STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
RHODE ISLAND DEPARTMENT OF HEALTH

IN RE: INVENERGY THERMAL DEVELOPMENT LLC'S APPLICATION TO CONSTRUCT THE CLEAR RIVER ENERGY CENTER IN BURRILLVILLE, RHODE ISLAND – DOCKET NO. SB-2015-06

PUBLIC NOTICE

Pursuant to the Notice of Designation (the "Notice") to the Rhode Island Department of Health (the "Department") from the Energy Facility Siting Board (the "Board") dated March 10, 2016, Section 1.1 of the Board's *Rules of Practice and Procedure*, Rhode Island Gen. Laws Chapter 42-35, Rhode Island Gen. Laws §§ 42-98-9 and 42-98-10, and the *Rules and Regulations Pertaining to Practices and Procedures before the Rhode Island Department of Health [R42-35-PP]*, the Department shall hold a hearing on August 9, 2016, 5:30 PM at Burrillville High School, 425 East Avenue, Harrisville, Rhode Island 02830 (the "Hearing").

The Department has been designated as an agency of state government acting at the direction of the Board, for the purpose of rendering an informational advisory opinion (the "Opinion") on certain issues to be considered in evaluating Invenergy Thermal Development LLC's application to construct the Clear River Energy Center in Burrillville, Rhode Island (the "Facility") filed in Docket No. SB-2015-06. Specifically, the Opinion is required to address (i) the potential public health concerns relating to the Facility, including but not limited to biological responses to power frequency, electric, and magnetic fields associated with the operation of the Facility and (ii) the potential impacts on the quality of drinking water associated with the construction and operation of the Facility. The purpose of the Hearing is to provide an opportunity for public comment on the Opinion before the Department submits it to the Board for consideration at the Board's final hearing on this matter. The Opinion will be submitted to the Board on or before September 10, 2016 based upon the evidence presented, absent good cause.

Written comments on the Opinion or questions about the Hearing (including requests for reasonable accommodation) may be directed to Barbara Morin, Rhode Island Department of Health, 3 Capitol Hill, Providence, Rhode Island 02906, by phone at 401-222-7766 or by e-mail at barbara.h.morin@health.ri.gov. Persons intending to present comments at the Hearing are encouraged to bring a written copy of testimony, if at all possible.

RHODE ISLAND DEPARTMENT OF HEALTH

Energy Facility Siting Board

Advisory Opinion:

Clear River Energy Center

DRAFT for PUBLIC COMMENT

07.08.2016

1.0 SUBMISSION OVERVIEW

The Rhode Island Department of Health (RIDOH)'s Advisory Opinion of the Proposed Clear River Energy Center (CREC) is RIDOH's response to the State of Rhode Island Energy Facility Siting Board (ESFB)'s "Notice of Designation to the Rhode Island Department of Health to Render an Advisory Opinion" issued on March 10, 2016. Pursuant to R.I. General Laws 42-19-10, RIDOH has considered the issues consigned to it for review. This Advisory Opinion will be finalized for submission by September 10, 2016, per EFSB Order 86. A public hearing by RIDOH on this matter will ensure compliance with the following requirements:

> In accordance with Rule 1.11(a) of the Board's Rules of Practice and Procedure (Rules), the designated agency shall render its advisory opinion, to the extent possible, pursuant to the procedures that would be followed absent Board designation of the agency. Where necessary, an agency shall modify its procedures to conform to the requirements of the Act, the Rules, and the Preliminary Decision. In accordance with Rule 1.11(c) the advisory opinion shall conform with the Rhode Island Administrative Procedures Act R.I. Gen. Laws § 42-35 requirements regarding Decisions and Orders and shall be clearly identified as an advisory opinion issued to the Board for consideration at the Board's final hearing. A designated agency lacking a process compliant with the Administrative Procedures Act may, and shall at the direction of the Board's Chairperson, make a witness available to sponsor and be examined on its advisory opinion at the final hearing to be scheduled and held following the advisory opinion deadline.

2.0 CONTENT OUTLINE

The RIDOH Advisory Opinion consists of the review of a select set of potential health issues associated with the proposed CREC. Selection of these issues was based on a review of the ESFB Preliminary Decision and Order and other publicly available documentation. The following potential health issues are examined within this document:

- Electromagnetic Fields;
- Noise;
- Drinking Water Quality;
- Air Pollution;
- Asthma;
- Emergency Response and Prevention; and
- Climate Change and Health.

3.0 CONTACT INFORMATION

For additional information related to this Advisory Opinion, please address all correspondence to:

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4.0 ISSUE 1: Electromagnetic Fields

Background

The recent proposal submitted for CREC of Burrillville, Rhode Island, includes an analysis of **estimated increased intensity of electric and magnetic fields** (EMFs) projected to occur in proximity to electric transmission lines originating at CREC. The new transmission lines will use an existing right of way (ROW) for electric transmission lines. The ROW is currently populated by two sets of lines. The new lines will add a third set, and thereby increase the EMFs within the ROW and in close proximity to the ROW. Estimates of the increase were produced by Exponent at the request of ESS Group, which prepared the *Rhode Island Energy Facility Siting Board Application* for CREC at the request of Invenergy. Exponent's report is appended to the *Application* as *Appendix F – EMF Analysis – CREC Transmission Line*. Results of this report are summarized in the *Application* in pages 99-105. Excerpts of the Exponent analysis are attached to this document as Appendix I.

In its analysis, the applicant used standard assumptions about the generation and magnitude of EMFs, and a conservatively generous assumption about the magnitude of EMFs, i.e., that CREC would operate continuously at peak load, thus generating magnetic fields of maximum intensity. **As expected, the proposed new transmission lines would not increase the strength of electric fields significantly, but would increase the strength of magnetic fields**. (The latter are related to increased transmission, while the former are not.)

The estimates of increased EMF strength at the edges of the ROW do not exceed existing standards as set by international organizations for whole body exposure to 60-Hz fields for the general public. As Exponent points out, "These exposure limits are based on extensive weight-of-evidence reviews and evaluations of relevant health research and are designed to prevent acute, short-term biological responses such as perception, annoyance, and the stimulation of nerves and tissue that can occur at very high EMF exposure levels to which the general public [might] be exposed."

Furthermore, the applicant's results demonstrate that the projected intensity of the magnetic field that will be produced 100 feet from the ROW when CREC is operating at peak load is equal to the existing (present) intensity of the magnetic field at the border of the ROW. In short, the increased intensity of the EMF is measurable for only a short distance further (100 feet). This is because the intensity of EMFs diminishes as the square of the distance from the source, i.e., very quickly. As discussed above, EMF exposures in that area do not exceed health-based standards.

60 Hz Magnetic Fields and Cancer

Over the past four decades, many studies have been done to explore the potential relationship between exposure to 60 Hz (extra low frequency or ELF) magnetic fields and cancer. Here is how the National Cancer Institute (NCI) summarizes the findings of these studies:

According to the NCI, "No mechanism by which ELF-EMFs or radiofrequency radiation could cause cancer has been identified. Unlike high-energy (ionizing) radiation, EMFs in the non-ionizing part of the electromagnetic spectrum cannot damage DNA or cells directly. Some scientists have speculated that ELF-EMFs could cause cancer through other mechanisms, such as by reducing levels of the hormone melatonin. There is some evidence that melatonin may suppress the development of certain tumors. Studies of animals have not provided any indications that exposure to ELF-EMFs is associated with cancer. […] Although there is no known mechanism by which non-ionizing EMFs

could damage DNA and cause cancer, even a small increase in risk would be of clinical importance given how widespread exposure to these fields is." More information available at http://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet.

Therefore, the research continues, with a decided focus on 60 Hz magnetic fields and childhood cancer. The latter studies have been equivocal. Some find no relation between EMF exposure and cancer, while others find a weak relation. However, after decades of research, when all the evidence is weighed as a body, "No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found," as per the NCI. One reason for the equivocality of findings is that childhood cancer is rare, which means that researchers do not have many cases to study. Another reason is that one's exposure to EMFs in the course of one's life is very difficult to measure. Therefore the potential dose-response relationship of EMFs to cancer can only be measured very crudely, using broad categories of exposure intensity which do not lend themselves to standard-setting. Nevertheless, were the relation a strong one – if EMFs, as normally encountered, were a significant cause of cancer – the relation would be observable despite small numbers and other measurement issues.

Summary and Conclusion

The proposed addition to the electrical transmission in the ROW to be used by CREC will increase the strength of magnetic fields therein and close by, but the resulting intensity of potential human exposure is well within limits set by international standard-setting agencies. Furthermore, EMFs have not been demonstrated to create health risks—acute or otherwise—at the levels generated by the transmission lines in question. For this reason, the health impact of CREC attributable to EMFs is negligible, and may in fact be non-existent.

