**<u>Eight Leading Questions/Concerns of</u>**
**<u>Maine CDC's Approach to and Report on Smart Meters</u>**
**November 29, 2010**

In October, the Maine CDC was requested by the Office of the Public Advocate (OPA) to comment on health concerns related to the wireless communication technology, also known as smart meters, being installed by Central Maine Power (CMP). As a result, Maine CDC submitted a report on November 8th to OPA and the Public Utilities Commission (PUC) of our review of national and international government-affiliated organizations' analyses on this subject (http://www.maine.gov/dhhs/boh/smart_meters.shtml).

Subsequently, we at the Maine CDC and others received several correspondences from people expressing concerns about our review. In order to make sure OPA, PUC, and the correspondents have our responses in a concise format, we have grouped the concerns into eight topic areas and compiled our responses into this document.

**Concern #1: Maine CDC's review of smart meters was outcome-driven and only presented a selective one-sided choice of sources.**

The six members of Maine CDC's Smart Meters Team, after reviewing the many documents sent to us in October about smart meters, acknowledged that a full review of all the literature on the subject matter of radiofrequency (RF) and health was beyond the scope of a small state's public health agency. The Maine CDC is not an agency with the amount of resources for reviews and analyses such as are done by the U.S. CDC, National Institutes of Health (NIH), or the World Health Organization (WHO). We also could not find any other state health department's recent review of the literature on this subject or expressions of health concerns about smart meters, including from states with smart meters already installed.

Therefore, we approached this issue as we often do on a subject matter (such as RF and health) that has thousands of articles, studies, and research published on it – by reviewing the analyses of the literature conducted by federal and international agencies (such as the U.S. CDC, NIH, and WHO). We commonly rely on such authorities to conduct reviews and analyses since they have the depth and breadth of expertise and resources to do so, and are generally considered impartial.

Maine CDC often focuses on U.S. federal resources for such reviews, but for the one on smart meters/wireless technologies we decided to include the work of some well reputed international government affiliated organizations such as the World Health Organization (WHO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP), Health Canada, the Health Protection Agency of the United Kingdom, the Swedish Radiation Protection Authority, the Australian Radiation Protection and Nuclear Safety Agency, and others. For U.S. federal agencies, we mainly focused on the information published by the Federal Communications Commission (FCC) and the National Institutes of Health (NIH). (The FCC's work is in turn informed by the U.S. Department of Health and Human Services.)

**Concern #2: Many references in Maine CDC's review mention scientific uncertainty, inconclusively, and the need for more data and research**.

Maine CDC included in its report what we felt were the relevant excerpts from a number of analyses and/or links to websites with applicable information. These excerpts and links discuss the levels of uncertainties in the science, along with the conclusions the current scientific evidence points to.

When trying to evaluate health outcomes associated with exposure from relatively new technologies, it is extremely common and even expected that there will be uncertainties limiting our ability to fully comprehend and evaluate the question at hand. Since many of the sources of radiofrequency (RF) exposure have not been in common existence until modern times (radio, television, cell phones, pagers, cordless phones, wireless communications), there are likely to be uncertainties related to their health risks for years or decades to come. Therefore, decisions related to public health should take into account such factors as: the scientific research indicating evidence of risks of the technologies; the ease, risks, and benefits of implementing alternatives; as well as the uncertainties.

We acknowledged these uncertainties by including them in the excerpts and links in our report as well as noting the ones related to cell phones (the lack of very long term studies and the lack of studies involving significant exposure in childhood) and pointing out other caveats or limitations in our executive summary. However, in addition to these uncertainties, we also recognized the conclusions of the many reviews that we read, which pointed to no consistent or convincing evidence to support a concern for health effects related to the use of RF in the range of frequencies and power used by smart meters.

**Concern #3: Maine CDC's approach to using comparisons with cell phone studies is flawed since cell phones operate in a much lower frequency band.**

Cell phones in the United States operate in two different radiofrequency "bands". The first band is from 0.8 to 0.9 gigahertz (GHz) and was the frequency range that original mobile phones used. The newer phones use that frequency range as well as the 1.8 to 2.0 GHz range. Central Maine Power's smart meters operate in the 2.4 GHz range.

However, we do not agree that the difference in frequency means we should not consider results of studies from cell phone users to assess potential health problems from smart meters.

