apparatus" anywhere within Canada (section 3(1)(3)). "Radio apparatus" are devices capable of being used for radiocommunication, which includes the AMI gas meters. Under this statute, the Minister of Industry has enacted the *Radiocommunication Regulations,* SOR/96-484, providing that certain categories of radio apparatus, which include the AMI gas meters, must be certified and may only be operated if maintained in conformity with various applicable standards, which are in turn published by Industry Canada.

These applicable standards include, among others, Industry Canada's Radio Standards Specification (RSS) 102 – *Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands),* available here: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01904.html. RSS 102 provides, in section 1, that (bolding added), "It is the responsibility of proponents and operators of antenna system installations to ensure that all radiocommunication and broadcasting installations **comply at all times with Health Canada's Safety Code 6,** including consideration of combined effects of nearby installations within the local radio environment. These requirements are specified in *Client Procedures Circular CPC-2-0-03, Radiocommunication and Broadcasting Antenna Systems*."

RSS 102 sets out various requirements, processes, and evaluation methods for certification of radiofrequency apparatus as being compliant with RF exposure limits. Under section 4, RSS 102 states that, "For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6".

Safety Code 6 itself is drafted in mandatory terms. In its Preface, Safety Code 6 states that, "This document is one of a series of safety codes prepared by the Consumer and Clinical Radiation Protection Bureau, Health Canada. These safety codes specify the requirements for the safe use of, or exposure to, radiation emitting devices". The Preface also notes that, "This code has been adopted as the scientific basis for equipment certification and RF field exposure compliance specifications outlined in Industry Canada's regulatory documents (1-3), that govern the use of wireless devices in Canada, such as cell phones, cell towers (base stations) and broadcast antennas". Further, section 1 of Safety Code 6, "Introduction", states that (bolding added), "In the following sections, the maximum exposure levels for persons in both controlled and uncontrolled environments are specified. **These levels shall not be exceeded**."

This is consistent with the BCUC's prior decision regarding FortisBC Inc.'s electric AMI meters, where the panel noted, at page 108 of Decision and Order C-7-13, that the electric AMI meters were subject to a limited licensing exemption, but determined that the AMI technology then under consideration was "*not* exempt from compliance with Safety Code 6" (italics in original).

Based on this regulatory framework, FEI's understanding is that the AMI gas meters are required to comply with the RF exposure limits specified in Safety Code 6. The RF exposure levels set out in Safety Code 6 are not "recommendations" or "voluntary" as CORE and its witnesses suggest. Additionally, Dr. Heroux's argument that "our homes are not federally regulated sites" to which Safety Code 6 would apply is inapt given that the meters themselves are subject to federal regulation, including Safety Code 6.

As referenced in FEI's prior response to CORE IR 2.36.a., the AMI gas meters produced by Sensus have received certification from Innovation, Science and Economic Development Canada (ISED), the details of which are set out in Appendix F-1 of the Application, Table 2 at p. 20. FEI understands that this ISED certification signifies the meters' compliance with RSS 102.

Q10: In CORE's response to CEC IR1 13.4, Dr. Heroux refers to and attaches, as Appendix "H", an "Emergency Order Issued on April 11, 2022 by the Board of Health of the City of Pittsfield, ordering Verizon to stop operation of a cell phone tower because of the health impacts the tower has on neighboring residents".

The same Emergency Order of the Pittsfield Board of Health was also the subject of and was provided pursuant to a Letter of Comment filed by Sherry Ridout in this proceeding (Exhibits E-9 and E-9-1).

What is FEI's understanding of the present status and circumstances of the Emergency Order referred to above?

A10: FEI understands that, in response to the Pittsfield Board of Health's Emergency Order, on May 10, 2022, Verizon Wireless (Verizon) filed a Complaint against the Board of Health in the United States District Court for the District of Massachusetts. Verizon's Complaint states, among other things, that, "The Board improperly based its order on the premise that the RF emissions from the Facility have health effects and that state and local law give the Board authority to address those effects by requiring Verizon to shut down its tower, even though the Board recognized that the Facility complies with the [Telecommunications Act of 1996 ("TCA"), 47 U.S.C. § 332] and the FCC regulations". A copy of Verizon's Complaint is attached as **Appendix A**.

Following this, public reporting indicates that on or about June 1, 2022, the Pittsfield Board of Health voted to rescind its Emergency Order. See here for article in iBerkshires.com: https://www.iberkshires.com/story/68417/Pittsfield-Health-Board-Rescinds-Verizon-Cease-Desist-Order.html.

After the Board of Health rescinded the Emergency Order, Verizon filed a Notice of Voluntary Dismissal on June 2, 2022. This Notice, a copy of which is attached as **Appendix B**, states that, "The Defendant, Pittsfield Board of Health, has not filed an answer or motion for summary judgment. At its meeting on June 1, 2022, the Defendant Board voted to rescind the cease-and-desist order dated April 11, 2022 which it had issued to the Plaintiff, thereby making this action moot". According to the Civil Docket for the case (3:22-cv-10718-MGM), a judge of the Massachusetts District Court requested the Clerk of Court to close the case on June 3, 2022.

Q11: In its response to CEC IR1 2.1, CORE refers to testimony of Dr. James McNamee of Health Canada in a case in the Quebec courts, *White c. Chateauguay*. CORE says that Dr. McNamee "acknowledged … that there are studies which indicate the existence of non-thermal effects of radio frequencies."

Is FEI familiar with the testimony of Dr. McNamee that CORE is referring to and is CORE's description of this testimony consistent with FEI's understanding of it?

A11: Yes, FEI is familiar with the testimony of Dr. McNamee that CORE refers to in its IR response. A transcript of Dr. McNamee's testimony from a hearing in the Quebec Superior Court on February 18, 2013 was filed with the BCUC as Exhibit B-46[9] in FBC's prior application for approval of electric AMI meters. The BCUC quoted in full the passage from Dr. McNamee's testimony that CORE paraphrases in Decision and Order C-7-13, at p. 111:

> Q. And do I understand that, even though there is out there some studies regarding non-thermal effects for our frequency, the position of Health Canada is that none of these studies, because it's what it's saying in Safety Code 6, is relevant and there's no change?
>
> A.: We recognize that there are a large number of studies assessing virtually every health endpoint there is. There are a large number that show an adverse effect here, an adverse effect there. So, I'm not denying that there are studies showing effects, no question. There are also a large number of studies that don't show effects, and generally, a much larger number of studies, in many cases much more thorough and much more well-conducted. (Exhibit B-46, pp. 69-70)
>
> [Underlining added.]

[9] https://docs.bcuc.com/Documents/Proceedings/2013/DOC_33975_B-46_FBC-transcript-of-evidence-McNamee.pdf

Appendix A
VERIZON COMPLAINT

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

Pittsfield Cellular Telephone Company d/b/a Verizon Wireless	)
Plaintiff,	)
v.	)
Board of Health of the City of Pittsfield, Massachusetts	)
Defendants.	)

COMPLAINT

1. This is an action for declaratory judgment relief brought pursuant to Section 332 of the Telecommunications Act of 1996 ("TCA"), 47 U.S.C. § 332. Section 332(c)(7)(B)(iv) prohibits state and local governments from regulating a personal wireless service facility ("PWSF") on the basis of perceived health effects of radiofrequency ("RF") emissions, to the extent that the facility complies with Federal Communications Commission ("FCC") regulations concerning such emissions. The defendant Pittsfield Board of Health ("Board") violated this section of the TCA by issuing an order (the "Emergency Order") to plaintiff Pittsfield Cellular Telephone Company d/b/a Verizon Wireless ("Verizon") and its landlord requiring that Verizon cease and desist operating its lawfully constructed and lawfully operating PWSF at 877 South Street in Pittsfield, Massachusetts (the "Facility"). The Board improperly based its order on the premise that the RF emissions from the Facility have health effects and that state and local law give the Board authority to address those effects by requiring Verizon to shut down its tower, even though the Board recognized that the Facility complies with the TCA and the FCC

regulations. In fact, however, the TCA preempts the Board's authority to regulate the Facility on the basis of RF emissions. Therefore, the Emergency Order is unlawful, improper, and the relief this complaint requests in the form of a declaratory judgment is appropriate.

JURISDICTION AND VENUE

2. This Court has subject matter jurisdiction over this action pursuant to 28 U.S.C. §1331, as Plaintiff's claims arise under the laws of the United States, specifically 47 U.S.C. §332(c)(7)(B)(v), which provides that "any person adversely affected by any final action or failure to act by . . . local government or any instrumentality thereof" in violation of §332(c)(7)(B) may seek review "in any court of competent jurisdiction [and the] court shall hear and decide such action on an expedited basis." This Court also has jurisdiction over this action under 28 U.S.C. §1337(a), because the Federal Communications Act of 1934 and the TCA are Acts of Congress regulating commerce.

3. This Court has jurisdiction to order declaratory judgment relief under 28 U.S.C. §§2201 and 2202 because there is an actual controversy between the parties.

4. Venue is proper in the District of Massachusetts pursuant to 28 U.S.C. § 1391(b) because all of the Defendants reside in this District and all events or omissions giving rise to this action occurred within this District and the Facility is located in this District.

PARTIES

5. Plaintiff Verizon is a Massachusetts general partnership with an office at 20 Alexander Drive, Wallingford, Connecticut, and with a principal place of business at 180 Washington Valley Road, Bedminster, New Jersey.

6. Defendant Board is an instrumentality of the City of Pittsfield, Massachusetts with an address of 100 North St., Pittsfield, Massachusetts. The Board has five members. The Mayor of the City appoints these members, subject to City Council approval.

7. Verizon provides Personal Wireless Services ("PWS") as that term is defined in the TCA. The Federal Communications Commission ("FCC") has licensed Verizon to provide service to the area that includes Pittsfield, Massachusetts using various bands of the radio spectrum.

8. Verizon's network functions by exchanging low power signals between a user's wireless device and a Verizon communications facility at a fixed location known as a PWS facility or a "cell site." A cell site consists of one or more antennas and related radio and power equipment mounted on a building, tower, or other structure; a climate-controlled room, fenced off area or other enclosure that houses other radio and power equipment; and related cabling. Each cell site uses one or more radio spectrum bands licensed to Verizon and operates in compliance with FCC regulations. A cellular network like the one operated by Verizon is an interlinked system consisting of many individual cell sites, each serving a discrete geographic area or "cell."

9. Connections to wireless network infrastructure, and the telecommunications and ancillary services offered over them, are a critical means by which Americans engage with each other, reach 911 emergency services, and obtain broadband data access to the Internet and a multitude of smartphone applications. Over 68% of adults and more than 79% of children live in households that do not have a landline telephone but do have at least one wireless telephone.[1] In 2018, 61.8% of Massachusetts households relied either exclusively or mostly on wireless for

[1] Blumberg, Stephen J. and Julian V. Luke, *Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, Centers for Disease Control, Jan.-June 2021*, Nat'l Center for Health Statistics, Nat'l Health Interview Survey Early Release Program (rel. 11/2021) available at https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless202111.pdf.

their telephone service. Furthermore, 80% of 911 calls are made from wireless devices.[2] During the height of the COVID-19 pandemic, despite the fact that people were at home more than usual, there was a 24.3% increase in wireless voice traffic and a 19.6% increase in wireless data traffic.[3] In 2021, mobile wireless data usage per smartphone in North America was 14.6 GB per month, an increase of more than 30% in just one year.[4] This upward trend is expected to continue, as mobile data traffic per smartphone in North America is expected to reach 52 GB per month in 2027.[5]

10. The Facility is similar in design, function and operation to thousands of other tower-mounted facilities that Verizon operates in Massachusetts, throughout New England, and across the country. It consists of an array of panel antennas mounted near the top of a 115 foot tall tower with associated radio and power equipment on and adjacent to the tower, all within a fenced enclosure. Verizon leases the property containing the Facility and a utility and access easement from Farley White South Street, LLC ("Property Owner").

11. After the City of Pittsfield properly issued to Verizon all required local zoning approvals and other required permits, Verizon began constructing the Facility in early 2020, and began operating it as part of the Verizon network on August 21, 2020.

12. After the Facility was constructed, however, the Board entertained allegations by certain members of the public who claimed that they or their family members were suffering from health issues that they attributed to RF emissions from the Facility. The Board discussed

[2] NENA - The 9-1-1 Assoc., *9-1-1- Statistics*, available at https://www.nena.org/page/911Statistics#:~:text=9%2D1%2D1%20Call%20Volume,more%20are%20from%20wireless%20devices.
[3] CTIA, *The Wireless Industry, Industry Data* (2020 Wireless Use Surge) available at https://www.ctia.org/the-wireless-industry/infographics-library.
[4] Ericsson Mobility Report, at 39 (Nov. 2021) available at https://www.ericsson.com/4ad7e9/assets/local/reports-papers/mobility-report/documents/2021/ericsson-mobility-report-november-2021.pdf.
[5] *Id*.

the Facility at its meetings on April 12, 2021, May 5, 2021, June 2, 2021, July 7, 2021, September 1, 2021, October 6, 2021, February 2, 2022, February 23, 2022, March 16, 2022, and April 6, 2022.