5.0 ISSUE 2: Noise

Background

Exposure to intense or long-term highly elevated noise levels, such as may occur in an occupational setting, can cause the loss of auditory sensory cells in the cochlea, resulting in permanent hearing loss. Indoor and outdoor environmental noise exposures are unlikely to cause hearing loss, but have been linked to a variety of effects, including annoyance; cognitive effects in children, including impairment of reading comprehension and memory; sleep disturbances; and cardiovascular effects, including an increased risk of hypertension and myocardial infarction.[1]

Noise-related annoyance manifests as sleep disruption, interference with speech intelligibility, stress reactions, and negative feelings, such as anger, depression and anxiety. The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[2]; therefore, noise-related annoyance is considered a health effect. According to the WHO, sleep disturbance, one of the most common complaints raised by noise-exposed populations, can have a major impact on health and quality of life. People can recognize and react to sounds, even when asleep. Those reactions, including wakening and changes in sleep stage, are associated with daytime after-effects, such as sleepiness, reduced cognitive and motor performance, and impairment of cardiovascular function.

Several studies have confirmed that environmental noise; including noise from road, rail and air traffic; can impair children's cognitive functioning. One of the most compelling of these studies was performed during the relocation of the airport in Munich, Germany in 1992. Children living in the vicinity of the old and new airports were evaluated before and two years after the airport was moved. Before the move, children living near the operating old airport showed deficits in reading comprehension and long-term memory. Two years after the relocation, those deficits were no longer seen in the children near the old airport but had appeared in children living near the new airport site.[3]

Studies have also demonstrated a link between transportation noise and cardiovascular effects, particularly hypertension and an increased risk of myocardial infarction. Noise exposure can cause increased blood pressure and alter heart rates and the release of stress hormones. There are two separate mechanisms for those effects, a direct neural pathway and an indirect pathway that is due to perceived discomfort. Since the direct pathway does not require conscious perception of noise, noise exposure during sleep, as well as during waking hours, is linked with cardiovascular outcomes.

CREC Noise Analysis

A noise analysis was submitted as part of the EFSB application for the proposed CREC facility. In that analysis, the applicant reported existing noise levels measured at five locations surrounding the proposed facility, as well as the modeled noise impacts at those locations associated with the construction and operation of the proposed facility. The locations of the noise receptors, which were chosen to represent the closest residential areas, are shown in Table 1.

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[1] Basner, Mathias, et al, "Auditory and Non-Auditory Effects of Noise on Health," Lancet Apr 2014, 383(992):1325-1332

[2] World Health Organization Regional Office for Europe, "Burden of Disease from Environmental Noise," 2011. http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

[3] Hygge S, et al, "The Munich Airport Noise Study – Effects on Chronic Aircraft Noise on Children's Perception and Cognition," inter.noise 2000, 29th International Congress and Exhibition on Noise Control Engineering, Nice, France, Aug 26-30, 2000. http://www.conforg.fr/internoise2000/cdrom/data/articles/000676.pdf

Table 1 – Locations of Noise Receptors

Receptor	Street	Direction/Distance from Center of Facility Site
M1	Wallum Lake Road	2,300 feet NE
M2	Jackson Schoolhouse Road	2,500 feet E
M3	Wilson Trail and Doe Crossing Drive	4,300 feet NW
M4	Buck Hill Road	4,300 feet N
M5	Jackson Schoolhouse Road	7,200 feet SE

The applicant's analysis predicted that noise from construction of the proposed facility would not increase ambient levels significantly and that "(t)he average individual is likely to tolerate construction noise given its temporary nature and that the majority of construction will take place during daytime hours." Further, the modeling analysis demonstrated that, with the proposed acoustical design, operation of the proposed facility would not cause noise impacts that exceed the Town of Burrillville's limit on nighttime noise of 43 A-weighted decibels (dBA). The Town noise ordinance also includes limits for octave-band frequencies; the applicant stated that "attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility." Since RIDOH does not know the basis for the noise limitations in the Town ordinance, the discussion below is based on a comparison of current and predicted noise levels with health-based reference values, rather than on a determination of whether noise levels comply with the Town's ordinance.

Nighttime Noise Exposures

Nighttime noise levels are particularly critical because of the importance of undisturbed sleep to health and wellbeing. According to the WHO, the Lowest Observed Adverse Effect Level (LOAEL) for nighttime outdoor noise effects on sleep is 40 dBA, averaged over an eight-hour period, and, when nighttime levels are in the range of 40 – 55 dBA, "many people have to adapt their lives to cope with the noise at night."[4] As shown in Table 2, the existing current average nighttime noise levels measured at all receptors in the CREC analysis except for M3 were above the 40 dBA LOAEL. According to that document, the predominant source of nighttime noise at receptors M1, M2 and M4 was the nearby Algonquin compressor station, while frog sounds predominated at the other two sites.

The modeled nighttime noise levels associated with CREC operations were above the sleep effect LOAEL at all receptors except for M5. When the CREC noise contributions were combined with existing noise levels, the total nighttime noise levels at all sites were above the LOAEL. Note that, when two noise sources (in this case the existing noise and noise from the CREC facility) impact noise levels at a location, the total noise level at that location is 0 - 3 dBA higher than the louder of the two noises. Note also that the noise survey conducted for the CREC EFSB application did not consider noise that will be generated by an additional turbine at the Algonquin compressor station that has been approved by the Federal Energy Resource Commission (FERC) and permitted by the Rhode Island Department of Environmental Management (RIDEM) but is not yet operating. The analysis presented in the Environmental Impact Statement for the Algonquin project does not identify the nighttime or daytime average noise levels associated with operation of that turbine.

[4] World Health Organization, Regional Office for Europe, "Night Noise Guidelines for Europe", 1999.

Table 2 – Nighttime Noise Levels (8-hour average, in dBA)

Location	Measured Existing Nighttime Noise Level (CREC EFSB Application)	Modeled CREC Operations Level (CREC EFSB Application)	Total Nighttime Noise Level (Existing & CREC) (Calculated)
MI	45-48	43	47-49
M2	40-41	41	44
M3	34-36	40	41
M4	51	41	51
M5	44-45	34	44-45

As shown in Table 2, the CREC modeling indicates that operation of the CREC facility would increase the average nighttime noise levels at M1, M4 and M5 by less than 3 dBA, the minimal increase that is generally discernable to the human ear. However, as discussed previously, existing noise levels measured at four of the five receptors already exceed the LOAEL for sleep disturbance. Whether or not CREC operations will result in an increase in the number or severity of those disturbances is dependent on a number of factors, including the time pattern and nature of the noise emissions at the two facilities. This issue is discussed further below.

Daytime Noise Exposures

Exposure to elevated environmental noise levels during daytime hours causes annoyance and can impact speech intelligibility, children's cognition, and the cardiovascular system. According to the WHO, an outdoor daytime average noise level of 50 dBA is associated with moderate annoyance and a level of 55 dBA serious annoyance.[5] 55 dBA is also at the lower end of the range of noise levels associated with an increased risk of hypertension.[6]

Current measured daytime noise levels at the five receptors, as well as modeled levels associated with the construction and operation of the CREC facility, are shown in Table 3. Existing daytime noise levels measured at all receptors except M3 were above the 50 dBA moderate annoyance threshold on at least one of the measurement days. The primary source of daytime noise at sites M1 and M2 was recorded as the compressor station, while birds predominated at M3 and M5 and traffic on Buck Hill Road was the main noise source at M4.

[5] Berglund, Birgitta et al, "Guidelines for Community Noise," World Health Organization, Geneva, Switzerland, April 1999. http://www.who.int/docstore/peh/noise/guidelines2.html

[6] World Health Organization Regional Office for Europe, "Burden of Disease from Environmental Noise," 2011. http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

Table 3 – Daytime Noise Levels (16-hour average, in dBA)

Location	Measured Existing Daytime Noise Level (CREC EFSB Application)	Modeled CREC Construction Noise Level (CREC EFSB Application)[7]	Modeled CREC Operations Noise Level (CREC EFSB Application)	Total Daytime Noise During Construction (Calculated)	Total Daytime Noise During Operation (Calculated)
MI	52-53	49	43	54	53
M2	50-52	53	41	55-56	51-52
M3	36-44	41	40	42-46	41-45
M4	50-51	47	41	52	51
M5	46-52	37	34	46-52	52

As shown in Table 3, the analysis predicts that noise levels associated with construction activities will be highest at location M2 (Jackson Schoolhouse Road); at that location, average daytime noise levels from construction activities would be as high as 53 dBA, resulting in a total noise level at that site of 55–56 dBA, an increase of 4-5 dBA from current levels. Therefore, the total daytime noise at that location during construction activities would exceed the serious annoyance threshold and may cause a slightly increased risk of hypertension for nearby residents.