First, the frequency ranges are relatively close. For instance, the frequency ranges for non-ionizing electromagnetic fields are generally between 50 Hz (e.g. residential electrical power) to 1,000,000,000,000,000 Hz = $10^{15}$(e.g. visible light). The frequency range of RF (radiofrequency) is generally 3 kHz (kHz = 1,000 Hz) to 300 GHz (GHz = $10^9$ Hz), which is equal to 3,000 Hz to 300,000,000,000 Hz. Therefore, the radio frequency ranges of cell phones, 0.8 – 2.0 GHz (800,000,000 to 2,000,000,000 Hz), are relatively close to that of CMP's smart meters, 2.4 GHz (2,400,000,000 Hz), and are even in close proximity within the range of frequencies contained in RF. This range of RF that includes cell phones and other wireless technologies such as smart meters is also regulated the same or similarly by the FCC (http://www.fcc.gov/oet/rfsafety/).

| **Source of EMF** | **Approximate Hertz Range** | **Examples** |
|---|---|---|
| Non-ionizing EMF | 50 – 1,000,000,000,000,000 | electrical power to light |
| Radiofrequency | 3,000 – 300,000,000,000 | radio, tv, cell phones, smart meters |
| Cell Phones | 800,000,000 – 2,000,000,000 | |
| CMP Smart Meters | 2,400,000,000 | |

Second, the overall RF exposure from cell phones is greater than that from smart meters. RF exposure, or dose, is considered the most important overall measure of impact, and is calculated using the factors of frequency, power and/or distance from the body. Exposure can be measured several different ways, such as by calculating the specific absorption rates, or SAR (watts per kilogram), or by calculating the power density (milliwatts per square centimeter). When either measure is used to compare the RF exposure of smart meters with cell phones, the results indicate that the estimated RF exposure from smart meters is less than that from cell phones.

The table below shows the estimated exposure (mW/cm$^2$) using the power density calculation for smart meters of various distances from the body compared with Bluetooth wireless and cell phone radiofrequencies. Even when one assumes very close physical proximity to smart meters, the RF exposure is smaller than with typical cell phone use.

| **Source** | **Distance from source (inches)** | **Frequency (MHz)** | **Broadcast power (watts)** | **OET 65 equation 7 (partial reflection) mW/cm$^2$** | **OET 65 equation 6 (full reflection) mW/cm$^2$** | **0ET 65 equation 3 (no reflection) mW/cm$^2$** |
|---|---|---|---|---|---|---|
| **Smart Meter** | 2 | 2400 | 1 | **7.8941** | 12.3345 | 3.0836 |
| **Smart Meter** | 6 | 2400 | 1 | **0.8771** | 1.3705 | 0.3426 |
| **Smart Meter** | 12 | 2400 | 1 | **0.2193** | 0.3426 | 0.0857 |
| **Smart Meter** | 36 | 2400 | 1 | **0.0244** | 0.0381 | 0.0095 |
| **Repeater** | 180 | 5800 | 1 | 0.0010 | 0.0015 | 0.0004 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **(CMP collector)** | | | | | | |
| **Bluetooth** | 6 | 2442 | 0.1 | 0.0877 | 0.1371 | 0.0343 |
| **G Router** | 12 | 2400 | 0.2 | 0.0439 | 0.0685 | 0.0171 |
| **N Router** | 12 | 5800 | 0.2 | 0.0439 | 0.0685 | 0.0171 |
| **cell phone** | 1 | 1910 | 1 | 31.5764 | 49.3382 | **12.3345** |
| **cell phone** | 12 | 1910 | 1 | 0.2193 | 0.3426 | 0.0857 |

The equations of power density used in the table above can be found in the FCC's Office of Engineering and Technology (OET) Bulletin 65 on pages 20 – 21 (http://www.fcc.gov/oet/info/documents/bulletins/). The three equations assume different levels of reflection of the RF from the surroundings, such as from the ground or a wall lacking the ability to absorb RF energy. Reflection of RF is not much of a consideration with cell phones since the antenna is next to the body, so the "no reflection" equation is the most appropriate to use. Partial reflection is the most appropriate equation for most situations involving smart meters.

Since the RF bands used by smart meters and cell phones are close together in frequency and since the overall exposure of RF is higher from cell phones, we feel it is reasonable to use studies that examine the potential health effects of exposure to cell phone RF to inform an assessment about the potential health effects of smart meter RF exposure. Because the exposure to RF appears to be greater with cell phones than with smart meters, it seems to us that the lack of any consistent and convincing evidence of a causal relation between RF exposure from cell phones and adverse health effects would indicate even less concern for potential health effects from use of smart meters.

**Concern #4: Cell phone use causes cancer.**

The numerous national and international analyses of the literature that Maine CDC reviewed do not conclude that the evidence thus far points to cell phones causing cancer. Below are just three relevant excerpts from the most recent studies or reviews on this topic that are also found in our report. See the November 8th report for additional reviews.