13. On September 9, 2021, at the request of the Board, Verizon attended a meeting with Board members to address health concerns that had been raised about the Facility. During that meeting, Verizon affirmed that that the Facility operated in full compliance with the health requirements set forth in the FCC regulations.

14. The City of Pittsfield and Verizon each commissioned its own independent RF emissions study (dated June 15, 2021 and October 5, 2021, respectively) to measure and document actual RF emissions levels from the Facility. Both studies conclusively demonstrated that the RF emissions from the Facility are well below the FCC regulatory standards.

15. On January 7, 2022, again at the request of the Board, Verizon representatives attended another meeting with Board members. During that meeting Verizon representatives reiterated that Verizon operates the Facility in full compliance with all FCC regulatory standards.

16. During the September 9, 2021 and the January 7, 2022 meetings, and in other communications with City officials and the Board, Verizon repeatedly reminded the Board that the TCA preempts the Board from regulating the Facility on the basis of alleged environmental or health effects of its RF emissions.

17. On April 11, 2022, the Board issued the Emergency Order, the full caption of which is "Emergency Order Requiring that Pittsfield Cellular Telephone Company d/b/a Verizon Wireless, and Farley White South Street, LLC Show Cause Why the Pittsfield Board of Health Should Not Issue a Cease and Desist Order Abating a Nuisance at 877 South Street Arising from the Operation of a Verizon Wireless Cell Tower Thereon and Constituting Immediate Order of

Discontinuance and Abatement if No Hearing is Requested." A copy of the Emergency Order is attached to this Complaint as Exhibit A.

18. The Emergency Order directed Verizon and the Property Owner "to show cause why the Board should not issue an order requiring cessation of operations" of the Facility. The Board of Health purported to act under its "statutory and historical" police powers.

19. The Emergency Order did not contend or allege that the Facility operated in violation of FCC RF emissions regulations.

20. The Emergency Order gave Verizon and the Property Owner seven days from the date of the Emergency Order to request a hearing. It stated that if no hearing were requested, "this Order shall become and constitute a notice of discontinuance" requiring that Verizon and the Property Owner, within seven days, "abate and eliminate all activities and operations that the Board of Health deemed to be a nuisance and in violation of the State Sanitary Code."

21. In the Emergency Order, the Board purports to reserve the right to take direct action "to remove the offending facilities at the expense of Verizon Wireless and Farley White South Street LLC and or appointment of a receiver responsible for accomplishing the same."

22. The Emergency Order is based entirely on the Board's conclusions related to the alleged health effects of RF emissions—specifically that RF emissions from the Facility that fully comply with the levels set by the FCC are somehow causing "illness and negative health symptoms" in nearby residents.

23. Verizon responded to the Emergency Order by promptly submitting a letter to the Board of Health explaining that federal law preempts the Emergency Order, that the Emergency Order is unlawful, and that Verizon does not intend to cease operating the tower, which is

operating in compliance with the FCC RF emission standards. A copy of this letter is attached to this Complaint as Exhibit B.

24. The Facility is a critical part of Verizon's communications network in Berkshire County. Before the facility was built and brought online, there was a gap of approximately five miles between Verizon's two existing facilities along U.S. Route 7/20 in Lenox and Pittsfield, including 3.6 miles where Verizon's existing facilities were incapable of providing indoor or in-vehicle coverage at a reliable signal strength. The increased coverage provided by the Facility eliminated the 3.6 mile gap for in-vehicle coverage and reduced the gap in reliable indoor coverage to less than 0.7 miles. Reliable indoor coverage is critical for residents and businesses that use Verizon's communications network for their personal, educational, and business needs. Reliable in-car coverage is critical for vehicle connectivity and safety systems. If the Facility were forced to power down, Verizon's customers in Pittsfield and Lenox would be subject to increased dropped calls, ineffective call processing and connections, and a 50% decrease in wireless data throughput. As a result, customers and first responders would also experience decreased reliability of wireless E-911 calls.

25. The Emergency Order targets just one of more than two dozen wireless facilities currently operating in the City of Pittsfield where Verizon maintains wireless equipment to provide cellular service in the area. Yet other Verizon facilities in the City operate at similar power, frequency, and proximity to the public as the Facility, and likewise fully comply with all federal RF emissions standards and FCC requirements. The TCA imposes a national standard requiring that PWSF facilities comply with FCC RF regulations and prohibiting local and state bodies from exercising their own discretion in regulating on the basis of RF emissions, precisely

to ensure that bodies like the Board cannot undercut federal telecommunications policy, as would be the result here if the Emergency Order were to stand.

26. The Board's conclusions and the Emergency Order are a direct challenge to the adequacy and supremacy of the FCC's RF emissions regulations. The Emergency Order stems from the Board's conclusion that "RF/EMF – *even if emitted at levels within the FCC emissions guidelines* – can be injurious to health or cause common injury to the significant portion of the public who are electromagnetic sensitive" and that such emissions are "a cause of sickness" (emphasis added). Simply stated, the Board's conclusion is both contrary to applicable federal law and specifically preempted by the TCA.

COUNT I
(Violation of TCA Prohibition on Local Regulation
of PWSF Based on Alleged Effects of RF Emissions)

27. Plaintiff's allegations contained in paragraphs 1 through 26 above are incorporated by reference as if fully set forth herein.

28. The Board of Health is an instrumentality of state or local government within the meaning of 47 U.S.C. § 332(c)(7)(B)(iv).

29. The Emergency Order attempts to regulate the placement, construction, modification, and operation of a PWSF on the basis of the environmental and health effects of RF emissions and the Facility complies with the FCC's regulations concerning such emissions.

30. The Emergency Order violates Section 332 of the TCA because it purports to regulate the placement, construction, modification and operation of a PWSF based on alleged environmental and health effects of RF emissions. In 47 U.S.C. § 332(c)(7)(B)(iv), the federal government preempts local and state governments from regulating PWSFs on the basis of the

environmental and health effects of RF emissions "to the extent that such facilities comply with the [FCC] regulations concerning such emissions." The Emergency Order explicitly states that the Board is exercising its local and state statutory and police powers and is in response to the Board's belief that RF emissions from the Facility have affected the health of certain individuals.

31. 47 U.S.C.§ 332(c)(7)(B)(iv) expressly and impliedly preempts the Emergency Order, and the Emergency Order was improperly issued, is null and void, and has no legal effect.

COUNT II
(Declaratory Judgment pursuant to 28 U.S.C. §§ 2201 and 2202)

32. Plaintiff's allegations contained in paragraphs 1 through 31 above are incorporated by reference as if fully set forth herein.

33. The Court has authority under 28 U.S.C. §§ 2201 and 2202 to declare that the Emergency Order violates and is preempted by the Telecommunications Act of 1996, 47 U.S.C. § 332(c)(7)(B) (iv) and to grant further necessary and proper relief to Plaintiff.

WHEREFORE, Plaintiff Pittsfield Cellular Telephone Company d/b/a Verizon Wireless respectfully requests the following relief:

1. An expedited review of the matters set forth in this Complaint, pursuant to the Telecommunications Act of 1996, 47 U.S.C. § 332(c)(7)(B)(v).

2. A declaratory judgment stating that the Emergency Order violates and is expressly or impliedly preempted by the Telecommunications Act of 1996, 47 U.S.C. § 332(c)(7)(B)(iv), and is null and void and of no effect.

3. Such further relief as the Court may deem appropriate and proper.

Plaintiff Pittsfield Cellular Telephone Company d/b/a Verizon Wireless,

By its attorneys,

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Appendix B

NOTICE OF VOLUNTARY DISMISSAL

UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

Pittsfield Cellular Telephone Company d/b/a Verizon Wireless	)	
Plaintiff,	)	**Case No. 3:22-cv-10718-MGM**
v.	)	
Board of Health of the City of Pittsfield, Massachusetts	)	
Defendants.	)	

NOTICE OF VOLUNTARY DISMISSAL

The Plaintiff, Pittsfield Cellular Telephone Company d/b/a Verizon Wireless, hereby files its Notice of Dismissal of the above-captioned action pursuant to Fed. R. Civ. P. 41(a)(1)(A)(i). The Defendant, Pittsfield Board of Health, has not filed an answer or motion for summary judgment. At its meeting on June 1, 2022, the Defendant Board voted to rescind the cease-and-desist order dated April 11, 2022 which it had issued to the Plaintiff, thereby making this action moot.

Plaintiff Pittsfield Cellular Telephone Company d/b/a Verizon Wireless,

By its attorneys,

/s/ William J. Egan
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CERTIFICATE OF SERVICE

I, William J. Egan, hereby certify that a copy of the foregoing document, filed through the ECF system, will be sent electronically to the registered participants as identified on the Notice of Electronic Filing (NEF) and paper copies will be sent to those, if any, indicated as non-registered participants on this 2nd day of June, 2022.

/s/ William J. Egan
William J. Egan

Part 2

REBUTTAL EVIDENCE OF EXPONENT ON BEHALF OF FORTISBC ENERGY INC.

Advanced Metering Infrastructure Project Application for a Certificate of Public Convenience and Necessity

Rebuttal Evidence of Exponent on behalf of FortisBC Energy Inc.

to the Intervener Evidence filed by the Coalition to Reduce Electropollution (CORE)

June 23, 2022

Table of Contents

1.0 INTRODUCTION

Q1: Can you please identify the names and qualifications of the individuals responsible for Exponent's rebuttal to CORE's evidence?

A1: Benjamin Cotts, Ph.D., Pamela Dopart, Ph.D., and William H. Bailey, Ph.D. See curriculum vitae in Exhibit B-1-1-1. The reports they submitted are in Appendix F-1 Exponent RF Technology Report (hereafter Exponent's RF Technology Report) and Appendix F-2 Exponent RF Health Report (hereafter Exponent's RF Health Report) to Exhibit B-1 of the FortisBC Energy Inc. (FEI) Application.

The contribution of Exponent's witnesses to responses in this Rebuttal Evidence is indicated in an Index in Appendix A to this testimony.

Q2: What is the purpose of this Rebuttal Evidence and how is it organized?

A2: The purpose of this Rebuttal Evidence is to provide Exponent's response to aspects of the evidence of Hans Karow, Dr. Paul Héroux, Dr. Anthony Miller, and Dr. Magda Havas on behalf of CORE (Exhibits C7-12 and C7-12-1).

The first part of Exponent's response covers topics common in all the evidence provided on behalf of CORE and the second part covers topics specific to each of the CORE authors' respective reports.

Exponent has not sought to reply to every matter, particularly where matters have already been addressed in Exponent's RF Technology Report and RF Health Report and in its responses to information requests. Exponent's silence should not be construed as agreement.

Exponent understands that FEI is submitting separate rebuttal evidence.

2.0 EXPONENT'S RESPONSE TO CORE'S COMMON EVIDENCE

2.1 STATUS OF THE RESEARCH

Q3: On page 2 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **The Exponent Status of Research report missed identifying at least 88% of the primary references on studies done specifically on 900 MHz [Megahertz] and over 70% of other relevant literature for the year 2020. Other years—2017, 2018, 2019, 2021 and 2022—had similar shortcomings.**

In a Letter of Comment, dated April 28, 2022 (Exhibit E-8), Margaret Friesen, M.Sc. makes an equivalent statement on p. 4/24.

How do you respond to these statements?

A3: Mr. Karow does not provide any support for his claim nor does he provide a list of the references that the Exponent RF Health Report reportedly "missed."

In her letter, Ms. Friesen stated that she conducted her own literature search in EMF-Portal "using the search term '900' for the years 2017–2022," as well as searches in PubMed and her "own database" (p. 3). She then provides a list of documents for the year 2020, separated into four groups, that she claims were "missing" from the Exponent RF Health Report.

As stated in the Exponent RF Health Report, the objective of the report was to provide "a summary of primary, peer-reviewed epidemiologic and experimental research (i.e., published articles that present the authors' original research and findings) published after the most recent comprehensive review—SCENIHR (2015) … on such outcomes as cancer and non-specific symptoms" (p. 32). The documents listed by Ms. Friesen as not included in the Exponent RF Health Report were not included because they did not fit this objective inclusion criteria. Specific reasons for exclusion from the Exponent RF Health Report are listed below in Table 1.

Many of the published articles listed by Ms. Friesen are outside the scope of the Exponent RF Health Report, in that they are *in vivo* studies of biological and health outcomes other than cancer. *In vivo* studies of non-cancer outcomes were not covered in the report, which notes that all studies relevant to such outcomes have been reviewed by scientific and health organizations and that the overall conclusions of these organizations remain consistent. Specifically, the scientific evidence does not confirm that exposure to RF fields below scientifically-based exposure guidelines cause or contribute to the development of any adverse health effects, including chronic diseases and other health conditions. In addition, several of the documents listed by Ms. Friesen are review articles, not primary research articles. Review articles were intentionally excluded from the Exponent RF

Health Report, as is common in systematic literature reviews, because they do not report on new, original data, and are subject to gaps in the literature and the biases of the author or authors.[1]

Some of the other articles listed by Ms. Friesen would never be included in a report that summarizes research on RF exposure and human health because they either did not study the association between RF fields and a health outcome or they were not at all relevant to humans (e.g., a study on RF exposure to ticks; a separate study on RF exposure to onions). Additional documents listed by Ms. Friesen are not peer-reviewed articles published in a reputable journal and instead are simply articles pulled from the internet.