Operation of the facility, once constructed, is predicted to have a minimal impact on current average daytime noise levels. However, as with nighttime noise, existing daytime noise levels measured at four of the five receptor sites are already in the moderate annoyance range and, depending on factors like the time pattern and nature of the noise emissions at the two facilities, the frequency or severity of annoyance may increase at some locations as a result of CREC operations. As discussed previously, noise associated with operation of the permitted additional turbine at the Algonquin compressor station was not included in these calculations.

Day/Night Noise Exposures

Another important measure of noise exposure is L_{DN}, a metric which combines daytime and nighttime exposures. To calculate L_{DN}, noise levels in the nighttime hours are increased by 10 dBA to account for the increased need for quiet during those hours, and a 24-hour average level is then calculated. The EPA has identified a L_{DN} of 55 dBA as the outdoor exposure level that would prevent annoyance, including interference with the intelligibility of speech.[8] According to the WHO, exposure to a L_{DN} of 50 dBA has not been shown to cause adverse effects, while some children showed cognitive effects at a L_{DN} of 55 dBA and the risk of myocardial infarction was slightly increased when L_{DN} levels were above 60 dBA.

L_{DN} levels associated with the CREC facility are shown in Table 4. Measured existing L_{DN} levels were not presented in the CREC application. However, the Environmental Impact Statement for the expanded Algonquin compressor station includes L_{DN} values for three of the receptors modeled in the CREC application; those values were used to calculate total L_{DN} values for those sites.

[7] These values are for grading and excavation and steel erection. Noise levels during concrete pouring, equipment installation and finishing are projected to be lower than the levels in this table.
[8] US EPA Office of Noise Abatement and Control, "Information on Levels of Environmental Noise Requisite to Protect Public Health and the Environment," March 1974 http://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF

Table 4 – Day/Night L_{DN} Noise Levels (weighted 24-hour average, in dBA)

Location	Day/Night Noise Level With New Compressor Operating Before CREC (Algonquin FERC Application)	Modeled Day/Night Noise Level (CREC EFSB Application)	Total Daytime Noise During Operation (Calculated)
MI (Algonquin 1)	57	55	59
M2		58	
M3 (Algonquin 4)	45	57	59
M4 (Algonquin 3)	53	53	56
M5		51	

As shown in Table 4, the L_{DN} noise level at M1, before the addition of CREC impacts, was above 55 dBA and the L_{DN} impacts of the CREC operations alone at M1, M2 and M3 locations were at or above 55 dBA, the L_{DN} value associated with cognitive effects in some children. The total L_{DN} values for the three sites (M1, M3 and M4) for which existing noise levels were available in the Algonquin application were all above 55 dBA.

Summary and Conclusions

The reported measurement of existing nighttime and daytime noise levels in the vicinity of the proposed facility that exceed annoyance thresholds is consistent with testimony submitted to the EFSB by residents living at or near those locations. In particular, written testimony received from a resident living on Wallum Lake Road, near receptor M1, the monitored/modeled noise receptor that is closest to the proposed facility, included the following statement:

> Specifically, in the past year, I have experienced excessive noise and vibrations coming from the Algonquin Compressor Station site which this project will be located next to. The noise and vibrations emanating from this site are extremely disruptive and negatively impacting our health and we are unable to sleep or enjoy the peace and quiet of our home. I am concerned that the noise levels and vibration are only going to increase during the construction and operational phase of this project.[9]

Note that, in the CREC noise survey, the current daytime noise level measured at that location (M1) was in the moderate annoyance range and the current nighttime noise level exceeded the threshold for sleep disturbance. The compressor station was the primary existing noise source of both day and night noise at that location. Measured noise levels at site M4 (Buck Hill Road) also exceed both nighttime and daytime annoyance thresholds, due primarily to the compressor operations and road traffic.

The model predicts that construction operations at the CREC facility would increase daytime average noise levels at the five receptor locations by between 0 and 6 dBA and that operation of the facility would increase nighttime noise levels by 0–7 dBA and daytime levels by 0–6 dBA. In most cases, the average predicted increases are in a range that is not generally discernable to the human ear. However, noise is a complex issue, and the potential for the introduction of an additional noise source to result in an increase

[9] CREC/Invenergy Docket, EFSB. http://www.ripuc.ri.gov/efsb/efsb/SB2015_06_PC_orourke.pdf

in the prevalence or severity of periods of annoyance and sleep disturbance is dependent on a number of factors, including:

- **The pattern of noise variation with time**
  For example, a continuous noise may have a different effect than periodic louder noises that are interspersed with relative quiet, even if the average noise levels are the same. Loud noises emitted by a source during a time that neighboring sources are quiet may increase the number of disturbances during the day or night. Regular variations in noise level may create an unpleasant pulsing sensation.
- **The noise frequency (pitch)**
  The human ear perceives low frequency (pitch) sounds as not as loud as higher frequency sounds of the same level. The A-weighting procedure used to calculate dBAs attempts to account for these differences, but dBA levels do not always correlate well with subjective perception of complex sounds.
- **Types of noise**
  A person's degree of annoyance to a particular noise level is also influenced by the nature of the noise and whether or not it provokes negative associations, like fear.
- **Individual differences**
  There is a substantial variation among people in sound perception.[5]

Existing daytime and nighttime noise annoyances in the neighborhood around the proposed facility, due primarily to the operation of the compressor station, have already been documented, both by subjective reports from residents and by objective noise measurements. In addition, due to the factors discussed above, the full impact of noise generated by operation of the new turbine at the compressor station and the CREC facility, in conjunction with the existing noise levels, is impossible to predict.

Therefore, RIDOH recommends that, if the CREC facility is constructed, the facility should work in conjunction with Algonquin to minimize neighborhood noise impacts to the extent possible and that such actions should include, but not be limited to, consideration of equipment and operational modifications, sound proofing of impacted residences and, if indicated, the purchase of properties subject to noise levels that cause serious annoyance and/or sleep disruption.

6.0 ISSUE 3: Drinking Water Quality

Background

Potential impacts on the quality of drinking water associated with the construction and operation of the CREC were evaluated within the context of the CREC proposal. The Invenergy power plant, as proposed, raised a number of questions regarding potential impacts on drinking water quality in private wells and public wells, groundwater, and public water system licensing. These concerns include possible groundwater depletion, possible contamination of drinking water wells, exposure to MTBE and other contaminants, and pollutant concentrations in discharged wastewater.

Situation and Analysis

Approximately 9,300 residents in Burrillville rely on private wells for drinking water. Burrillville currently has 4,232 structures served by private wells, representing 58.9 percent of all Burrillville structures. These wells rely on groundwater within sand and gravel deposits or from wells in fractured bedrock. The proposed power plant is approximately 1,500 feet from the nearest structures and associated wells. Additionally, the proposed project sits within the watershed of Wallum Lake, which provides sourcewater for Zambarano Hospital. The construction and operation of the project may impact the quantity and quality of the water of wells in the vicinity of the plant and its construction activities.

Invenergy proposes to draw process water from two wells known to have been contaminated with methyl tertiary butyl ether (MTBE), a retired component of gasoline. These wells cannot provide drinking water for the facility and a separate, approved source should be developed for onsite use. Concerns have been expressed regarding the impact of groundwater withdrawals from these wells on other water wells in Burrillville. Invenergy's assessment is that operation of the Facility will actually improve the quality of groundwater in the areas affected by the contamination event.

Summary and Conclusions

At this time, the principal concern is protection of sourcewater for nearby wells, including private wells and Wallum Lake, the source serving Zambarano Hospital. Invenergy proposes to develop a spill prevention, control and countermeasure plan. Effort should be made to protect these sourcewaters from contamination through each phase of the project, including construction and operations.

While groundwater withdrawals from the MTBE-contaminated wells for process water are not a health concern at this time, these wells may not be used to provide water to the plant's offices. Should the power plant use well water on-premises for human use and consumption, and their offices serve more than 25 persons more than 60 days out of the year, then the plant will have to obtain a public water system license through RIDOH's Center for Drinking Water Quality.