The Conclusion from the May 2010 Interphone Study:
http://ije.oxfordjournals.org/content/39/3/675.full
*"This is the largest study of the risk of brain tumours in relation to mobile phone use conducted to date and it included substantial numbers of subjects who had used mobile phones for ≥10 years.* ***Overall, no increase in risk of either glioma or meningioma was observed in association with use of mobile phones****. There were suggestions of an increased risk of glioma, and much less so meningioma, at the highest exposure levels, for ipsilateral exposures and, for glioma, for tumours in the temporal lobe. However,*

*biases and errors limit the strength of the conclusions we can draw from these analyses and prevent a causal interpretation."*

Key Points from the National Cancer Institute's Review and Analysis, May 2010:
http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones

- *"Cell phones emit radiofrequency (RF) energy, which is another name for radio waves.*
- *Research suggests that the amount of RF energy produced by cell phones is too low to cause significant tissue heating or an increase in body temperature.*
- *Concerns have been raised that RF energy from cell phones may pose a cancer risk to users.*
- *Researchers are studying tumors of the brain and central nervous system and other sites of the head and neck because cell phones are typically held next to the head when used.*
- ***Research studies have not shown a consistent link between cell phone use and cancer.** A large international study (Interphone) published in (May) 2010 found that, overall, cell phone users have no increased risk for two of the most common types of brain tumor—glioma and meningioma. For the small proportion of study participants who reported spending the most total time on cell phone calls there was some increased risk of glioma, but the researchers considered this finding inconclusive."*

Conclusion from the November 2010 Study from the National Institute of Cancer in the National Institutes of Health
http://www.ncbi.nlm.nih.gov/pubmed/20639214
*"The use of cellular telephones has grown explosively during the past two decades, and there are now more than 279 million wireless subscribers in the United States. If cellular phone use causes brain cancer, as some suggest, the potential public health implications could be considerable. One might expect the effects of such a prevalent exposure to be reflected in general population incidence rates, unless the induction period is very long or confined to very long-term users. To address this issue, we examined temporal trends in brain cancer incidence rates in the United States, using data collected by the Surveillance, Epidemiology, and End Results (SEER) Program…**Overall, these incidence data do not provide support to the view that cellular phone use causes brain cancer."***

**Concern #5: Smart meters will be forming a mesh network, something that Maine CDC is not considering, and some who have written Maine CDC requested a calculation of the RF exposure from such networks.**

We included a statement from the FCC about this issue in our report, and refer further questions on mesh networks to the FCC and other such experts.

**Concern #6: Maine CDC should promote the precautionary principal and ask that new meters use alternative technologies to wireless systems, such as hard wired meters.**

The precautionary principle provides a framework for making decisions in the face of scientific uncertainty. Maine CDC has used and referred to "The Precautionary Principle in Action: A Handbook" in related work (can be found at http://environmentalcommons.org/precaution-handbook.pdf).

A description of a six-step process for applying the precautionary principle to a particular problem can be found in Section VI, pages 7 – 10 of the handbook. The six steps are pasted in below from these pages. We have included our very brief summary responses to the first two steps, which are the ones that are most relevant to Maine CDC's work. The other steps (3 – 6) are more appropriate for organizations such as OPA and the PUC to answer. We believe there are several outcomes possible if the precautionary principle is applied to the situation related to smart meters, and they do not necessarily include a ban on the use of wireless technologies.

***"Step One: Identify the possible threat and characterize the problem***
*The purpose of this step is to gain a better understanding of what might happen should the activity continue and to ensure that you are asking the right questions about this activity. Poor solutions are often a result of badly defined problems. Identify both the immediate problem and any other global issues that might go along with this threat.*

*Here are questions to ask:*
*Why is this a problem? Presumably it has the potential to threaten public health or the environment. What is the potential spatial scale of the threat - local, statewide, regional, national, global? What is the full range of potential impacts? To human health, ecosystems, or both? Will there be impacts to specific species or loss of biodiversity? Are the impacts to waterways, air, or soil? Do indirect impacts need to be considered (such as a product's lifecycle-production and disposal)? Will some populations (human or ecosystems) be disproportionately affected? What is the magnitude of possible impacts (intensity)? Is the extent of harm negligible, minimal, moderate, considerable, catastrophic? What is the temporal scale of the threat? There are two issues to consider: 1) The time lapse between a threat and possible harm (immediate, near future, future, future generations). The further in the future harm might occur, the less likely that impacts can be predicted, the harder it will be to identify and halt a problem, and the more likely that future generations will be impacted. 2) Persistence of impacts (immediate, short term, mid term, long term, inter-generational). How reversible is the threat? If the threat were to occur would it be easy to fix or last for generations? (easily/quickly reversed, difficult/expensive to reverse, irreversible, unknown) A note about existing problems: Defining a problem at hand is less difficult than projecting problems from a future project. But the first questions are similar: Is the problem local pollution from a particular facility or broader lack of attention to pollution prevention or*