Ms. Friesen does not provide a reference list for the remaining search years, but based on the literature she specifically listed for 2020, we expect that these references similarly do not meet the inclusion criteria for the Exponent RF Health Report. It should be noted that the Exponent RF Health Report explicitly states that it covers research published through March 2021; therefore, it would indeed be expected that any studies Ms. Friesen identified after March 2021 and in 2022 were not included.

Table 1. Reasons for exclusion from the Exponent RF Health Report

Reason for exclusion in Exponent RF Health Report	Friesen Group 1. Primary Research specifically on 900 MHz exposures (n=21)	Friesen Group 2. Primary/original – RF radiation but not specifically on 900 MHz (n=2)	Friesen Group 3. Comments and articles about the NTP animal studies (n=1)	Friesen Group 4. Reviews and comments – except on NTP studies (n=25)
Not primary, peer-reviewed epidemiologic or experimental research			1	20
Outside the scope of the report (*in vivo* studies of non-cancer outcomes; *in vitro* studies; studies not relevant to human exposures)	19	1		1
Did not study the association between RF fields and a health outcome	1			1
Not isolated RF exposure	1	1		1

[1] Two additional articles identified by Ms. Friesen that were not included in the Exponent report (Rodrigues et al., 20210; Shih et al. 2020) do not provide sufficient evidence to alter the conclusions of the health and scientific organizations that have reviewed the literature on RF and health; that is, that the evidence does not confirm that RF fields below scientifically-based exposure guidelines cause or contribute to the development of cancer, or other chronic diseases, in adults or children.

Q4: On page 2 of Appendix A to Exhibit C7-12-1, Mr. Karow states:

> **CORE is further concerned that no Environmental Assessment has been completed. Flora and fauna, especially birds and insects, are highly vulnerable to the biological effects of exposure to wireless radiation. The effects of the increased levels of environmental RF pollution need to be investigated before this project is approved.**

Is an Environmental Assessment of the proposed AMI Gas Metering proposal warranted?

Q4: Scientists from Leiden University and the National Institute for Public Health and the Environment in the Netherlands published a systematic review of more than 113 peer-reviewed studies and existing reviews on the potential ecological effects of RF/microwave electromagnetic fields in the range of 10 MHz to 3.6 Gigahertz (GHz). Their main conclusion was that "No clear dose-effect relationship could be discerned" (Cucurachi et al., 2012, p. 116). These reviewers commented further:

> Considering the relevant remark of Beers (1989) 'a long list of reports of positive results yielded by inadequate experiments may appear impressive in a review and yet mean little.' No clear relationships, in fact, could be found between dosage and effects because of a wide variety of exposure strengths, durations, conditions, frequencies, time between exposures, assessment methods, measurement systems, replications efforts, and adequate dosimetry ...

> The plotting of the size of the ecologically relevant effects in relationship to the dose conditions applied did not seem to define a trend. Thus, the result of the graphical meta-analysis leads to no definitive conclusions about whether the effects are real, not real, or can be found only under certain conditions. The plotting of the size of the ecologically relevant effects in relationship to the dose conditions applied did not seem to define a trend (p. 137).

Scientists from the Australian Radiation Protection and Nuclear Safety Agency more recently described the state of knowledge about RF and potential impacts to the environment in their proposal to prepare a "systematic map [that] will collate all the available evidence on whether anthropogenic RF EMF has a negative effect on plants and animals in the environment" (Karipidis et al., 2021). As part of this proposal they discussed the Curcurachi et al. (2013) review cited above and other more recent reviews:

> A number of more recent reviews on anthropogenic RF EMF exposure have assessed the evidence on specific environmental topics e.g. animal orientation and migration [26], effects on insect pollinators [27],

> and alterations in the morphology and development of plants [28]. However, these reviews have generally been narrative rather than systematic, lacking detailed literature search methods or a rationale for the inclusion or exclusion of relevant studies. The inclusion of studies has often been selective (e.g. only presenting studies that show an effect) and a detailed analysis of the included studies has often been lacking. The European Union Eklipse project, which provides advice on issues related to biodiversity, published a recent overview on the impact of EMF on animals and plants [29]. Eklipse noted that the majority of the reviews are not systematic or objective but appear to be unbalanced and asserting a particular world view (i.e. that anthropogenic EMF is a problem for biodiversity) without strong supporting evidence (p. 3).

Given the weakness of the evidence for any effects of RF exposure to ecology and the environment even for sources that transmit RF signals at higher intensities and for longer periods like mobile phones, there is not a reasonable expectation that a separate Environmental Assessment is either warranted or would be informative.

2.2 CHARACTERISTICS OF RADIOFREQUENCY SIGNALS

Q5: Mr. Karow states on p. 1 of Appendix A to Exhibit C7-12-1, that the intensity of the Sonix IQ's RF signal "could be as high as 600 µW/cm^2." Is he correct?

A5: No. As admitted in his response to FEI IR 1 1.1, Mr. Karow states that he was incorrect. His response to FEI IR1 1.1 is further incorrect in that he cites documentation for an older generation of the Sonix IQ meter (FCC ID SDBSONIXIQ, Industry Canada Reference number 2200A-SONIXIQ), which is not the Sensus product proposed to be used by FEI.[2] The correct citation is SDBSONIXIQV2 and 2220A-SONIXIQV2, which operates at a lower power than the meter cited by Mr. Karow.

Q6: In CORE's response to BCSEA IR1 2.2, it states as follows:

> **Despite the fact that Safety Code 6 does not apply to microwave radiation, even if it did, the emissions exceed the allowable limits, according to the FCC ID relating [to] the Sensus Sonix IQ gas meters (FCC ID SDBSONIXIQ https://fccid.io/SDBSONIXIQ/RF-Exposure-Info/RFExposure-3997379). According to this certification document, this smart gas meter's power density at 20 cm is .448 mW/cm^2 or 448 µW/cm^2. The allowable limit according to Safety Code 6 is .273 mW/cm^2 or 273 µW/cm^2. The Sensus Sonix**

[2] Note the citations of "2220A-SONIXIQV2" and "SBDSONIXIQV2" are correctly identified in the Exponent RF Technology Report, Table 2, p. 18.

IQ's power density exceeds Safety Code 6's allowable limit by 164%.

Is this an accurate description of Safety Code 6 (SC 6)? Do the statements regarding Sensus Sonix IQ gas meters that FEI proposes to implement mean that they exceed the SC 6 allowable limit by the amount stated or at all? Please explain your answers.

A6: Mr. Karow's statements about SC 6 are inaccurate. SC 6 does apply to all electromagnetic field frequencies between 3 kilohertz (kHz) and 300 GHz, (SC 6, 2015, Table 5). Innovation, Science and Economic Development Canada (ISED) determined compliance of the Sonix IQ gas meters with SC 6, as identified in Table 2 of the Exponent RF Technology Report. Similarly, the U.S. Federal Communications Commission (FCC) has separately determined that the meters comply with the FCC standard.

Also, Mr. Karow misunderstands the SC 6 Standard by implying that the metric by which compliance with SC 6 is established is an instantaneous comparison with the SC 6 reference levels. This is incorrect. The metric for compliance with SC 6 is the basic restriction. The only scientifically *established* effect from RF/microwave electromagnetic energy occurring at the lowest level of exposure is heating of body tissue (for additional discussion regarding the status of research and conclusions on potential non-thermal effects see the response to Q8). Therefore, the basic restriction limits the amount of energy that can be absorbed by the body (including a safety factor) (see SC 6, Section 2, p. 4). The Reference Period of 6 minutes (SC 6, Table 5) for time averaging is used in recognition of the fact that the human body has natural processes to deal with temperature increases. For instance, when a person goes for a run, the core body temperature increases. As a result, the body sweats in order to regulate the temperature increase associated with the exercise (i.e., thermoregulation). The 6-minute averaging time is therefore a reflection of the ability of the body to properly thermo-regulate itself (i.e., remove the low level of excess heat) that results from exposure to the low level of electromagnetic energy.

Further, it is important to note that in addition to the temporal averaging, there is also a spatial component to compliance with SC 6. Particularly where a potential exposure is non-uniform over the spatial extent of the body (as is clearly the case for close proximity to a Sonix IQ gas meter) it is important to evaluate how the potential exposure changes in different portions of the body. This is clarified in the description for SC 6 reference levels which states:

> Spatially non-uniform external field strengths of power density can be spatially averaged, provided the sampling scheme applied ensures that none of the basic restrictions are exceeded at spatially-averaged exposures equal to the reference level. If spatial averaging is not applied, the spatial peak field strength shall be compared to the reference levels. In the case of field strengths, spatial averaging is with respect to the squared values of the field strength samples while for

power density, spatial averaging is with respect to the power density samples (SC 6, Section 2.2.2, p. 9).

At a distance of approximately 20 cm from the Sonix IQ meter, the power density is highly non-uniform, so spatial averaging is required to assess the exposure. In this situation, spatial averaging of measurements or a specific absorption rate (SAR) evaluation demonstrates compliance with SC 6.

The time factor only comes into play when measurements are taken to assess compliance with the standard. Persons can be exposed at or below 100% of the limit indefinitely. Exposure to levels above 100% can be permitted provided the duration is sufficiently short. This is because the absorption of RF energy by the body, and therefore the effects of RF exposure, are described by an intensity x time relationship. SC 6 allows short-term exposures higher than 100% of the reference level power density if the time-weighted average during any 6-minute period does not exceed the SC 6 reference level. Essentially, the total absorbed energy must not exceed the product of intensity and time.

It may be easier to understand the concept if we envision the accumulation of RF energy in tissue like water flowing into a small container. In this case the reference level states that the bucket cannot overflow. Different rates of water filling and time durations all will meet the standard as long as the total amount of water or energy deposited in a 6-minute period does not exceed the capacity of the container to accept flow without "spilling over."

Q7: On page 18 of Appendix B to Exhibit C7-12-1, Dr. Héroux states:

> **Figure 3 of the Exponent report (p. 8, PDF 326) attempt [*sic*] to picture Sonix's FSK protocol as part of the same family as the familiar AM and FM signals. The diagram does not display that the FSK signal is not continuous, but spurious, suddenly turning on and off with a duration of about 55 milliseconds (the burst is much longer than the 0.577 millisecond of GSM cell phone signals). A spurious signal increases biological activity.**

On page 76 of Appendix D to Exhibit C7-12-1, Dr. Havas states:

> **Several other aspects related to how a smart meter functions is worth noting here. Smart meters, WiFi, Bluetooth and cell phones, emit modulated and pulsed radiation. Scientists have long known that pulsed frequencies are more harmful than continuous radiation. Natural sources of radiation are continuous and not pulsed. An example of pulsed "light" would be strobing light, which has different biological characteristics to continuous light from an incandescent light bulb, for example. Pulsed light can bring on seizures in epileptics and would be stressful for all others should they be**

> **exposed to it for any length of time. Pulsed RFR [radiofrequency radiation] is detected by the body and causes physiological stress.**

And on page 77 of Appendix D, Dr. Havas states:

> **The radiation from a smart meter is modulated with a carrier wave and communication frequencies. This results in a chaotic emission and chaotic radiation adversely affects the body compared with coherent emissions that can be beneficial. The difference between coherent and chaotic is like the difference between music and noise.**

How do you respond to these statements?

A7: The RF signal from the Sonix IQ gas meter turns on and transmits a continuous frequency shift-keying (FSK) signal for 55 milliseconds and then turns off for approximately 4 hours. This is analogous to Dr Havas' description of "continuous light from an incandescent light bulb." While the light receptors in the human eye can detect when a light of sufficient intensity and frequency is turned on, scientists have not confirmed any analogous receptor for electromagnetic fields oscillating at lower frequencies, including RF/microwave. In essence, the human eye may be capable of seeing a light shown for a brief duration of 55 milliseconds, but the human body is not capable of directly detecting an RF wave at 900 MHz (whether brief or continuous).

Neither Dr. Héroux nor Dr. Havas have provided scientific evidence that would support their distinction between biological effects of sources of modulated or unmodulated RF signals. The mere adding of adjectives such as "spurious,"[3] "natural,"[4] "pulsed,"[5,6] and "chaotic" to describe RF signals from the Sensus FlexNet meters or other sources does not provide evidence for or against the potential effects of RF exposure on the body. Nowhere in their reports do they cite a body of peer-reviewed studies that support their claims in the text cited above.