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7.0 ISSUE 4: Air Pollution

Background

The Invenergy power plant, as proposed, will be a major source of nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), carbon dioxide (CO_2), particulate matter smaller than 10 microns (PM_{10}) and particulate matter smaller than 2.5 microns ($PM_{2.5}$). The facility will also emit a number of air toxics, which are pollutants for which the US EPA has not established a National Ambient Air Quality Standard (NAAQS). Pollutants will be emitted primarily from processes that combust natural gas and ultra-low sulfur diesel oil (ULSD). VOC will also be emitted from two aboveground ULSD storage tanks.

Invenergy has applied to the Rhode Island Department of Environmental Management (RIDEM) for a major source air pollution control permit for the facility. To obtain this permit, Invenergy must demonstrate that the facility will comply with the requirements of 18 of RIDEM's Air Pollution Control Regulations (APCRs), including APCR No. 9, "Air Pollution Control Permits," and APCR No. 22, "Air Toxics." Note the APCR No. 22 lists health-based Acceptable Ambient Levels (AALs) for approximately 250 air toxics.

Among the requirements for obtaining a major source permit, APCR No. 9 specifies that permit applications must demonstrate that facility emissions will be consistent with the Lowest Achievable Emissions Rate and that ambient air impacts from the facility will not cause a violation of any NAAQS or AAL. NAAQS evaluations consider total ambient air levels, including impacts from the proposed facility, background ambient air pollutant concentrations, and impacts from nearby interacting sources. Compliance with NAAQS and AALs is evaluated using US EPA-endorsed air pollution dispersion models, which utilize several years of hour by hour meteorological data to determine impacts under a range of meteorological conditions.

In addition, major source applications must include a Health Risk Assessment (HRA), which considers potential impacts by all exposure routes. Note that the AALs are derived to be protective of inhalation exposures. The HRA also considers deposition of pollutants, which may lead to ingestion of those pollutants via various media, including soil, water and food products. The HRA also considers dermal absorption, which may cause additional exposure for some pollutants. In addition, the HRA evaluates the cumulative effect of exposure to more than one pollutant associated with the same health effect (e.g. respiratory irritation). To standardize procedures for calculating multi-pathway and cumulative risks, RIDEM's "Guidelines for Assessing Health Risks for Proposed Air Pollution Sources,"[10] which was revised in 2015, requires that HRAs be conducted using software developed by the California Air Resources Board for this purpose.

Situation and Analysis

RIDEM's regulations provide a comprehensive framework for evaluating impacts of air pollution emissions. Rhode Island's Air Toxics regulation is one of the most stringent in the nation, and the requirement for a HRA for major sources provides an extra level of health protection. RIDEM's

[10] RIDEM's "Guidelines for Assessing Health Risks for Proposed Air Pollution Sources" is available on the RIDEM website at: http://www.dem.ri.gov/programs/benviron/air/pdf/riskguid15.pdf

regulations, as well as the HRA guidelines referenced above, have been the subject of a public participation process that included opportunities for submittal of both oral and written testimony.

Questions have been raised concerning the modeling analysis submitted by Invenergy to demonstrate compliance with NAAQS and AALs and as the basis for the HRA. RIDEM is now evaluating the permit application, including the modeling analysis and the HRA; that process is separate from the EFSB proceedings. RIDOH, as well as members of the public, will have an opportunity to comment on RIDEM's evaluation of the permit application and on the proposed permit during RIDEM's public comment period and hearing, which will occur when that review is complete.

Questions have also been raised about whether the NAAQS adequately protect public health. Specifically, epidemiological studies have reported an association between ambient NO_2 levels and various health metrics, including new diagnoses of asthma; clinic and emergency department visits for asthma; hospitalizations for asthma, COPD, stroke and heart failure; and death from cardiovascular and respiratory diseases. In some cases, exposure levels reported in those studies were below the current NAAQS for that pollutant.

Those studies and a number of other epidemiological and experimental studies are discussed in some detail in the US EPA's Integrated Science Assessment for Oxides of Nitrogen – Health Criteria (2016 Final Report) document, (https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879), which was prepared as part of the US EPA's requirements to periodically reevaluate the adequacy of the NAAQS. The US EPA found that experimental and epidemiological data are sufficient to establish a causal relationship between short-term (minutes to one-month) exposures to NO_2 and respiratory effects. Evidence for an association between short-term NO_2 exposure and cardiovascular and related metabolic effects and total mortality are classified as "suggestive, but not sufficient, to infer a causal relationship."

However, it does not appear likely that the US EPA's review of these studies will lead to the proposal of a more stringent NO_2. A more stringent standard could not be based on experimental data, because experimental studies have focused on exposures to NO_2 concentrations of 100 ppb (the current one-hour average NAAQS) and higher. The US EPA acknowledges that epidemiological studies report health effects at NO_2 levels that are below the NAAQS. However, the document discusses a number of issues that make quantitative interpretation of air pollution epidemiological studies difficult, including issues with accurately characterizing exposure levels and concomitant exposures to other air pollutants.

Questions have also been raised about health effects that may be associated with elevated very short-term (less than one-hour) emissions rates of certain pollutants. While variations in instantaneous emissions rates do occur, quantification and evaluation of the impacts of those variations is virtually impossible, given available modeling tools and health data.

Summary and Conclusions

RIDEM is currently conducting a comprehensive review of the Invenergy major source air pollution control permit application. That review includes the evaluation of the applicant's modeling analysis demonstrating that emissions would not cause exceedances of health-based NAAQS and AALs and that multi-pathway and cumulative impacts of those pollutants would not result in adverse health effects.

Although RIDOH agrees that there is epidemiological evidence that health effects may be associated with exposures to NO_2 at levels below the NAAQS, no other health-based standard is available for evaluating impacts of that pollutant at this time. States are allowed to adopt more stringent standards than the EPA's NAAQS standards, but no states have promulgated a short-term NO_2 standard that is more stringent than the NAAQS and the process for adopting such standards is arduous. Note that standards are needed to make informed, consistent regulatory decisions.

RIDOH plans to review the HRA, as well as RIDEM's permit evaluation, and will have the opportunity to supply comment during RIDEM's public comment period if indicated.

8.0 ISSUE 5: Asthma

Background

Asthma is one of the public health concerns which has been raised through the EFSB public hearing process, as well as in phone calls to RIDOH. Asthma is a chronic respiratory disease that causes a person's airways to narrow, resulting in difficulty breathing. If left untreated, asthma can cause permanent lung damage, disability, and even death. An asthma attack occurs when a person with asthma has greater difficulty breathing than their normal level and requires increased medication and/or medical attention.

The burden of asthma can be described in multiple ways: asthma prevalence (how many people have asthma), visits to the hospital and emergency department, insurance claims data, and mortality data. There is no cure for asthma, but the chronic condition can usually be managed and attacks can be prevented. Asthma is treated through medications and by reducing exposure to asthma triggers.[11] Asthma management and control is multi-factorial. Asthma triggers include various outdoor air pollutants as well as allergies, mold, pests, pet dander, smoke, dust, and other triggers. Individuals with asthma are sensitive to different sets of triggers, which can change seasonally or over time.

Due to these complexities, it is difficult to establish causal relationships between a single environmental factor and asthma outcomes without conducting rigorous scientific research. However, in general, people with asthma or other respiratory diseases are more susceptible and reactive to the impacts of air pollutants. With regards to general population health, policies which reduce the overall level and concentration of air pollution and other environmental asthma triggers will support improved public health with respects to asthma.

Analysis of Known Triggers and Asthma Burden

The proposed CREC facility would emit several air pollutants that are known asthma triggers, including nitrogen oxides (NO_x), volatile organic compounds (VOC), sulfur dioxide (SO_2), and particulate matter. As discussed in Section 7.0 above, CREC is a major emissions source for NO_x, VOC, particulate matter smaller than 10 microns (PM_{10}) and particulate matter smaller than 2.5 microns ($PM_{2.5}$). Smaller PM particles are associated with greater respiratory risk due the ability for smaller particles to move deeper into the lungs. NO_x and VOC also react in the atmosphere, in the presence of light and heat, to form ozone, another pollutant which is of concern for asthma. The facility would also emit smaller quantities of several other pollutants that are known asthma triggers. In general, air pollutants have a greater impact on children because they breathe more air per unit of body weight and have lungs which are still developing.