*both? Is it caused by a government failure or a company's negligence? Is it a serious threat or just an eyesore?"*

Maine CDC's very brief answer to Step One is from the executive summary of our November 8th report: "In conclusion, our review of these agency assessments and studies do not indicate any consistent or convincing evidence to support a concern for health effects related to the use of radiofrequency in the range of frequencies and power used by smart meters. They also do not indicate an association of EMF exposure and symptoms that have been described as electromagnetic sensitivity."

***"Step Two: Identify what is known and what is not known about the threat.***
*The goal of this step is to gain a better picture of the uncertainty involved in understanding this threat. Scientists often focus on what we know, but it is equally, and perhaps more, important to be clear about what we don't know. There are degrees and types of uncertainty, as the later discussion explains.*

*Relevant questions:*
*Can the uncertainty be reduced by more study or data? If so, and if the threat is not great, a project with substantial benefits might be continued. Are we dealing with something that is unknowable nor about which we are totally ignorant? High uncertainty about possible harm is good reason not to go ahead with a project. What is known about additive and synergistic effects from exposure to multiple stressors and cumulative effects from combined exposures to various stressors? Do industry and government claims that an activity is safe mean only that it has not yet been proven dangerous? You might want to make a chart listing what is known and what is not known about the threat to gain a better comparative picture and understand gaps in understanding."*

Maine CDC's very brief answer to Step Two includes the uncertainties identified in our executive summary:

- Lack of very long term studies of cell phone use (>> 10 years), especially among high-end users;
- Lack of long term studies that include significant exposure during childhood; and
- Lack of specific data on actual RF exposures from the expected use of smart meters.

These uncertainties can be reduced over time by existing ongoing studies and/or data collection.

***"Step Three: Reframe the problem to describe what needs to be done***
*The goal of this step is to better understand what purpose the proposed activity serves. For example, a development provides housing, a solvent provides degreasing, a pesticide provides pest management, a factory provides jobs and a product for a specific service. The problem can then be reframed in terms of what needs to be achieved in order to more readily identify alternatives."*

Presumably OPA and/or the PUC have a full understanding of the purposes and benefits of smart meter wireless technology.

***"Step Four: Assess alternatives.***
*Proposed and existing activities are addressed somewhat differently in this step.*

*Proposed activities: Integral to the precautionary principle is a comprehensive, systematic analysis of alternatives to threatening activities. This refocuses the questions to be considered by a regulator or company from how much risk is acceptable to whether there is a safer and cleaner way to undertake this activity. Assessing alternatives drives ingenuity and innovation. It is more difficult to dismiss proposals that not only name problems but set forth alternatives, or demand that they be considered. The "no action" alternative must be considered: perhaps an activity should not proceed because it poses too much of a threat and/or is not needed.*

*Existing activities: At this point you would develop and assess a range of alternative courses of action to deal with the problem. The options can be to study further, to completely stop the activity, prevent, control, mitigate, or remediate. In either case, the assessment of alternatives is a multi-stage process.*

*First, you might brainstorm a wide range of alternatives, then screen out those options that seem impossible. The next stage is to assess the alternatives to determine whether they are politically, technically, and economically feasible. Do not let conventional wisdom limit this assessment. Keep in mind that something that is not economically or technically feasible today may be feasible in the near future. And government agencies and firms rarely consider the "external" costs of threatening activities harm to health, loss of species, etc. which are often unquantifiable. These concerns must be incorporated in the assessment. The last step of the alternatives assessment is to consider potential unintended consequences of the proposed alternatives. A common criticism of the precautionary principle is that its implementation will lead to more hazardous activities. This need not be true: alternatives to a threatening activity must be equally well examined."*

Likewise, we assume OPA and/or the PUC have information related to possible alternatives available to smart meter wireless technologies.