Furthermore, by their own definitions of "pulsed," the FEI system would not be considered "pulsed." Dr. Havas defines *"*pulsed*"* as "a reference to digital as opposed to analog signals… The major difference is that the analog signals have continuous electrical signals, while digital signals have non-continuous (or pulsed) electrical signals*."* An FSK

---

[3] In response to FEI IR 6.1, Dr. Héroux defines spurious as "meant to express that the pulse will occur at an unexpected time from the point of view of the people exposed." So if FEI or anyone turns on an RF signal or a room light, it would be classified by Dr. Heroux as spurious for anyone else in the room simply because no warning was given. This definition has no technical meaning.

[4] The term natural by itself should not be understood to imply any description of health harm or benefit. There are both natural substances and electromagnetic fields in the environment (plant compounds, elements, electric fields, etc.) that while naturally occurring are nevertheless hazardous at defined concentrations or exposures, (e.g., arsenic, radon, ultraviolet light, cosmic rays).

[5] In response to FEI IR 6.1, Dr. Héroux defines pulsed as "a non-sinusoidal waveform, often of step, ramp or exponential waveforms that has no periodic repetition over time. It occurs over a limited period of time."

[6] In response to FEI IR 9.1, Dr. Havas defines pulsed radiation as "a reference to digital as opposed to analog signals. Analog and digital signals both carry information. The major difference is that the analog signals have continuous electrical signals, while digital signals have non-continuous (or pulsed) electrical signals.

signal is simply using two different analog sinusoidal signals (one of higher frequency and one of lower frequency) to represent digital values. Both sinusoids are analog signals; they are simply interpreted by a receiving digital device as digital information. Dr. Héroux defines “pulsed” as “a non-sinusoidal waveform, often of step, ramp or exponential waveforms that has no periodic repetition over time.” Figure 1 illustrates graphically the sinusoidal AM, FM, and FSK signals compared to examples of step, ramp, and exponential signals described by Dr. Héroux. Although not acknowledged by either Dr. Havas or Dr. Héroux, the only real difference between the FSK signal and the AM or FM signals that they appear to favor over other waveforms is that the AM and FM signals are constantly on while the FSK signal of the Sonix IQ meters transmits for only very brief periods (55 thousandths of a second every 4 hours).

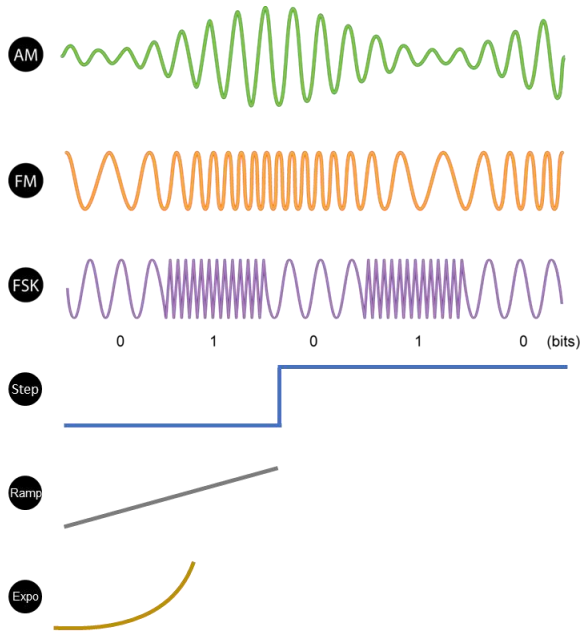

Figure 1. AM, FM, and FSK modulation types in contrast to step, ramp and exponential signals.

3.0 EXPONENT'S RESPONSE TO DR. HEROUX'S EVIDENCE (APPENDIX B TO EXHIBIT C7-12-1)

3.1 RF SAFETY LIMITS

Q8: **On page 3, Dr. Héroux states:**

> **Canadian Safety Code 6 (SC 6), describing safety limits for Radio-Frequency (RF) radiation, is based on an older Institute of Electrical and Electronics Engineers (IEEE) document, C95.1, which bases its own recommendations on avoidance of short-term tissue heating (temperature rise).**
>
> **Short-term heat cannot represent long-term health.**
>
> **Therefore, Exponent's assessment of FortisBC smart meter health impacts, based on SC 6, is entirely based on heat, and is incorrect.**

How do you respond to these statements?

A8: Given that Dr. Héroux has not adduced evidence showing that the scientific evidence cited and relied upon in the IEEE C95.1 RF standard is wrong or out-of-date and that the basis both for the IEEE C95.1 standard and the current and past versions of SC 6, have withstood the test of time, the inference that these standards are flawed is unsubstantiated.

With regard to Dr. Héroux's claim that the IEEE C95.1 standard, SC 6, and Exponent's assessment of the FEI gas meters are all incorrect because their assessments concluded that the only scientifically confirmed adverse effects at the lowest levels of exposure were caused by local or global heating of the body, it is based on his misstatement of those assessments.

Each of the standards criticized by Dr. Héroux state that reported effects of all RF exposures have been reviewed and evaluated, including those apparently linked to exposures of such low intensity that a thermal mechanism is unlikely. Hence, in the absence of reliable evidence for health effects from long-term exposure to RF fields, health and scientific agencies have focused on limiting exposures that would produce acute adverse effects from a shorter-term exposure.

a. Safety Code 6 (2015). Limits of Human Exposure to radiofrequency/microwave Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz.

> The exposure limits specified in Safety Code 6 have been established based upon a thorough evaluation of the scientific literature related to

> the thermal and non-thermal health effects of RF fields (p. 1, emphasis added).

b. IEEE International Committee for Electromagnetic Safety (ICES) (2019; 2020. IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields

> Review of the extensive literature on electromagnetic field (EMF) biological effects revealed that electrostimulation is the dominant effect at low frequencies and that thermal effects dominate at high frequencies. Examination of the radio frequency (RF) exposure literature revealed no reproducible low-level (nonthermal) adverse health effects. Moreover, the scientific consensus is that there are no accepted theoretical mechanisms that would explain the existence of low-level adverse health effects (p. 15, emphasis added).

c. International Commission on Non-Ionizing Radiation Protection (ICNIRP) (2020). Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz)

> For the purpose of determining thresholds, evidence of adverse health effects arising from all radiofrequency EMF exposures is considered, including those referred to as 'low-level' and 'non-thermal', and including those where mechanisms have not been elucidated. Similarly, as there is no evidence that continuous (e.g., sinusoidal) and discontinuous (e.g., pulsed) EMFs result in different biological effects (Kowalczuk et al. 2010; Juutilainen et al. 2011), no theoretical distinction has been made between these types of exposure (all exposures have been considered empirically in terms of whether they adversely affect health) (p. 5, emphasis added).

Additional limitations of Dr Héroux's statement "Short-term heat cannot represent long-term health" are explained in Section 4, Exposure Limits and Regulatory Standards, of the Exponent RF Health Report.

Q9: On page 11 of Appendix B to Exhibit C7-12-1, Dr. Héroux provides Table 1 (reproduced below) that lists RF exposure limits advocated by various groups and the exposure limits published in SC 6, ICNIRP, and IEEE-ICES standards.

Table 1. Exposure limits specified by EUROPAEM, AMA, IGNIR, Baubiologie, SC6 and ICNIRP-IEEE at 900 MHz.

Safety Limit	Category	Reference Level Power Density, µW/m2	Ratio to SC6
European Academy for	Daytime	100	27,000
Environmental Medicine	Nighttime	10	270,000
EUROPAEM (2016)	Sensitive	1	2,700,000
Austrian Medical	Very far above normal	1000	2,700
Association	2nd risk level	10-1000	270,000 - 2,700
AMA (2012)	1st risk level	1-10	2,700,000 - 270,000
	Normal	< 1	> 2,700,000
International Guidelines on	Daytime	10-100	270,000 - 27,000
Non-Ionising Radiation	Nighttime	1-10	2,700,000 - 270,000
IGNIR (2018)	Sensitive	0.1-1	27,000,000 - 2,700,000
Baubiologie MAES	Extreme Concern	>1000	< 2,700
Bau (2018)	Severe Concern	10-1000	270,000 - 2,700
	Slight concern	0.1-10	270,000 - 27,000,000
	No Concern	<0.1	> 27,000,000
Health Canada SC6		2,700,000	1
SC6 (2015)			
ICNIRP-IEEE		4,500,000	1.67
ICNIRP (2020-2019)			

What is your assessment of the limits recommended by these other groups? Are they RF standards?

A9: Any organization or person can propose an exposure limit, but that does not mean the limit merits the appellation of a “standard.” Standards are developed by expert organizations or agencies to protect occupational and public safety. A comparison of the exposure limits that Dr. Héroux appears to endorse reveals that:

a. There are a few pages of the EUROPAEM (2016), Austrian Medical Association (AMA) (2012), International Guidelines on Non-Ionising Radiation (IGNIR) (2018), and Baubiologie MAES (Baubiologie) (2018) documents devoted to RF limits, but there is no evidence that they were developed based upon a robust review of the relevant peer-reviewed scientific literature, let alone the full-fledged documented review provided by SC 6, ICNIRP, and IEEE.

b. IGNIR (2021) states, “IGNIR guidelines are designed to prevent all adverse effects from wireless radiation and EMFs for all people without any exceptions, at the relevant level of Day, Night or Sensitive.”

No evidence is presented to support the claim that exposure to RF during the day produce different effects from those at night or that there are “sensitive” populations for whom the weight of the evidence identifies RF exposure as the cause of self-reported symptoms. Neither IGNIR (2018) nor the current edition, IGNIR (2021), provide their own scientific rationale or documentation for the IGNIR guideline. Rather, IGNIR states that, *“*IGNIR has developed a set of Guidelines for electromagnetic exposure based on the peer-reviewed EUROPAEM EMF Guidelines 2016*.”* The frequency ranges to which the limits of the EUROPAEM, AMA, and Bau guidelines are meant to apply are not specified, except for IGNIR, which states a range from 30 MHz to 300 GHz.

c. The EUROPAEM guidelines (Belyaev et al., 2016) are a little more than a recitation of “... more than 20 position papers and resolutions regarding EMF and health [that] have been adopted by EMF researchers and physicians” (p. 4). The EUROPAEM guidelines are based on an earlier document, “EUROPAEM EMF guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses,” that was also published in the journal *Reviews on Environmental Health*, and was later retracted by the authors (Belyaev et al., 2015). Like the 2015 paper, EUROPAEM (2016) paper is titled *“EUROPAEM EMF Guideline for the prevention, diagnosis and treatment of EMF-related health problems and illnesses”* so the question of whether scientific evidence supports the premise of adverse effects or disease caused by RF is not one examined by EUROPAEM. Despite the many references cited, the text devoted to EMF at RF frequencies is scant, and no health assessment or research upon which the guidelines should be based is provided; the focus is merely on guidance for avoiding exposure. There is no explanation for the 1,000-fold difference between exposure limits for different sources. EUROPAEM (Belyaev et al., 2016) also notes *“*These recommendations are preliminary and in large parts, although related to the whole body of evidence rooted in the experience of the team, cannot in every detail be strictly considered evidence-based*”* (p. 13).

Q10: On page 5 of Appendix B to Exhibit C-7-12, Dr. Héroux states that:

> **In toxicology and risk assessment, one sets safety limits based on observable physiological reactions, or on diseases. This is amply illustrated in the American Conference of Government Industrial Hygienists [ACGIH] Threshold Limit Values [TLVs] for chemical Substances and Physical Agents. The table of adopted values, for more than 600 chemicals, lists the name of each of the chemicals, along with the physiological, medical or pathological impacts used to set the limit.**

On page 6 of Appendix B, Dr. Héroux states that:

> **IEEE used the wrong criteria or experiments to establish safety limits at ELF [extremely low frequency] (shocks) and RF (heat), but further focused on short, acute effects of shocks (1 second) or heat (6 or 30 minutes), which is again completely at odds with toxicological tradition. If we consider the body of data developed for protection against chemicals (TLVs and BEIs 2009), we note that only 15% of chemicals have a short-term exposure limit, while all of them have long-term exposure limits. This means that assessing toxicity and exposure over such short periods is expected to miss 85% of limit-setting toxicities. The choices made by IEEE deliberately ignored the health risks occurring over longer than a few seconds (ELF) or hour (RF).**

Are Dr. Héroux's comments about the standard setting process valid?

A10: No, Dr. Héroux's statements are incorrect in several ways.

First, the process followed by ACGIH is similar to the process by which the standards are developed by IEEE, SC 6, and ICNIRP.

On p. 5, Dr. Héroux appears to favor the risk assessment methods applied by ACGIH to the setting of its TLV and biological exposure indices (BEI) standards for occupational chemical exposures. On p. 5 Dr. Héroux describes the ACGIH process of setting safety limits. What he did not add is that both ACGIH (2009) that he cites and ACGIH (2021) also recommend TLVs for RF for workers between 30 kHz and 300 GHz.