The following asthma statistics describe the current asthma burden in Rhode Island and Burrillville; these statistics were derived from multiple data sources, including the Rhode Island Behavioral Risk Factor Surveillance System (BRFSS), the National Survey of Children's Health, Rhode Island Hospital Discharge Data, Rhode Island Emergency Department (ED) Data, and the 2014 Asthma Claims Data Book (RIDOH, 2014), based on a geographic analysis of insurance claims:

- As a state, Rhode Island has asthma rates which are significantly higher than the national averages. Approximately 16% of adults in Rhode Island have been diagnosed with asthma at some point in their lifetime, compared to 13% nationally, and 11% of adults in Rhode Island

[11] *The burden of asthma in Rhode Island.* (2014). Providence, RI: Rhode Island Department of Health, Asthma Control Program

currently experience asthma, compared to 9% nationally.[12] 17.1% of children in RI have been diagnosed with asthma, compared to 14.5% nationally, and 10.9% of children in RI currently experience asthma, compared to 8.8% nationwide.[13]

- Within Rhode Island, the burden of asthma is primarily concentrated within the four core cities of Providence, Pawtucket, Central Falls, and Woonsocket. In 2010– 2012, 12.8% of all children statewide between the ages of 2 and 17 had an asthma claim. Most of northwest Rhode Island had a very low prevalence of asthma claims, with most census tracts having a rate of 0–4.4% of children with an asthma claim. The central census tract in Burrillville was two steps higher than the surrounding area, with the percentage of children with an asthma claim between 6.3% and 7.9%. This was lower than the statewide average, which was driven primarily by the high asthma rates in the high poverty urban core cities, where 10.4-15.4% of children had an asthma claim.[14]
- In addition to asthma prevalence, the severity of asthma can be measured through asthma-related Emergency Department (ED) visits and hospitalizations, which are consistently higher for young children compared to other age groups. In 2010-2014, the statewide rate of children's ED visits due to asthma was 8.9 per 1,000 children. The rate in Burrillville was 4.4 per 1,000 children, compared to 15.1 per 1,000 children in the core cities. The statewide rate of child hospitalizations for asthma is 1.6 per 1,000 children. The rate in the four core cities is 2.4 per 1,000, while Burrillville is consistent with the remainder of the state at a rate of 1.2 hospitalizations per 1,000 children. In Burrillville, and across the state, the number of asthma-related pediatric emergency department visits had been steadily decreasing from 2011 to 2013. However, in 2014 there was a slight increase in statewide pediatric asthma ED visits. There were 21 pediatric asthma-related ED visits in Burrillville in 2014, which is higher than in any of the previous three years (17 in 2011, 10 in 2012, and 9 in 2013), though still less than that of the core cities.[15]

Summary and Conclusions

Without an in depth research study or comprehensive Health Impact Assessment, it is not possible to predict asthma-related impacts specific to the proposed CREC facility. As discussed in the previous section, for the facility to receive an air pollution control permit from RIDEM, the applicant must demonstrate that emissions from the facility, in conjunction with existing background ambient pollutant levels and emissions from nearby interacting sources, will not cause exceedances of National Ambient Air Quality Standards (NAAQS), which are largely based on respiratory health effects. In addition, as discussed in that section, CREC, as a major source of air pollutants, has been required to submit a Health Risk Assessment (HRA) for air toxics, pollutants for which a NAAQS has not been derived. Among other issues, the HRA must evaluate the cumulative impact of all air toxics emitted by the facility that have the potential to effect the respiratory system.

However, it is not possible to say definitively that emissions from the CREC facility will have no impact on asthma rates or on the wellbeing of nearby individuals with asthma. As discussed in the previous section, epidemiological studies have reported an association between ambient nitrogen dioxide (NO_2) levels and certain asthma-related health metrics, including new diagnoses of asthma, clinic and

[12] Ibid
[13] National Survey of Children's Health. NSCH 2011/12. Data query from the Child and Adolescent Health Measurement Initiative. Data Resource Center for Child and Adolescent Health website. Retrieved 06/24/2016 from www.childhealthdata.org
[14] *Asthma claims data book.* (2014). Providence RI: Rhode Island Department of Health, Asthma Control Program.
[15] Rhode Island Department of Health, Hospital Discharge Database, 2010-2014; U.S. Census Bureau, Census 2010.

emergency department visits for asthma, and hospitalizations for asthma. In some cases, the ambient air levels of NO_2 in those studies were below the NAAQS for that pollutant.

Children, in general, and people of all ages who have asthma or other respiratory diseases are more susceptible to impacts from air pollutants. Although Burrillville and northwestern Rhode Island have low asthma prevalence rates and low rates of asthma-related hospitalizations and emergency department visits compared to the core cities in Rhode Island, there are sensitive individuals living in all areas of the State. RIDOH received a call from a Burrillville resident who lives in close proximity to the existing compressor station and the proposed location of CREC, and who reported lifelong suffering from severe and poorly controlled asthma. RIDOH does not have comprehensive data available on how many other individuals with asthma are in close proximity to the proposed CREC facility.

Woonsocket is the closest area of high concern related to asthma, with both a large number and percentage of people with asthma and poor health outcomes with high rates of asthma-related hospitalizations and emergency department visits. If air quality modeling shows air quality impacts as far as Woonsocket, additional steps should be taken to examine, mitigate, and/or prevent those impacts.

Without further research, it is not possible to determine the extent or level of impact which this specific facility would have on individual or population health, in comparison to the many other factors impacting asthma. RIDOH recommends that, if the CREC is to be built, all possible steps be taken to reduce harmful emissions and mitigate the health impacts of emissions, with special consideration to individuals with asthma or otherwise impaired respiratory health. RIDOH can collaborate with the appropriate state partners that will help ensure that those possible steps are initiated and implemented effectively to prevent and mitigate such health impacts.

9.0 ISSUE 6: Emergency Response and Prevention

Background

Several areas of concern related to prevention and response to potential emergency releases and catastrophic events involving materials at or in transit to or from the proposed CREC facility have been identified, including:

- Potential for toxic releases of ammonia stored and used at the facility;
- Fire and explosion hazards associated with compressed hydrogen used to cool generators at the facility;
- Potential for spills/releases of fuel oil stored and used at the facility;
- Safe storage and transportation of and hazardous waste generated at the site; and
- Releases and catastrophic events involving natural gas at the facility or in the pipeline and related infrastructure in the vicinity of the facility.

Hazards

Emergency release concerns are minimally addressed in Invenergy's EFSB application, but are discussed in more detail in the applicant's responses to data requests by the Town of Burrillville. The following is a discussion of information supplied by the applicant and RIDOH's recommendations concerning those issues.

Ammonia Storage

The applicant states that the facility will store 40,000 gallons (more than 300,000 pounds) of 19% aqueous ammonia, which will be used to control air pollutant emissions. The US EPA requires facilities that store more than 10,000 pounds of 20% aqueous ammonia to prepare a Risk Management Plan (RMP) as part of a Risk Management Program designed to prevent and mitigate the consequences of accidental/emergency releases. In Response 11-3 to the Town's 11th Set of Data Requests, the applicant states that the 20% concentration criterion was set by the US EPA "because it does not consider aqueous ammonia stored at a concentration less than 20% to pose a public health risk upon release." No documentation was provided to support that statement. Note that, in some cases, threshold concentrations in the RMP rule may have been based on issues other than public health. See the Materials Safety Data Sheet in Appendix II for more information about aqueous ammonia.

In Response 11-3, the applicant reports that, although the CREC facility will not be subject to RMP requirements, an assessment was performed using the Area Locations of Hazards Atmospheres (ALOHA) model to determine the furthest downwind distance that concentrations at the level of the one-hour Acute Exposure Guideline Levels (AEGLs) for ammonia would occur in the event that the full 40,000 gallons of aqueous ammonia were released into the concrete containment area that will house the storage tank and associated pumps, valves and piping. The applicant states that ALOHA predicted that the furthest downwind point at which the most stringent AEGL, AEGL-1; which is associated with effects that are transient, reversible upon exposure cessation and not disabling; is only 121 yards, and that no off-property locations would be affected by such a release.

The applicant further states that the following measures will be implemented to minimize the potential for and mitigate the consequences of an accidental ammonia release:

- The concrete containment area that will house the ammonia storage tank and its associated transfer pumps, valves and piping is designed to contain up to 110% of the storage tank capacity;
- To minimize the evaporation rate of ammonia into the ambient air, the containment area will be filled with passive evaporative controls to reduce the exposed surface area of any aqueous ammonia within the containment area by 90%;
- Ammonia sensors within the containment area will alert plan operators of any system leaks;
- Emergency procedures will be established to evacuate facility personnel from areas on the property potentially impacted by a release and to require emergency personnel to use proper personal protective equipment; and
- The applicant will work with local emergency responders to establish emergency procedures in the event of a release.

RIDOH does not have sufficient information available to reproduce the ALOHA model run. It appears that the model may have been run assuming that the passive evaporation controls were fully functional, reducing the exposed surface area by 90%. If that is the case, RIDOH recommends that the model also be run without that assumption and that emergency planning consider the results of the more conservative model run, including the potential for off-site consequences.