***"Step Five: Determine the course of action.***
*Take all the information collected thus far and determine how much precaution should be taken: stopping the activity, demanding alternatives, or demanding modifications to reduce potential impacts. A useful way to do this is by convening a group of people to weigh the evidence, considering the information on the range and magnitude impacts, uncertainties, and alternatives coming from various sources. The weight of evidence would lead to a determination of the correct course of action."*

***"Step Six: Monitor and follow up***

*No matter what action is taken, it is critical to monitor that activity over time to identify expected and unexpected results. Those undertaking the activity should bear the financial responsibility for such monitoring, but when possible this should be conducted by an independent source. The information gathered might warrant additional or different courses of action."*

Steps 5 and 6 we also assume OPA and/or the PUC would be appropriate parties to answer these questions if the precautionary principle were to be applied to smart meters.

**Concern #7: Why did Maine CDC only cite studies that negate the existence of electromagnetic hypersensitivity condition and not cite other studies?**

We focused our October/early November reviews on national and international government or government-affiliated analyses and research. All such documents we found came to the same or similar conclusion as the World Health Organization, which states, "*EHS (electromagnetic hypersensitivity) has no clear diagnostic criteria and there is no scientific basis to link EHS symptoms to EMF exposure. Further, EHS is not a medical diagnosis, nor is it clear that it represents a single medical problem*."

The following reviews related to electromagnetic hypersensitivity were included in our report:

- World Health Organization 2005 review of electromagnetic hypersensitivity, http://www.who.int/mediacentre/factsheets/fs296/en/index.html

- The 2002 consensus report on electromagnetic hypersensitivity of the Institute of Electrical and Electronics Engineers (IEEE) http://ewh.ieee.org/soc/embs/comar/Hypersensitivity.htm

- A 2010 review of 46 studies on electromagnetic hypersensitivity http://www.ncbi.nlm.nih.gov/pubmed/19681059

- A review by the University of Ottawa's McLaughlin Centre for Population Health Risk Assessment http://www.rfcom.ca/faq/answers.shtml#q13

- A 2009 review by the Swedish State Radiation Protection Authority, Swedish State Radiation Protection Authority: Recent Research on EMF and Health Risks

We also could not find any reference to electromagnetic hypersensitivity or similar diagnosis in the International Classification of Diseases (ICD) systems (ICD-9 or ICD-10).

**Concern #8: The U.S. Access Board recognizes electromagnetic hypersensitivity, so therefore it is a legitimate medical condition (http://www.access-board.gov/).**

According to their website, *"The Access Board is an independent Federal agency devoted to accessibility for people with disabilities. Created in 1973 to ensure access to federally funded facilities, the Board is now a leading source of information on accessible design."*

On the U.S. Access Board's website we found the following reference to electromagnetic hypersensitivity: *"In November 1999, the Access Board issued a proposed rule to revise and update its accessibility guidelines. During the public comment period on the proposed rule, the Access Board received approximately 600 comments from individuals with multiple chemical sensitivities (MCS) and electromagnetic sensitivities (EMS). They reported that chemicals released from products and materials used in construction, renovation, and maintenance of buildings, electromagnetic fields, and inadequate ventilation are barriers that deny them access to most buildings." (*First paragraph from http://www.access-board.gov/research/ieq/intro.cfm.)

Besides the comments from individuals in response to the proposed rule, the other main source of reference informing their recognition of electromagnetic sensitivity by the U.S. Access Board was a 1998 California telephone survey that asked people if they had sensitivity to electromagnetic fields.

The 1998 California survey results can be found on this website: http://www.ehib.org/index.jsp (search under "Levallois", the author). In it, the authors recognized that electromagnetic sensitivity is not necessarily a bona fide diagnosis. For instance, on page A-79 of the survey's report, they state:

*"The literature reports a weak if any association of hypersensitivity with electric and magnetic field exposures (1, 12, 13). In fact, most of the provocation studies have been negative (1). In particular, in blind exposure experiments, HSEMF (hypersensitivity to electromagnetic fields) subjects were not able to detect the presence of the fields at low intensities (14-15). Therefore, HSEMF has been sometimes considered a subset of a more general "environmental illness" as multiple chemical sensitivity (11, 16). Other authors have suggested that it is a manifestation of somatization or conversion of stress (17) but its association with perception of risk has not been studied."*

Therefore, from a review of the U.S. Access Board's website, it appears that their recognition of electromagnetic sensitivity may not be scientifically based, but rather based on some public comments as well as a 1998 telephone survey, whose report acknowledges the improbability that such a disorder exists in relation to EMF exposure. We have contacted the U.S. Access Board to learn more about the basis of their recognition so that we have a more complete understanding of their perspective. We will share that information with the PUC, OPA, and others when it is available.