> These TLVs® represent conditions under which it is believed nearly all workers may be repeatedly exposed without adverse health effects. The TLVs® were designed to limit electrostimulaton of nerve and muscle tissue at frequencies from 0.03 to 0.1 MHz [30 kHz to 100 kHz] and tissue heating above 0.1 MHz [100 kHz] (ACGIH, 2021, p. 137)

As stated on the ACGIH website "Threshold Limit Values (TLVs®)" refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects.[7]

Table 2 shows that the ACGIH limit on RF exposure of workers at 900 MHz, the frequency of the Sonix IQ gas meter, is higher than the limits recommended by SC 6, IEEE, ICES, or the FCC in the United States for occupational exposure at this frequency. So the

[7] https://www.acgih.org/science/tlv-bei-guidelines/tlv-chemical-substances-introduction/

process that Dr. Héroux appears to approve of supports the ACGIH limit on RF, which is higher than limits set by SC 6, IEEE, and the FCC for occupational exposure.

Table 2. Comparison of ACGIH TLV Limit for Occupational Exposure to SC 6, IEEE, and FCC RF standards at frequency of 900 MHz

Agency	Power Density (W/m^2)	Occupational /Controlled Environment Averaging Period (Minutes)
ACGIH TLV (2021)	30	6
SC 6 (2015)	19.36	6
ICES (2019)	22.5	30
FCC	30	<6

Second, the standards in Table 2 did not focus or limit the review of evidence to just "short, acute effects (1 second) or heat (6 or 30 minutes)" as claimed. Studies in the large RF literature reviewed by these agencies have evaluated exposures lasting less than a second in duration or as long as many years. Based on reviews of the complete body of literature by these standard-setting organizations, exposure limits were developed to protect against established effects. See also the response to Q11.

3.2 Comparisons of RF to Other Frequencies of Electromagnetic Fields

Q11: On page 15 of Appendix B to Exhibit C-7-12, Dr. Héroux states:

> **All "energies" of electromagnetic fields are not the same, contrary to what is implied in many locations in the Exponent report. Natural sources such as the Earth's magnetic field, infrared emissions from the body, and sunlight, are entirely different from Sonix emissions. They differ in frequency, modulation, and pulsation.**

Dr. Héroux also provides Figures 9b through 9d, "updating" Exponent's Figure 6 (the Exponent RF Technology Report, p. 27) which provides a comparison of estimated RF exposure levels.

What is your response to Dr. Héroux's evidence in this regard?

A11: We agree that the electromagnetic fields across the spectrum of frequencies ranging from the static magnetic field of the Earth to sunlight differ in frequency by a factor of more than 10^{19} (as shown in the Exponent RF Technology Report, Figure 2, p. 3). Therefore their corresponding energies similarly differ and cannot be directly compared. Dr. Héroux himself agrees when he states "… it is not appropriate to compare, or lump together, signals or fields that have large differences in frequencies. Specifically, the static field of the Earth (frequency = 0), body infrared emissions (300 to 400,000 GHz) and the radiation from the Sun (higher than 75,000 GHz) …" (p. 16).

With respect to modulation and pulsation, there also are differences between sources. Dr. Héroux points to “pulsation” as a difference between electromagnetic fields. His definition in response to FEI IR1 6.1, states “A pulse is a non-sinusoidal waveform… .” However, the transmissions of the Sonix IQ meters are not pulsed (see response to Q8 above) since the FSK modulation is simply the combination of two sinusoidal waveforms of different frequencies. In comparing electromagnetic fields across wide swaths of frequencies, there are differences in the way they interact with organisms and differences in biological effects. However, within certain portions of the frequency range, the interactions with organisms and biological effects have been shown to be quite similar, as is the case for RF/microwave fields between about 100 kHz and 300 GHz.

Furthermore, Dr. Héroux provided no scientific evidence that the characteristics of modulation and “pulsation” of RF fields produce different biological or health effects.

A different but related topic is whether modulation of an RF signal has different effects. For this Dr. Héroux cites the National Toxicology Program (NTP) study in which small differences between effects of exposure to RF signals characteristic of mobile phones with GSM and CDMA modulations were reported. After peer review, the ratings given by the NTP to both modulations were the same (NTP, 2018a, 2018b). More important, as noted in the Exponent RF Health Report, there are serious criticisms of some methods and interpretation of the NTP study regarding the role of thermal effects. For this reason, the NTP is performing a partial replication of critical aspects of the study (NCI, 2022; NTP, 2022). The International Validation Project of the NTP Study on the Carcinogenesis of Mobile-Phone RFR was launched in 2019 and will be performed simultaneously in Korea and Japan (Ahn et al., 2022)

It is important to note that unlike the CORE scientists, the NTP did not list either RF EMF as “Known To Be Human Carcinogens” or “Reasonably Anticipated To Be Human Carcinogens” in its most recent Report on Carcinogens (NTP, 2021).

Q12: In his discussion on pages 19-23 of his report, Dr. Héroux argues that certain manmade and natural sources of RF electromagnetic energy should be excluded from the comparison to the Sonix IQ gas meters.

Is there merit to his claim?

A12: No. Dr. Héroux’s removal of the sources to which he objects is arbitrary, unfounded, and unsupported by any scientific evidence. The implication from his artificial removal of sources is that the *only* source in British Columbia that provides a “valid” comparison to the FEI system is a cell phone base station 28 km away (e.g., Fig. 9d on page 23).

Notwithstanding any of the above, it is interesting to note that even according to Dr. Héroux’s estimate, a single cell phone base station within 28 km would expose residents to over 10 times more RF energy than a Sonix IQ gas meter indoors (Fig. 9d, p. 23). It is also interesting to note that according to Dr. Héroux’s assessment, even if a person spent

their entire day indoors 1 m away from the Sonix IQ gas meter, it would meet the EUROPAEM "Daytime limits." If persons were concerned about the exposure from the Sonix IQ gas meter, they may be able to spend less than 100% of their time close to the Sonix IQ gas meter, and instead spend the majority of their time 3 m or more away from the gas meter. At a distance of 3 m or more, the exposure of the Sonix IQ gas meter indoors would be below even the "Sensitive limits" of EUROPAEM.

3.3 CUMULATIVE EFFECTS OF RF

Q13: In section 4 of his report (Appendix B to Exhibit C7-12-1), on page 38, Dr. Héroux comments on the "densification of the RF Environment" (i.e., the proposed increase in the number and distribution of RF sources associated with the AMI Project). Does he present a scientific basis for these comments?

A13: No. Dr. Héroux's complaint conflates the number of sources with the extent of exposure to RF fields. The very small areas around the Sonic IQ gas meters where RF signals are greatest in aggregate are very much smaller than the area exposed to RF fields by even a single radio station in British Columbia (e.g., as discussed in the Exponent RF Technology Report, pp. 28-29). The average RF power density indoors from the CBUT-DT broadcast station at a distance of approximately 340 kilometers is the same as the indoor exposure from the Sonix IQ gas meter. So, the number of sources is not a good proxy for RF exposure .

3.4 REBUTTAL TO SPECIFIC STATEMENTS

Q14: In Section 5.2 of his report (Appendix B to Exhibit C7-12-1), on pages 29-30, Dr. Héroux points to recommendations by the FCC and ISED contained in the Sonix IQ Quick Guide A9REC44.pdf to avoid exposure from regulated RF devices at distances of 20 cm and 26 cm, respectively.

Do these statements in the Sonix IQ Quick Guide support Dr. Héroux's opinion that "a considerable volume of a home could be subject to adverse radiation" due to the Sonix IQ meter and that this would "yield a deleterious zone of 260 m?"

A14: No. The recommendations noted above are "to ensure compliance" in notices that SC 6 reference levels or FCC maximum potential exposures (MPE) may be exceeded at closer distances. Since the devices are not intended to be used at closer distances, no additional lengthy and costly assessment is required to demonstrate compliance with the underlying basic restriction. Neither the FCC nor ISED have determined that there is any health risk from exposure to RF from small devices at distances less than those specified. Given the low signal strength of the meters (similar to a cell phone) and the short (55 milliseconds) and infrequent transmissions (about every 4 hours), even placement of a person's head at the surface of the meter would not be expected to cause a violation of the SC 6 basic restriction. This is consistent with the findings of the FCC (Knapp, 2010) which state that:

> … based on the typical maximum time-averaged transmitter power for many of these [smart meter] devices, they would generally be compliant with the local SAR limit even if held directly against the body" (emphasis added).

Dr. Héroux stakes his claim for adverse health effects at very low levels not by providing scientific evidence, but by invoking unsubstantiated precautionary limits of EUROPAEM, AMA, and Baubiologie in Figure 3.[8] It also should be pointed out that if Dr. Héroux's claim *were* valid, then a similarly sized "deleterious zone of 260 m" would be present around each and every cell phone operating within British Columbia (cell phones operate using similar power levels, but transmit, on average, far more often than the approximately 0.34 seconds per day of the Sonix IQ Gas Meters).

Q15: On page 26 of Appendix B to Exhibit C7-12-1, Dr. Héroux presents Fig. 11 showing a bank of meters from some other unidentified meter system. Without dismissing the possibility of an installation of more than one Sonix IQ gas meter being located close to another, would such an installation produce RF exposures that would exceed the SC 6 limit?

A15: No. First, each Sonix IQ gas meter is configured to transmit every 4 hours on a pseudo-random schedule of ±20% of the transmission period (see the Exponent RF Technology Report, p. 16), meaning that the likelihood of two meters transmitting at the same time is very low (the purpose of the pseudo-random transmission schedule is precisely to prevent potential transmission interference of two meters transmitting at the same time). Second, even if there were a bank of 100 meters, the total daily transmission time from the combined 100 meters would be approximately 34 seconds, which would result in a tiny fraction of the SC 6 limit (see the Exponent RF Technology Report, Table B-2). Third, as described by Equation 1 of the Exponent RF Technology Report (p. 21), the strength of the RF transmission from a gas meter decreases very rapidly with distance so only the gas meters immediately adjacent to a person would be meaningful in an exposure assessment because the contribution of those even a few meters away would be negligible in comparison.

As noted by the FCC, "… Irrespective of duty cycle, based on the practical separation distance and the need for orderly communications among several devices, even multiple units or 'banks' of meters in the same location will be compliant with the public exposure limits" (Knapp, 2010). In essence, the RF from smart meters would comply with RF exposure limits, even if held against the body or clustered together at one location.

Q16: On pages 14-15 of Appendix B to Exhibit C7-12-1, Dr. Héroux suggests that "health criteria to establish these much lower levels [of RF exposure recommended by EUROPAEM, AMA, IGNIR, Baubiologie]" include "(1) sleep disruption; (2) headaches; (3) ringing or buzzing in the ears; (4) fatigue; (5) loss of concentration,

[8] The units of exposure in Dr. Héroux's Figure 3 are not specified.

memory, and learning ability; and (6) disorientation, dizziness, and loss of balance. Dr. Héroux identifies to two public opinion surveys of self-reported symptoms in which sleep disruption symptoms were the most common of these or other symptoms reported in both surveys

Are these the type of surveys that can scientifically link self-reported health symptoms to RF exposure from smart meters?

A16: No, these public opinion surveys cannot assess the relationship between self-reported symptoms and RF exposure from smart meters. The symptoms reported by the survey respondents were not accompanied in any way by measured RF exposure levels from smart meters or any other source. The list of symptoms reported by the survey respondents are also very non-specific (e.g., headaches, sleep problems, nausea) and attributable to many other exposures in our environment. Therefore, the surveys cannot be used to inform the relationship between RF exposure and self-reported symptoms; this can only be assessed through a properly designed epidemiologic or experimental study in which both exposure and outcome are identified *a priori* and measured.

Q17: While the public opinion surveys cited by Dr. Héroux above in Appendix B to Exhibit C7-12-1 do not provide a scientific basis for his beliefs about smart meters, he did cite some published studies that to him support his beliefs about RF effects of cell phones on sleep symptoms in his response to RCIA IR1 3.1.1.

Do those studies confirm that sleep disturbance would be a consequence of the deployment of Sonix IQ gas meters?

A17: No. There are several reasons to doubt this inference. The cell phone studies to which Dr. Héroux refers involve the measurement of brain electrical activity (electroencephalogram [EEG]) during sleep. However, he seems to equate changes in EEG between exposure conditions with behavioral sleep disturbance; they are not the same. The EEG reflects brain activity from all environmental stimuli and many internal physiological states. The frequency and location of activity within the brain varies during different sleep stages but a change in EEG activity per se is not the same as a diagnosed sleep disturbance.

Moreover, the studies were of persons exposed to cell phones or simulated cell phone signals, so the levels of RF fields to which the subjects were exposed were far greater than exposures to persons within homes and at much greater distances from proposed Sonic IQ meters. Most of the EEG sleep studies cited by Dr Heroux were reviewed by SCENIHR (2009, 2015):

> … the previous evidence that RF exposure may affect brain activity as reported by EEG studies during both wake and sleep appears also in recent studies. However, the relevance of the small physiological changes remains unclear and mechanistic explanation is still lacking. Overall, there is a lack of evidence that RF EMF affects cognitive

> functions in humans. Studies looking at possible effects of RF fields on cognitive function have often included multiple outcome measures. While effects have been found by individual studies, these have typically been observed only in a small number of endpoints, with little consistency between studies (SCENIHR, 2015, p. 6).