Although it appears that, since the ammonia concentration is slightly lower than the RMP threshold, a RMP is not required, RIDOH strongly recommends that equivalent planning and prevention procedures be implemented. RMP programs include a hazard assessment; a prevention program that includes safety precautions and maintenance, monitoring and employee training measures; and an emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies should an accident occur.[16] Note that such a program is designed to ensure the comprehensive identification and mitigation of potential hazardous releases and the effective implementation of response procedures should a release occur.

In addition, all facilities are subject to EPA's General Duty Clause, which requires facilities to identify and assess hazards, design and maintain a safe facility to prevent accidental releases, and minimize the consequences of such releases if they should occur. A factsheet on the General Duty Clause is available at https://www.epa.gov/sites/production/files/2013-10/documents/gdc-fact.pdf.

RIDOH strongly recommends the following regarded storage of ammonia at the facility:

- Invenergy should establish clear, written procedures for the periodic inspection, testing and maintenance of the integrity of the containment area and the functionality of passive controls, sensors, etc., to ensure that those safety elements will function appropriately should an event occur;
- Invenergy should also establish clear, written emergency procedures. Emergency procedures should include appropriate training, including periodic refresher training, of staff who will be responsible for implementing emergency response. Those staff should be fitted for, have available, and be trained in the use of appropriate personal protective equipment.

[16] EPA Risk Management Plan (RMP) Rule Overview webpage: https://www.epa.gov/rmp/risk-management-plan-rmp-rule-overview

- If ALOHA was run with the assumption that the passive controls would significantly reduce the evaporation rate, the model should also be run assuming a failure in those controls. If, with that assumption, the distance to the toxic endpoint extends off-property, appropriate planning should be implemented for that possibility, including evaluating possible impacts on, and safety procedures for, potentially impacted receptors (residences, schools, health care facilities, etc.) Note that planning for potential impacts on Zambarano Hospital is particularly critical, due to the difficulties that would be associated with evacuation of the residents of that facility.
- Coordination with local emergency responders should include the identification of and coordination with the nearest hazardous materials response team. Emergency responders should be provided with full information about the quantities and locations of chemicals stored on site and of transport routes and procedures, as well as of the results of the worst-case analysis discussed above.

Compressed Hydrogen Storage, Use, and Transport

The applicant states that hydrogen will be used at the facility for cooling electric generators. Hydrogen generators will not be operated; hydrogen will be delivered to the facility in compressed gas cylinders or tube trailers. In its responses to the Town's 9th Set of Data Requests, the applicant outlines safety procedures that will be employed to assure safe storage and use of those tanks, including:

- To prevent the formation of flammable mixtures, the generator will be purged of hydrogen before opening the system to the atmosphere and purged of air, oxygen or other oxidizers before admitting hydrogen into the system;
- The hydrogen control system will automatically purge the generator using inert carbon dioxide gas to remove the hydrogen;
- When the generator is in operation, the hydrogen storage and supply system is designed to a nonexplosive level (i.e., 99.99%);
- Hydrogen cylinders and tube trailers will be located outside and away from high traffic areas and normally occupied spaces. The location will be based on NFPA 55 guidelines;
- A dedicated concrete pad will be constructed next to the cylinders for a tube truck as a back-up source of hydrogen;
- Protective bollards will be installed around the cylinders and the trailer pad to protect from traffic;
- Hazard signage will be posted;
- Systems will be designed and installed according to NFPA requirements to prevent sources of ignition, including the use of properly rated equipment in hydrogen storage and safety systems;
- The generator is equipped with end shields designed to direct a blast away from possible occupied spaces;
- Enclosed spaces will be furnished with hydrogen sensors to monitor leaks;
- An automated seal oil system control system, equipped with emergency pumps to maintain the seal in the event of a power loss, will be employed;
- Pressure release devices will be used in the compressed storage system to relieve pressure in a controlled manner through a vent system;
- The hydrogen system has a dedicated control panel to monitor hydrogen purity, backed up by an uninterruptible power supply;
- The manifold that supplies hydrogen to generator has a gas control valve assembly and gas pressure monitor;

- The building ventilation system is designed to prevent the accumulation of hydrogen, including redundant fans;
- Purged hydrogen sill be piped and vented to an elevated point outside of the generator building.
- Hydrogen sensors with an externally mounted alarm and control panel will be installed in all battery rooms;
- Hydrogen delivery trucks will follow DOT guidelines;
- Hydrogen tubes and trailers are designed and operated according to DOT specifications to ensure safe transportation; and
- The hydrogen storage and supply system will be designed to meet NFPA 55.

The threshold quantity for hydrogen storage in EPA's RMP rule is 10,000 pounds. If the total amount of hydrogen stored on the facility's site will not exceed that threshold at any time, a RMP is not required. However, as discussed above, RIDOH strongly recommends the implementation of equivalent planning and prevention procedures, including a comprehensive hazard assessment, prevention program and emergency response program. It appears that the applicant has designed a system for the storage and use of compressed hydrogen that considers these issues; however, a RMP-like plan would ensure, to the extent possible, that all possible hazards are identified and mitigated in advance and that emergency procedures would be effectively implemented if an incident were to occur. Note that hydrogen storage and use is also covered by the EPA's General Duty Clause, as discussed above.

RIDOH strongly recommends the following regarding hydrogen storage and use at the facility:

- Clear written procedures should be in place for the periodic inspection, testing and maintenance of all equipment, controls, sensors, etc. related to the storage and use of hydrogen at the facility to ensure that they are functioning appropriately;
- All staff that are involved with the storage, transfer and use of hydrogen should be provided with appropriate training, including periodic refresher training, in procedures necessary to ensure the safe maintenance and operation of the hydrogen system, as well as in emergency procedures.
- As discussed above, coordination with local emergency responders, including the nearest hazardous materials response team, is essential. Emergency responders should be provided with full information about the quantities and locations of hydrogen on site and of transport routes and procedures, as well as any other information relevant to ensure optimum response.

Additional Considerations

In addition to the ammonia and hydrogen issues discussed above, concerns have been raised about the potential for spills associated with the two million gallons of fuel oil that will be stored at the facility, the storage and transportation of hazardous waste generated at the site, and the potential for catastrophic events involving natural gas at the facility or in the pipeline and related infrastructure. RIDOH expects that the former two issues will be addressed by RIDEM. The potential for catastrophic events related to the safety of the transport and use of natural gas in the area should be considered in a more comprehensive context, rather than in an analysis that is limited to the CREC facility. RIDOH also recommends that all potential hazards be evaluated in a facility-wide RMP-like hazard analysis and in ensuring compliance with General Duty Clause requirements, as discussed above.

10.0 ISSUE 7: Climate Change and Health

Background

RIDOH considers climate change to be a current and future health threat in Rhode Island. The US Global Change Research Program states that human-induced climate change, which is caused by the burning of fossil fuels, "is a significant threat to the health of the American people"[17] and can include negative physiological and mental health impacts. Vulnerable populations already face risks due to warming temperatures, reduced air quality, increasing severity of storms, flooding, drought, and the rising of sea levels.

Discussion of Potential Concerns

Climate change threatens the health of Rhode Islanders in several salient ways, from larger storm systems and sea-level rise to the introduction of infectious diseases and infectious disease vectors formerly confined to more southern latitudes. Global warming may also threaten our food supply and supply of fresh water, both critical to public health. The magnitude of these effects is unknown, but public health officials project real threats to the public's health in the short, medium, and long-term.

The burning of fossil fuels and the extraction of fossil fuels by "fracking" both contribute to climate change by emitting various greenhouse gases to the atmosphere, most notably carbon dioxide and methane. Both have the effect of harming the health of Rhode Islanders now and in the future.

The contribution to climate change from the CREC facility proposed for Burrillville can be assessed indirectly by noting the projected annual rate of greenhouse gas emissions at the plant site and by estimating the annual rate of greenhouse gas emissions attributable to fracking the quantity of gas projected to be burned in the Burrillville plant. We cannot measure the direct contribution of the proposed plant, or of any single facility, to public health by means of climate change.

Summary and Conclusions

When considering expansion of the fossil fuel-based energy system, RIDOH acknowledges that the potential effects on climate change must be considered project by project and community by community. RIDOH supports the Resilient Rhode Island Act's goals, and thus supports any locally-requested examination of alternative energy sources and/or plans. If and when determined to be at all possible, RIDOH supports efforts aimed at carbon emission reduction and the development of alternative, renewable energy sources.

[17] Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, 2016: Executive Summary. T*he Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.* U.S. Global Change Research Program, Washington, DC, page 1–24. http://dx.doi.org/10.7930/J00P0WXS

11.0 Appendices

Appendix I

Excerpted from: Rhode Island Energy Facility Siting Board Application

[Received as: SB_Invenergy_application.pdf]

6.11 Electric and Magnetic Fields

This section provides an assessment of electric and magnetic fields (referred to as EMF) resulting from the operation of the Project's dedicated 345 kV AC electric transmission line that will interconnect the Project into the regional electric transmission system. The complete EMF Analysis Report for the CREC Transmission Line is located in Appendix F.

[…]

Above ground transmission lines are typically located in transmission corridors or Rights of Ways (ROWs) with the conductors suspended from towers or poles to keep the transmission lines at a safe height above the ground. Access to transmission line ROWs is usually restricted for safety reasons.

Table 6.11-2 is provided to illustrate guidelines suggested by various national and international health organizations for exposure to both electric and magnetic fields. The EMF guidelines identified in Table 6.11-2 were developed by the identified organizations to be protective against adverse health effects from EMF, but which should not be viewed as representing EMF levels that have been proven as safe versus levels that are un-safe; the values shown are simply guidelines based on current knowledge.

Table 6.11-2

60-Hz EMF Guidelines Established by Health and Safety Organizations

Organization	Magnetic Field	Electric Field
American Conference of Governmental and Industrial Hygienists (ACGIH) (occupational)	10,000 mG [a] 1,000 mG [b]	25 kV/m [a] 1 kV/m [b]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (general public, continuous exposure)	2,000 mG	4.2 kV/m
Non-Ionizing Radiation (NIR) Committee of the American Industrial Hygiene Assoc. (AIHA) endorsed (in 2003) ICNIRP's occupational EMF levels for workers	4,170 mG	8.3 kV/m
International Committee on Electromagnetic Safety (ICES)	9,040 mG	5.0 kV/m
U.K., National Radiological Protection Board (NRPB) [now Health Protection Agency (HPA)]	2,000 mG	4.2 kV/m
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Draft Standard, Dec. 2006 [c]	3,000 mG	4.2 kV/m
*Comparison to **steady** (DC) EMF, encountered as EMF outside the 60-Hz frequency range:*		
Earth's magnetic field and atmospheric electric fields, steady levels, typical of environmental exposure [d]	[550 mG]	[0.2 kV/m up to > 12 kV/m]
Magnetic Resonance Imaging Scan, static magnetic field intensity [d]	[20,000,000 mG]	---

Notes:
[a] ACGIH guidelines for the general worker.
[b] ACGIH guideline for workers with cardiac pacemakers.
[c] http://www.arpansa.gov.au/pubs/comment/dr_elfstd.pdf; and http://www.arpansa.gov.au/News/events/elf.cfm
[d] These EMF are steady fields, and do not vary in time at the characteristic 60-cycles-per-second that power-line fields do. However, if a person moves in the presence of these fields, the body experiences a time-varying fields

Table 6.11-3 shows guidelines that have been adopted by a number of states to establish EMF design guidance for future transmission line right of ways that are equivalent to that currently measured within or at the edge of existing transmission rights of way for similarly configured transmission-lines. These EMF state guidelines are not health-based standards, but simply guidelines to maintain EMF values for new transmission lines at EMF measurements experienced for existing similarly configured transmission lines.

Table 6.11-3
State EMF Standards and Guidelines for Transmission Lines

State / Line Voltage	Electric Field		Magnetic Field	
	On ROW	Edge ROW	On ROW	Edge ROW
Florida [c] 69 – 230 kV	8.0 kV/m	2.0 kV/m [f]		150 mG
230 kV and <= 500 kV	10.0 kV/m	2.0 kV/m [f]		200 mG,
>500 kV	15.0 kV/m	5.50 kV/m		250 mG [e]
Minnesota	8.0 kV/m			
Montana	7.0 kV/m [a]	1.0 kV/m [b]		
New Jersey		3.0 kV/m		
New York [c]	11.8 kV/m 11.0 kV/m [d] 7.0 kV/m [a]	1.6 kV/m		200 mG
Oregon	9.0 kV/m			

Key: ROW = right of way; mG = milliGauss; kV/m = kilovolts per meter

Notes:

[a] Maximum for highway crossings
[b] May be waived by the land owner
[c] Magnetic fields for winter-normal, maximum line-current capacity
[d] Maximum for private road crossings
[e] 500 kV double-circuit lines built on existing ROW's
[f] Includes the property boundary of a substation

Sources: "Questions and Answers about EMF." National Institute of Environmental Health Sciences and U.S. Department of Energy, 2002. http://www.niehs.nih.gov/health/topics/agents/emf/index.cfm
Florida, see: http://www.dep.state.fl.us/siting/files/rules_statutes/62_814_emf.pdf

[…]

6.11.3 Projected EMF Impacts

EMF standards and guidelines are applied at those locations where the public could have access to the Project. Most electric generation facilities are closed for general public access and as a result exposure to EMF within the facility is not an issue for the general public. Areas open to the public are typically publically accessible land along the edges of the ROW or for homes located contiguous to transmission rights of way.

As a result of the construction and operation of the Project the EMF levels along the six miles of the transmission ROW used by the Project will be impacted. To assess these impacts EMF estimates were developed that included impacts for the two existing 345 kV transmission lines (lines 341 and 347) and the addition of the Project's new 345 kV transmission line interconnecting the Project into the regional transmission system.

Table 6.11-4 provides the analysis of the magnetic fields (existing and proposed) within the ROW, at the edges of the ROW and 100 feet to either side of the ROW for the two arrangements of transmission towers depicted in Figure 6.11-1.

Table 6.11-4

Magnetic-field Levels (mG) at Peak Loading of CREC Line and Average and Peak Loading of the Existing 341 and 347 Lines

			Distance from Centerline of ROW				
Section	Loading	Condition	East ROW Edge -100 ft	East ROW Edge	Max on ROW	West ROW Edge	West ROW Edge +100 ft
4.4 Mile Section (See Figure 6.11-1)	Average	Existing	1.0	1.8	116	1.9	1.1
		Proposed	5.0	12	365	4.3	2.3
	Peak	Existing	0.5	1.1	171	8.2	2.0
		Proposed	6.4	14	342	3.8	1.6
1.6 Mile Section (See Figure 6.11-1)	Average	Existing	4.5	21	116	1.9	1.1
		Proposed	13	65	366	5.9	1.6
	Peak	Existing	3.5	22	171	8.2	2.0
		Proposed	19	79	336	46	14
Reference Exponent, Inc. Report Dated October 27, 2015 See APPENDIX F							

Table 6.11-5 provides the analysis of the electric fields (existing and proposed) within the ROW, at the edges of the ROW and 100 feet to either side of the ROW for the two arrangements of transmission towers depicted in Figure 6.11-1.

Table 6.11-5

Electric-field Levels (kV/m) With CREC and the Existing 341 and 347 Lines At Maximum Voltage

			Distance from Centerline of ROW				
Section	Voltage	Condition	East ROW Edge -100 ft	East ROW Edge	Max on ROW	West ROW Edge	West ROW Edge +100 ft
4.4 Mile Section (See Figure 6.11-1)	Maximum	Existing	0.02	0.05	7.5	0.39	0.02
		Proposed	0.04	0.11	7.5	0.38	0.04
1.6 Mile Section (See Figure 6.11-1)	Maximum	Existing	0.14	1.2	7.5	0.39	0.14
		Proposed	0.13	1.2	7.7	1.5	0.13
Reference Exponent, Inc. Report Dated October 27, 2015 See APPENDIX F							

The results of the analysis of the Magnetic and Electric field levels (EMF Levels) for the existing and the proposed addition of the CREC's transmission line within the National Grid ROW finds that the Magnetic and Electric Field levels at the edges of the ROW and 100 feet to either side of the ROW are calculated to be well below the reference levels recommended by International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (see Table 6.11-1) and well within the Standards and Guidelines set by many other States for new transmission line additions (see Table 6.11-3).