Finally, the Exponent RF Health Report's review of more recent human experimental and epidemiologic studies does not support the hypothesis that RF exposures are the cause of sleep disturbance or other symptoms. Thus, the weight of the scientific evidence does not support Dr. Héroux's assertion in his response to RCIA IR1 3.1.1 that "it is well known that one of the effects of RF radiation is to disturb sleep."

4.0 EXPONENT'S RESPONSE TO DR. MILLER'S TESTIMONY (APPENDIX C TO EXHIBIT C7-12-1)

Q18: On page 52 of his report (Appendix C to Exhibit C7-12-1), Dr. Miller states, "Since then [i.e. publication of IARC (2011)] new science has emerged, both human and animal, confirming that RFR causes cancer".

Does this accurately summarize the current science? What is your response to this statement?

A18: No, Dr. Miller's statement is in fact highly inconsistent with the current scientific consensus on RF and human health. In the time since the International Agency for Research on Cancer (IARC) classified radiofrequency fields as a Group 2B carcinogen in 2011, a number of prominent regulatory, scientific, and health organizations have reviewed the research on RF exposure and health (AGNIR, 2012; HCN, 2013, 2014, 2016; IARC, 2013; WHO, 2014, RSC, 2014; SCENIHR, 2015; SSM, 2016, 2018, 2019, 2020, 2021; ICNIRP, 2020; FDA, 2020). These organizations have all independently reached the same conclusion regarding RF exposure and health—that the evidence does not confirm that RF fields below scientifically-based exposure guidelines (e.g., the ICNIRP guidelines) cause or contribute to the development of cancer, or other chronic diseases, in adults or children.

Q19: Dr. Miller criticized Exponent's RF Health Report page 53, as follows:

> **I have had the opportunity to review Exponent's RF Health Report (Exhibit F-2) as well as FortisBC Energy Inc.'s responses to CORE's information requests and find much of this material to be uninformative, or simply wrong. Fortis appears to be claiming that radiofrequency radiation (RFR) has no adverse effects on humans other than tissue heating. This was disproved many years ago [emphasis added].**

Does Dr. Miller substantiate his criticism of the Exponent RF Health Report as "uninformative or simply wrong?" Do you agree that the weight of scientific evidence and the consensus of scientific opinion that there are no adverse RF/microwave effects on humans other than tissue heating was "disproved many years ago"?

A19: No to the first question. While Dr. Miller is free to offer an opinion about the Exponent RF Health Report, and responses to CORE's information requests, he offers no substantive evidence to back up his criticism.

In response to the second question, health and scientific agencies referenced in Exponent's RF Health Report contradict the opinion offered by Dr. Miller. The conclusions of these agencies is that there are no confirmed adverse health effects at levels of RF

exposure below levels set to avoid any injurious effect of RF whatever the mechanism involved. The consensus of scientific and health agencies is summarized in documentation supporting ACGIH's TLV standard for occupational exposure to RF electromagnetic fields:

> There is a scattering of reports of nonthermal effects from RF exposures at low exposure levels, as well as a body of epidemiology studies that report health effects I people occupationally exposed to RF fields, or to users of cellphones or other RF-emitting equipment. However for a variety of reasons, the expert committees that have reviewed this literature have not considered these reports to be persuasive evidence of potential hazards from RF exposures below the TLVs. ACGIH will continue to follow the scientific literature and revise the limits appropriately as new information appears (ACGIH, 2021, p. 6).

Q20: In his response to FEI IR1 7.1, Dr. Miller dismisses the relevance of the 288 page assessment prepared by 14 scientists for the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in 2015 to the assessment of neoplastic disease from RF exposure because "... it was written before the more recent studies that showed increased risk to humans from electrical the magnetic fields I cited in my report" (Response to FEI IR1 7.1).

Does Dr. Miller's report confirm this line of reasoning?

A20: No, his report references 17 studies, only 2 of which are human epidemiology studies published after 2015.

Q21: On page 53 of Appendix C to Exhibit C7-12-1, in an attempt to rebut Exponent's RF Health Report, Dr. Miller states, "I append an article I and several colleagues published a few years ago which documents that RFR is a human (as well as an animal) carcinogen" (p. 53) [Citation to Miller et al. (2019)].

On page 54, Dr. Miller reiterates this claim: "I and many other scientists now believe that RFR should be categorized as a Class 1 Human Carcinogen, in the same category as cigarette smoking, asbestos exposure, and X-Rays."

Do you agree with Dr. Miller's claim?

A21: Not at all. The conclusions of scientific and health agencies do not support this conclusion. (AGNIR, 2012; HCN, 2013, 2014, 2016; IARC, 2013; WHO, 2014a, RSC, 2014; SCENIHR, 2015; SSM, 2016, 2018, 2019, 2020, 2021; ICNIRP, 2020a; FDA, 2020.). The conclusion quoted above from Dr. Miller's testimony does not match the opinions he has expressed in the paper he appended to his testimony. In that paper (Miller et al., 2019),

Dr. Miller and his co-authors only state that, “we recommend that IARC re-evaluate its 2011 classification of the human carcinogenicity of RFR, and that WHO [the World Health Organization] complete a systematic review of multiple other health effects such as sperm damage” (p. 56).

We note that Dr. Miller’s claims expressed in his testimony are inconsistent with the assessment of the U.S. National Cancer Institute , which concluded that “the evidence to date suggests that cell phone use does not cause brain or other kinds of cancer in humans” (NCI, 2022).

Q22: Do you have any other comments on Dr. Miller’s review of RF research in Miller et al (2019)?

A22: Yes. The review itself is quite short, superficial, and selective, and is focused primarily on exposures (RF level and frequency) unrelated to the FEI Project. It also repeatedly references another publication from Dr. Miller himself (Miller et al., 2018). We address some of its shortcomings and scientific quality below.

Miller et al. (2019) is highly selective and not a comprehensive review of the existing body of published epidemiologic research on carcinogenicity. The review does not include many of the more recent published studies that have investigated the relationship between mobile phone use and cancer (e.g., Söderqvist et al., 2012; Moon et al., 2014; Vila et al., 2018, Luo et al. 2019). These studies, and many others, have been included by scientific and health organization in their reviews as part of the evidence for concluding that the research does not confirm that RF fields are a cause of cancer or any other disease at the levels we encounter in our everyday environment. Further, the Miller et al. (2019) review cites two pooled analyses that report associations between the use of mobile and cordless phones and glioma development (Hardell and Carlberg, 2015) and acoustic neuroma (Hardell et al., 2013). As pooled analyses, however, these two publications are of fairly limited value, as they only included data from previous studies published by the same authors; no data from any other published studies was included. Interestingly, Miller et al. (2019) did not include Carlberg and Hardell (2015), another pooled analysis by the same authors that observed no overall association between use of mobile or cordless phones and meningioma development, further demonstrating the selectivity of publications in this article.

Miller et al. (2019) also omits a thorough discussion on epidemiologic cancer studies involving more distant RF sources, such as mobile phone base stations, AM/FM radio and TV broadcast transmitters, or Wi-Fi (e.g., Dabouis et al. 2016; Satta et al. 2018, Gonzalez-Rubio et al., 2017). These exposure sources, in particular mobile phone base stations, are more comparable to the proposed FEI network base stations, as they represent low-exposure sources in communities due generally to being located high above ground.

The Miller et al. (2019) discussion on the literature related to non-cancer health outcomes is similarly selective and incomplete and does not include a comprehensive discussion of the strengths and limitations of the studies cited. Significant limitations of some of the cited studies have been discussed elsewhere, including in the literature reviews published by SCENIHR and the Swedish Radiation Safety Authority (SSM). These limitations include the potential for exposure misclassification (Sudan et al., 2016), residual confounding (Zhang et al., 2016; Choi et al., 2017), failure to consider potential exposure sources other than mobile phones (Rago et al., 2013), and studies with significant methodological shortcomings in a meta-analysis (Adams et al., 2014).

Dr. Miller argues that the existence of so called “electrical hypersensitivity” symptoms linked to exposure to RFR is justified in part because “Causal inference is supported by consistency between epidemiological studies of the effects of RFR on induction of human cancer, especially glioma and vestibular Schwannomas and evidence from animal studies (8)” (p. 59). Notwithstanding the weak and inconsistent epidemiological evidence for his claim for a causal relationship between RF exposure from mobile phones and some cancers discussed above, it is illogical and non-scientific to attempt to prove a causal relationship, if true, by citing unproven claims for cognitive RF-IEI effects of RF of a wholly different nature.

The review article cited (Miller et al., 2019) is clearly focused on research on cell phones, not wireless devices like Sonix IQ meters. Cell phones produce RF exposure to the head that are approximately 1.8 million-fold higher than the Sonix IQ meters (Exponent’s RF Technology Report, Figure 5).

Q23: The article Dr. Miller appended to his testimony (Miller et al., 2019) includes an Annex to explain “how the health policy recommendations above, invoking the Precautionary Principle, might be practically applied to protect public health” (p. 61).

Notwithstanding any views you may have about the scientific adequacy of Miller et al (2019), is the design of the proposed FEI Project consistent with “actions for reducing exposure” set out in the Annex to Dr. Miller’s article?

A23: Yes, the placement locations, low power, and infrequent signal transmissions effectively minimize exposure to the general public discussed in Recommendations 1 to 5. Other examples, the adoption of limits below SC 6 (Recommendation 6) and those pertaining specifically to cell phones and the Internet (Recommendations 7 to 11) are not under FEI’s remit or relevant to this project.

5.0 EXPONENT'S RESPONSE TO DR. HAVAS' EVIDENCE (APPENDIX D TO EXHIBIT C7-12-1)

Q24: Dr. Havas' report (Appendix D to Exhibit C7-12-1) focuses on certain aspects of Exponent's RF Technology Report (Appendix F-1 to Exhibit B-1). Is the content of Dr. Havas' report within her areas of academic training and expertise?

A24: No. Dr. Havas spent most her report addressing physics, engineering, and RF exposure topics, which lie outside of her training and expertise. She devoted very little of her report to electrical hypersensitivity, which is the main focus of her publications, public lectures, website postings, talks, Internet videos, etc.

5.1 COMPARISONS TO BLACKBODY RADIATION

Q25: On page 67 of Appendix D to Exhibit C7-12-1, Dr. Havas states:

Table 4 [of Exponent's RF Technology Report] states that blackbody radiation emits between 0.003–3,000 MHz. This is incorrect.

Blackbody radiation is shown in Fig. 1 [p. 67]. The "tail" to the right of visible light is infrared radiation and not radiofrequency radiation. This is important because Exponent then uses this information in Figure 5 and states that humans and the earth emit radiofrequency radiation when in fact, they are both emitting heat (infrared radiation) and not RFR.

Dr. Havas' Figure 1 is reproduced below.

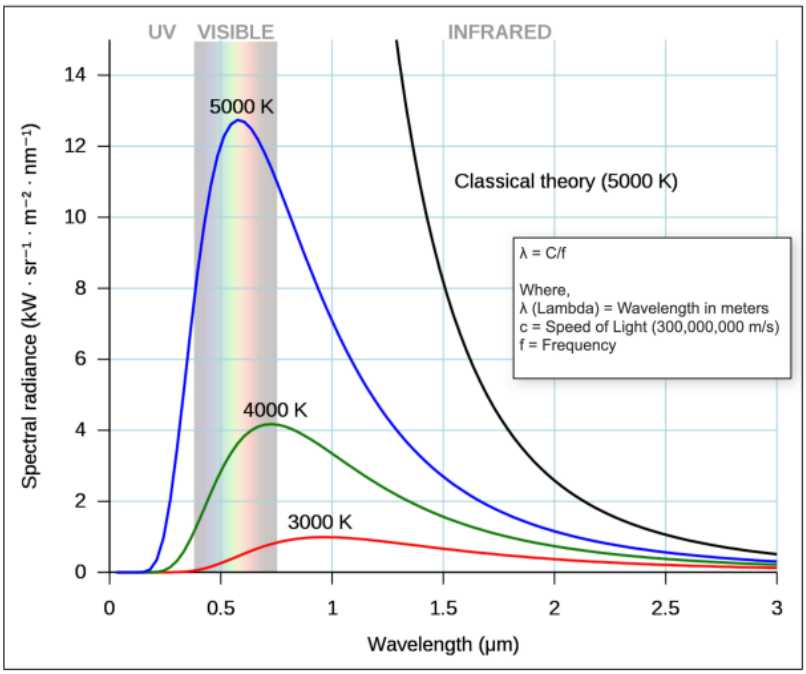

Figure 1. Spectral radiance associated with Blackbody Radiation.
Source: https://commons.wikimedia.org/wiki/File:Black_body.svg

What is your response to these statements about Blackbody radiation?

A25: First, Dr. Havas contradicts herself in her response to FEI IR1 8.2 (copied from Wikipedia) stating that:

> A black-body is an idealised object which absorbs and emits all radiation frequencies. Near thermodynamic equilibrium, the emitted radiation is closely described by Planck's law and because of its dependence on temperature, Planck radiation is said to be thermal radiation, such that the higher the temperature of a body the more radiation it emits at every wavelength [emphasis added].

While it is true that the *majority* of the electromagnetic energy emitted by the earth and humans is in the infrared portion of the electromagnetic spectrum, these black bodies also emit electromagnetic energy in the RF/microwave portion of the electromagnetic spectrum (i.e., 3 kHz–300 GHz) that are covered by standards such as SC 6, ICNIRP (2020), and ICES (2019).

Second, quantum physics and statistical mechanics identify that every object with a temperature above -273° C (0 degrees Kelvin [K]) has an average kinetic energy that consists of electrons moving at a vast range of velocities and frequency ranges whose span include the RF range (i.e., black body radiation). Black body radiation is discussed in the Exponent RF Technology Report at pp. 4-5. The haphazard motion of the electrons causes a motion whose spectrum is broadband and causes spontaneous emissions that are directly related to temperatures > 0 Kelvin. The emission of electromagnetic fields at

any frequency, including in the RF/microwave range of 3 kHz–300 GHz can be readily calculated by Planck's law shown in Dr. Havas' figure from Wikipedia.

Dr. Havas attempts to rebut Exponent's description of black body radiation between 3 kHz and 300 GHz by reference to Figure 1 from Wikipedia. What Dr. Havas does not acknowledge is that the wavelengths of the electromagnetic fields in the Wikipedia figure only extend to 3 micrometers (µm) (i.e., the lowest frequency shown is about 100,000 GHz). The wavelengths of the range of frequencies cited by Exponent for the earth and human body extend far off the x-axis of this graph as their frequencies are much lower (i.e., 3 kHz to 300 GHz). Further, the temperature of the human body is 37° C (about 310 K), so the scale of the y-axis does not show low K values and a logarithmic scale would be needed to see the very large energies of the Sun and the very small energy of earth or humans.

Figure 2 below, from a peer-reviewed engineering journal, compares power from 3K and 310 K sources as a function of wavelength on a logarithmic scale. The figure clearly shows the power density of black body radiation of the human body, although less than from a light bulb, is nevertheless still quite evident. The energy from a human or earth (i.e., the electromagnetic energy *only* in the 3 kHz–300 GHz RF/microwave range)[9] is so small as to be negligible to any potential exposure assessment, but as shown in the Exponent RF Technology Report (Figure 5), this comparison provides valuable context—even this extremely small amount of energy is approximately 4,200 times greater than the average exposure 1 meter away (indoors) from a Sonix IQ gas meter.

[9] The blackbody energy from humans or earth at higher frequencies (i.e., lower wavelengths) is thousands of times larger; this is why infrared imaging of a human or earth is so much easier than imaging or measurement of very weak RF/microwave signals.

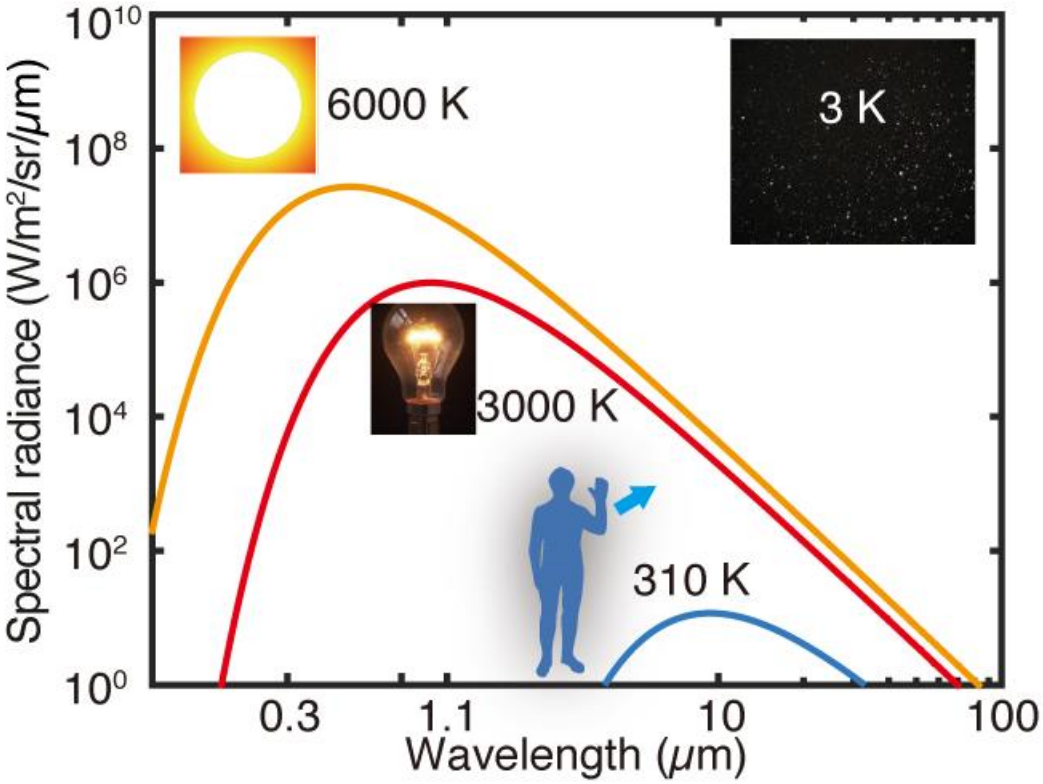

Figure 2. Blackbody thermal radiation at temperatures of several important thermodynamic resources: Sun at 6000 K, light bulb at 3000 K, human body at 310 K, and the universe at 3 K (Li and Fan, 2018).

Although extremely small, the blackbody energy from humans *can* be measured with the use of proper instrumentation. For example, the RF/microwave energy of a human is shown below in Figure 3. The image is an example of the RF energy from a human in the RF/microwave portion of the electromagnetic spectrum, and is proposed to be used in security applications.

(a) (b)

Figure 3. Blackbody image of a human holding a toy metal gun (a) photograph, (b) image in the RF/microwave portion of the electromagnetic spectrum. (Meng et al., 2018).

Dr. Havas also does not acknowledge that her claims are not supported by a major assessment of RF research:

> At high radio frequencies, above 30 MHz, the natural EM-fields originate from very broadband blackbody radiation from the warm earth and from extraterrestrial processes, mainly from the sun and the extraterrestrial microwave background radiation from the whole sky (Kraus 1986; Burke and Graham- Smith 1997). … It is of interest to note that the blackbody radiation from a person in the RF-band is approximately 3 $mW \cdot m^{-2}$ (ICNIRP, 2009, p. 10) (emphasis added).

Q26: Dr. Havas also provides conclusions that the Earth does not emit continuous RFR (p. 71) and that human beings do not emit RFR (p. 74). Additionally, in her video evidence, filed as Exhibit C7-12, Dr. Havas shows herself conducting certain tests with an RF meter, and she suggests that her results demonstrate that Earth and humans do not emit RF radiation.

What is your response to this evidence?

A26: When making measurements, it is important to carefully evaluate the capabilities of the instrumentation selected. In this case Dr. Havas is using the wrong tool for the job. The manual for the measurement device used by Dr. Havas specifies that the device is not capable of measuring the vast majority of RF/microwave energy (3 kHz–300 GHz) from

either a human or from the Earth.[10] Other instrumentation, such as that cited by Meng et al. (2017), is required to measure the extremely low levels of RF/microwave energy from humans or the Earth.

Q27: On pages 69-77 of Appendix D to Exhibit C7-12-1, Dr. Havas makes a number of claims that Figure 5 in the Exponent RF Technology Report contains "misinformation." For example, on page 69, Dr. Havas states that:

> **Figure 5 compares the Sonix IQ meter to various objects that allegedly emit radiofrequency radiation (RFR). … The two most glaring errors in Fig. 5 are that the human body and the earth emit RFR at levels that are measurable. This is false information.**

Dr. Havas repeats this claim again on p. 71:

> **One of the most glaring errors is that the earth does not generate RFR at levels stated in Fig. 5. SC 6 applies to frequencies between 3 kHz and 300 GHz. It does not refer to higher or lower frequencies.**

Is Dr. Havas correct that the Earth and human beings do not emit RF radiation and, if so, is this just a minor error?

A27: No, as stated above, her claims are incorrect and deny the existence of the entire scientific field of passive microwave sensing which uses satellites to measure and visualize temperature-related microwave energy from the Earth to assess water, weather, and soil conditions. (See the presentation by Professor Ernesto López Baeza of the Earth Physics and Thermodynamics Department at the University of Valencia, available at https://earth.esa.int/web/eo-summer-shool/documents/973910/1002056/EL1.pdf).

The second problem with Dr. Havas' understanding of the basic nature of RF is revealed by her conclusions that the Earth does not emit continuous RFR (page 71) and that human beings do not emit RFR (page 74).

Both these conclusions are incorrect; the Earth and other parts of the environment and the human body all emit electromagnetic fields in the RF range of frequencies. Her opinions are not just about definitions of RF and infrared frequencies.[11] She states in her response to FEI IR1 8.1 "Neither the human body nor the earth generate RFR. It isn't possible to measure something that does not exist" (emphasis added). It appears that she

[10] https://safelivingtechnologies.com/content/Products/RFMeterSafeAndSoundProIIUserManual.pdf. The specified measurement range for "a true ±6dB response [is] from 400 MHz – 7.2 GHz." This represents approximately 2.2% of the portion of the RF/microwave electromagnetic spectrum.

[11] Dr. Havas apparently believes that "Neither the earth nor the human body emits radio frequency radiation. What they are both generating is heat or infrared radiation and this is NOT RFR." (Response to FEI 10.41).

does not believe her own quotation from Wikipedia in response to FEI IR1 8.2, which states "A black body … emits at all radiation frequencies."

For example, Momenroodaki and Popovic (2014) measured RF fields at a frequency of 1.4 GHz to estimate temperatures within a human phantom containing water at 30° C and 40 C, corresponding to temperatures of 303.2 and 313 degrees K. Measurements of electromagnetic energy emitted from persons at 3.7 GHz have been used to detect and locate humans as a passive surveillance tool (Jacob et al., 2018). To assist Dr. Havas in understanding the portion of the electromagnetic energy included in the RF/microwave assessment (i.e., that is used in of Table 4 and Figure 5 of Exponent's RF Technology Report), we prepared the figure below to explicitly show the portion of the blackbody radiation from humans and the Earth in the RF/Microwave portion of the electromagnetic spectrum (i.e., 3 kHz to 300 GHz).

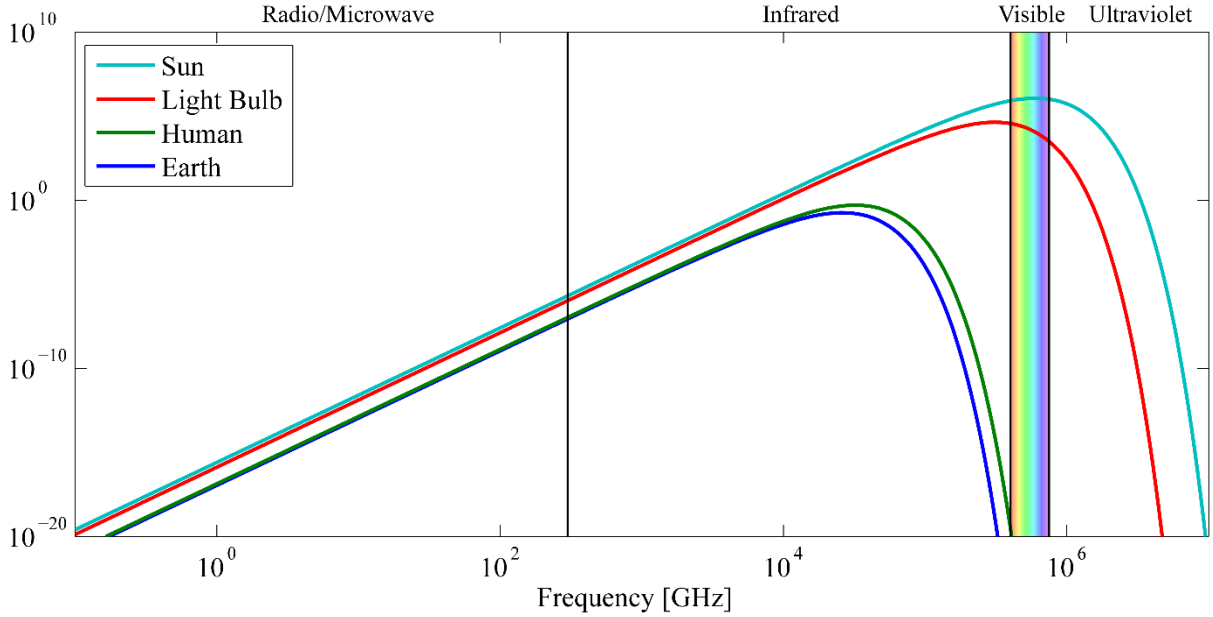

Figure 4. Blackbody thermal radiation of several example sources: Sun, light bulb, human body, and the Earth.[12]

Note that the horizontal axis is in units of frequency instead of wavelength (as is typical for blackbody calculations). Also note the logarithmic scale on both vertical and horizontal axes. The blackbody energy in the RF portion of the electromagnetic spectrum (0.003 to 300,000 MHz) is millions upon millions of times lower than that in the infrared portion of the electromagnetic spectrum (see Exponent RF Technology Report, Figure 2).

[12] Calculated from Planck's Law. Values integrated between 3 kHz and 300 GHz (i.e., the RF/microwave portion of the electromagnetic spectrum) were used as a basis for comparison.

5.2 HAVAS CRITICISMS OF EXPONENT CALCULATIONS

Q28: Dr. Havas also provides calculations related to power density of various devices included in Figure 5 (of the Exponent RF Technology Report), reproduced on page 71, and in her calculations in Table 1 on page 73, and criticizes a lack of data.

What is your response to these criticisms?

A28: Dr. Havas attempts to make calculations based on an illustrative presentation of the data (Figure 5 of the Exponent RF Technology Report, p. 26) instead of reviewing the data clearly summarized in Table 4 (p. 24) and without reading the underlying literature specifically cited. Footnote 24 to Table 4 (p. 24) which reads, "RF exposure can be heavily dependent upon situation, so exposure conditions are provided for each exposure value. For reference, see Mantiply et al. (1997); Foster (2007); Valberg et al. (2007); HPA, (2008); ICNIRP,(2009); Viel et al. (2009); and Abdulla and Badra (2010)."

For example, at page 71 of her Evidence, Dr. Havas provides two different calculation methodologies. In "Calculation A" she correctly approximates the power density of a smart meter as 0.12 $\mu W/m^2$. This number matches (to within rounding error) the value of 0.11 $\mu W/m^2$ cited in the Exponent RF Technology Report, Table B-2. The error in her calculations is that she then uses that number to "scale" the potential exposure of all other sources. This is an error because the SC 6 limit varies with frequency. For instance, the limit for the ~900 MHz signal of the Sonix IQ gas meter is about 2.7 W/m^2 whereas the limit for the 2,400 MHz signal for WiFi (the frequency of 2,400 MHz also was explicitly referenced in the Exponent RF Technology Report in Table 4, p. 24) is approximately 5.3 W/m^2.[13] This oversight alone introduces an error of about a factor of 2 into her calculation. We have provided the correct calculations, as follows:

> The value of 8.52 listed under "Power Density Calculation A" for "WiFi Router should be 5,300,000 $\mu W/m^2$ * 0.0000042% * 71 ≈ 16 $\mu W/m^2$.

Dr. Havas makes an additional error in her "Calculation B" analysis. The SC 6 limit for WiFi is 5.3 W/m^2, not the 10 W/m^2 she cites in her response.

> In this case the incorrect value of 30 $\mu W/m^2$ for her "Power Density Calculation B" for "WiFi Router" also should be 0.00030% * 5,300,000 $\mu W/m^2$ ≈ 16 $\mu W/m^2$.

If Dr. Havas had not made these multiple errors (separate errors in each of her calculations), the results would have matched, as indeed, they should.

[13] SC 6 (Table 5 on pg. 8) specifies that the limit for sources between 300 MHz and 6,000 MHz is $0.02619 \times f^{0.6834}$ where 'f' is specified in units of MHz. The limit for a 2,400 MHz signal, then, is: $0.02619 \times 2400^{0.6834} = 5.3$ W/m^2.

Exponent has not reviewed the remainder of Dr. Havas's calculations to evaluate if there are additional errors; however, to assist Dr. Havas in accurately assessing the contents of Table 4 (p. 24) and Figure 5 (p. 26) of the Exponent RF Technology Report, we have prepared Tables 3 and 4 explicitly laying out the calculations, source information, and results for all the sources in Exponent's RF Technology Report (Table 4 and Figure 5; p. 24 and 26, respectively). Similar to the detail provided in Exponent's RF Technology Report, Table B-2, these two tables provide several columns. Table 3 describes in detail the column headings of Table 4. Table 4 provides a complete summary of data used to generate Table 4 (p. 24) and Figure 5 (p. 26)of the Exponent RF Technology Report.

Table 3. Explanation of column headings in Table 4

Column Heading	Explanation
1. **Wall attenuation of 0.736?**	Since some sources (such as the Sonix IQ gas meter) are external to the house a representative wall attenuation factor of 0.736 has been added to sources that are outside the home. This is representative of the attenuation that would occur at a frequency of about 900 MHz due to a wall comprised of a sheet of plywood and a sheet of drywall. Higher attenuation would be present for other types of materials (e.g., brick) or if additional materials are present (e.g., vinyl siding)
2. **Power Density (PD) or SAR**	Some citations specify results in terms of power density and some in terms of specific absorption rate. This column specifies the type of assessment made
3. **Units**	Specifies the units of power density (W/m^2) and SAR (W/kg)
4. **Potential Exposure Value (including Wall Attenuation)**	Calculated value (either power density or SAR)
5. **Frequency (MHz)**	Frequency at which the assessment was performed (for reference to SC 6 limits; column 5)
6. **SC 6 limit**	Calculated SC 6 limit in units specified in column 3
7. **% of SC 6**	Ratio of column 4 to column 6
8. **times greater than Sonix IQ meter inside at 1 m away**	Calculation of the values used in Exponent's RF Technology Report, Figure 5 to show how many times greater the exposure is than the Sonix IQ gas meter (at 1 m away indoors)
9. Citation	Specific citation and table/page number for reference to the original source material
10. Notes	Additional notes to assist the reader in reviewing source material

Table 4. RF exposure of a Sonix IQ gas meter relative to other RF sources. Including specific citation, frequency, representative potential exposure values and calculations of exposure relative to SC 6 for select natural and common man-made RF sources.

Column number	1	2	3	4	5	6	7	8	9	10
Source	**Include Wall attenuation of 0.736?**	**Power Density (PD) or SAR**	**Units**	**Potential Exposure Value (including Wall Attenuation)**	**Frequency (MHz)**	**SC 6 limit**	**% of SC 6**	**Times greater than Sonix IQ meter inside at 1m away**	**Citation**	**Notes**
Sonix IQ meter inside at 1 meter away	Yes	PD	W/m^2	1.147×10^{-07}	901.5	2.739	0.00000419%	1	Exponent RF Technology Report, Table B-2	2nd row of table
Wireless router at 1 meter away	No	PD	W/m^2	1.600×10^{-05}	2400	5.348	0.000299%	71	Foster, 2007 (Table 2)	At ~>1 meter from laptop card
FM+TV Broadcast towers inside	Yes	PD	W/m^2	3.905×10^{-05}	Varies	Varies with Freq.	0.00262%	627	Mantiply, 1997 (p. 571 and 572)	Combination of FM and TV broadcast (next two rows)
FM Broadcast towers	Yes	PD	W/m^2	1.952×10^{-05}	88	1.291	0.0015%		Mantiply, 1997 (p. 571)	Median in the United States
TV Broadcast towers	Yes	PD	W/m^2	1.952×10^{-05}	470	1.755	0.0011%		Mantiply, 1997 (p. 572)	20% exceed this value
Natural RF from the Earth	No	PD	W/m^2	0.0013	0.003 to 300,000	Varies with Freq.	0.0090%	2139	Planck's Law; ICNIRP, 2009	
Natural RF from the human body	No	PD	W/m^2	0.003	0.003 to 300,000	Varies with Freq.	0.0176%	4206	Planck's Law; ICNIRP, 2009	
Bluetooth at 1 meter away	No	PD	W/m^2	0.00102	2,400	5.348	0.0191%	4554	Valberg et al., 2007 (Table 4)	
Microwave oven at 1 meter away	No	PD	W/m^2	0.0060	2,450	5.424	0.11%	26282	Mantiply, 1997 (p. 573)	1 meter from microwave
Cordless phone handheld unit typical exposures	No	SAR	W/kg	0.034	1,900	1.6	2.12%	507542	HPA, 2008	Average of the range of reported values
Cell phone next to head typical exposures	No	SAR	W/kg	0.122	850	1.6	7.63%	1822423	Abdulla and Badra 2009 (Tables 7-10)	Average of values provided

5.3 ELECTROMAGNETIC ILLNESS/ELECTROHYPERSENSITIVITY

Q29: Dr. Havas limits her discussion of electrohypersensitivity to her Conclusions in the last 2 pages of her 11 page submission (pages 78 and 79 of Appendix D to Exhibit C7-12-1). Here, Dr. Havas cites two studies related to the health symptoms attributed to electrohypersensitivity and its prevalence in the population.

What is your response to these citations?

A29: The two references cited by Dr. Havas (Bevington 2021 and Belyaev et al., 2016) are overall inconsequential and do not provide any evidence to change the conclusions of reviews by health and scientific agencies that exposure to RF signals from mobile phones or other sources are not perceived by persons or that such exposures have not been confirmed to cause symptoms or disturbances to well-being.

Dr. Havas cites a study by Bevington (2021) to estimate the alleged prevalence in British Columbia of idiopathic environmental intolerance attributed to electromagnetic fields/electromagnetic hypersensitivity.[14] This study, which summarizes IEI-EMF/EHS prevalence levels reported in other published studies, has some significant limitations that severely limit its meaningfulness. It is unclear how the author selected the studies included in their analysis or whether a comprehensive literature search was ever conducted. Of the studies that were included, several have been excluded from literature reviews conducted by international health and scientific agencies for being of little value or irrelevant to the body of research on RF exposure and health. Specifically, three of the studies were determined by SCENIHR in their 2015 report to "not add useful information" to their database (Tseng et al., 2011, Baliatsas et al., 2014, and Johansson et al., 2010), and an additional three studies were excluded by SSM (2018, 2019) in their analyses for either not studying non-ionizing electromagnetic fields (Huang et al., 2018) or not in any way studying the association between RF fields and a health outcome (Kjellqvist et al., 2016 and Hojo et al., 2016).

Dr. Havas also cites Belyaev et al. (2016), which is not a research study, and is in fact the EUROPAEM EMF Guidelines 2016. The limitations of the EUROPAEM EMF Guidelines are discussed in response to Question 9.

Q30: In response to CEC IR No. 1.25.1 (Does the World Health Organization recognize long-term exposure to EMF at levels as may be found from Smart Meters as risk factors for cancer, Alzheimer's disease, male infertility and/or electrohypersensitivity?), Dr. Havas states on page 48:

> **Based on this, my answer to the question above is "yes," the WHO recognizes adverse health effects (not specified) attributed to levels of EMFs that are below existing international guidelines.**

[14] The WHO defines IEI-EMF as EHS.

What is your response to this claim?

A30: Dr. Havas' answer to this question was incomplete and therefore misleading. In her response, Dr. Havas quoted from the WHO's International Workshop on EMF Hypersensitivity in Prague in 2004, where the question of adverse health effects in relation to EMF was discussed. However, Dr. Havas' selection of text from that document failed to include some of the workshop's major conclusions, in which the WHO stated that idiopathic environmental intolerance (IEI) symptoms "cannot be attributed to EMF" (p. 4). Specifically, the WHO concluded:

> The majority of studies indicate that IEI individuals cannot detect EMF exposure any more accurately than non-IEI individuals. By and large well controlled and conducted double-blind studies have shown that symptoms do not seem to be correlated with EMF exposure. There are also some indications that these symptoms may be due to pre-existing psychiatric conditions as well as stress reactions as a result of worrying about believed EMF health effects, rather than the EMF exposure itself… there is presently no scientific basis to link IEI symptoms to EMF exposure (p. 3).

Moreover, Dr. Havas' response does not make clear that the WHO has not opined specifically about smart meters anywhere, nor does she cite the position of the WHO in the more recent WHO (2014b) fact sheet*:* Electromagnetic Fields and Public Health: Mobile Phones.

> A number of studies have investigated the effects of radiofrequency fields on brain electrical activity, cognitive function, sleep, heart rate, and blood pressure in volunteers. <u>To date, research does not suggest any consistent evidence of adverse health effects from exposure to radiofrequency fields at levels below those that cause tissue heating. Further, research has not been able to provide support for a causal relationship between exposure to electromagnetic fields and self-reported symptoms, or "electromagnetic hypersensitivity</u>" (emphasis added).

6.0 <u>CORRECTION TO PRIOR EVIDENCE</u>

Q31: Does Exponent have any corrections to make to its reports previously filed as Appendix F to Exhibit B-1 in this proceeding?

A31: Yes, a typographical error was found in two entries of Table 4 (Exponent's RF Technology Report, p. 24). The frequency range specified for evaluation of blackbody radiation from humans and Earth was stated as "0.003 – 3,000 MHz" This should be 0.003 – 300,000 MHz (i.e., the full RF and microwave portion of the electromagnetic spectrum of 3 kHz to 300 GHz). The specified values as a percent of the SC 6 limit are

unchanged in the aforementioned Table 4 (and subsequent Figure 5) and are correct for both sources.

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Appendix A

Index

Table A-1. Index to contributions of Exponent witnesses to Rebuttal Testimony

Q&A No.	Bailey	Cotts	Dopart
1	X	X	X
2	X	X	X
3			X
4	X		
5		X	
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