Appendix II: Material Safety Data Sheet (Aqua Ammonia – 19%)

Terra Industries Inc.
Terra Centre – 600 Fourth Street
Sioux City, Iowa 51101

Material Safety Data Sheet

Aqua Ammonia (19% NH_3)

MSDS Number 2050A (Revised February 16, 2007) 8 Pages

1. CHEMICAL PRODUCT and EMERGENCY TELEPHONE CONTACT

Product Name:	Aqua Ammonia (19% NH_3)
Chemical Family:	Inorganic Nitrogen Compound
Synonyms:	Ammonium Hydroxide; Ammonia Solution, Aqueous Solution; Ammonia Monohydrate; Ammonia Water; Ammonia Liquor
Formula:	NH_4OH in H_2O
Product Use:	Fertilizers; Pharmaceuticals; Lubricants; Household Cleaners; SCR NO_x Control

EMERGENCY TELEPHONE NUMBERS

CHEMTREC (U.S.):	800-424-9300
CANUTEC (Canada):	613-996-6666

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient Name/CAS Number	Concentration	Exposure Limits (NH_3)
Ammonium Hydroxide / 1336-21-6	39.1%	25 ppm TWA
Water / 7732-18-5	60.9%	35 ppm STEL
		50 ppm PEL
Contains 19% ammonia as NH_3		300 ppm IDLH

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Corrosive liquid! May be fatal if swallowed. Vapor is toxic and irritating to eyes, nose, throat and skin. Liquid will burn skin and eyes. Vapor is flammable under limited conditions. Use water to control fire and disperse vapors.

NFPA Hazard Classification (for ammonia vapor)	Health Hazard (Blue)	3
	Flammability (Red)	1
	Reactivity (Yellow)	0

POTENTIAL HEALTH EFFECTS

Primary Routes of Entry: Inhalation, skin contact/absorption and eye contact.

General Acute Exposure: Aqua ammonia may cause caustic injury. The severity of injury depends upon the concentration and duration of exposure. The extent of injury ranges from mild skin irritation or cough to severe burns or laryngeal edema and life-threatening pulmonary edema.

Inhalation:
Corrosive! Ammonia vapor is toxic and a severe irritant of the respiratory tract. It may cause a running nose, coughing, chest pain, cessation of respiration and death. It may cause severe breathing difficulties, which may be delayed in onset. ADDITIONAL MEDICAL INFORMATION: Bronchospasm, laryngitis, tracheitis, wheezing, dyspnea, and laryngeal stridor may be noted. Mucosal burns to the tracheobronchial tree, Pulmonary Edema, and associated hypoxemia frequently occur following exposure to concentrated ammonia.

Skin Contact:
Corrosive! Aqua ammonia is a severe irritant of the skin. Skin exposure to high concentrations may cause pain and deep and severe burns to the skin. ADDITIONAL MEDICAL INFORMATION: Corrosive effects on the skin and other tissues may be delayed, and damage may occur without the sensation or onset of pain. Strict adherence to first aid measures following exposure is essential.

Eye Contact:
Corrosive! Vapors cause irritation. Effects as a result of direct contact with aqua ammonia may range from irritation and lacrimation to severe injury and blindness. ADDITIONAL MEDICAL INFORMATION: Eye exposure may result in conjunctivitis, lacrimation and/or corneal irritation. Total corneal epithelial loss may occur.

Ingestion:
Toxic! May cause corrosion to the esophagus and stomach with perforation and peritonitis. Symptoms may include pain in the mouth, chest, and abdomen, with coughing, vomiting and collapse. Ingestion of as little as 3-4 ml of ammonium hydroxide may be fatal.

Note to the Physician: Pneumonitis should be anticipated after severe inhalation or ingestion. If severe exposure is suspected, observe for 48-72 hours for delayed pulmonary edema.

Carcinogenicity:

NTP:	Not Listed
IARC:	Not Listed
OSHA:	Not Regulated

Medical Conditions Aggravated by Exposure: Chronic respiratory or skin disease.

4. FIRST AID MEASURES

First Aid for Eyes: Immediately flush eyes with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, excessive tearing, or light sensitivity persists, the patient should be seen in a health care facility and referral to an ophthalmologist considered.

First Aid for Skin: Immediately flush exposed area with copious amounts of tepid water for at least 15 minutes followed by washing area thoroughly with soap and water. The patient should be seen in a health care facility if irritation or pain persists.

First Aid for Inhalation: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. If trained to do so administer supplemental oxygen with assisted ventilation as required. Administer artificial respiration if patient is not breathing.

First Aid for Ingestion: Call a physician. If conscious, give the patient 4 to 8 ounces of milk or water to drink immediately. Do not induce vomiting.

5. FIRE FIGHTING MEASURES

Flash Point:	Not Applicable
Lower Flammable Limit:	15.5 % Volume in Air (for NH3)
Upper Flammable Limit:	27.0 % Volume in Air (for NH3)
Autoignition Temperature	1204° F (651° C) (for NH3)

Extinguishing Media: Stopping the flow of gas rather than extinguishing the fire is usually the best procedure to follow when escaping gas is burning.

Small Fire:	Dry chemical or CO_2
Large Fire:	Water spray, fog or foam

Special Fire Fighting Procedures: Use water to keep fire exposed containers cool. Use water fog or foam to reduce vapor concentrations if necessary. Full protective equipment including a self-contained breathing apparatus should be worn in a fire involving the material.

6. ACCIDENTAL RELEASE MEASURES

Spill or Leak Measures: Stop leak if you can do so without risk. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Evaluate the affected area to determine whether to evacuate or shelter-in-place by taping windows and doors, shutting off outside air intake (attic fans, etc.), and placing a wet towel or cloth over the face (if needed). Self-contained breathing apparatus (SCBA) and structural firefighter's protective clothing used in conjunction with water spray will provide limited protection in outdoor releases for short-term exposure. Fully encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Use water spray to control vapors.

CAUTION:
Runoff from vapor control or dilution of spilled product may cause pollution.

Determining Spill Size: Generally, a small spill is one that involves a single, small Package (i.e. up to a 55 gallon drum), small cylinder, or a small (non-continuing) leak from a large container. **Small Spill:**

a. Flush area with flooding amounts of water.
b. First isolate 100 feet in all directions and then protect persons downwind 0.1 miles during daylight and 0.1 miles at night (recommended for ammonia vapor).

Large Spill:

a. Dike far ahead of liquid spill for later disposal.
b. Follow local emergency protocol for handling.
c. First isolate 200 feet in all directions, than protect persons downwind 0.4 miles during daylight and 1.4 miles at night (recommended for ammonia vapor).

7. HANDLING AND STORAGE

Handling: Avoid contact with either liquid or vapors. Direct contact with mercury must be avoided. Use proper PPE when working with or around aqua ammonia (See section 8).

Storage: Ambient temperature. Store in dry, well-ventilated area away from incompatible materials. Protect against physical damage. Keep out of direct sunlight and away from heat sources.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection Requirements: (for NH3)

<25 ppm:	No protection required.
25 to 35 ppm:	Protection required if the daily TWA is exceeded.
35 to 50 ppm:	Protection required if exposed for more than 15 minutes.
50 to 250 ppm:	Minimum of an air-purifying respirator equipped with ammonia canister(s) or cartridge(s).
250 to 300 ppm:	Minimum of a full-face air-purifying respirator equipped with ammonia canister(s) or cartridge(s).
>300 ppm:	A fresh air supply system must be used (i.e. SCBA)

Skin Protection Requirements: Nitrile rubber, neoprene, or PVC gloves and protective clothing should be used.

Eye Protection Requirements: Use chemical (indirectly vented) goggles when there is a potential for eye contact. A full-face shield is recommended in addition to goggles for added protection.

Other Protective Equipment: Safety shower and eyewash fountain should be provided in the aqua ammonia handling area. When transporting, provide at least 5 gallons of readily accessible, clean water and personal protective equipment.

Engineering Controls: Maintain adequate ventilation to keep ammonia concentrations below applicable standards.

NOTE: See Section 2 for regulatory exposure limits.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form:	Liquid
Color:	Colorless
Odor:	Strong pungent penetrating odor, ammonia.
pH:	12.0 (neat)
Specific Gravity:	0.9277 (@ 20° C)
Vapor Density:	0.60 (@ 15.5° C) for NH3
Vapor Pressure:	236 mm Hg (@ 15.5° C)
Molecular Weight:	35.05
Relative Density:	0.9261 kg/l (@ 20° C)

10. REACTIVITY

Stability:	This is a stable material.
Hazardous Polymerization:	Will not occur.

Decomposition: Will liberate ammonia if heated. Hydrogen is released on heating ammonia above 850° F (454° C). The decomposition temperature may be lowered to 575° F (300° C) by contact with certain metals such as nickel. At 1290° F (690° C) or in the presence of electric spark ammonia decomposes into nitrogen and hydrogen gases, which may form a flammable mixture in the air.

Conditions to avoid: Excessive heat.

Materials to avoid: Contact with calcium hypochlorite, bleaches, gold, mercury, and silver may form highly explosive products. Contact with iodine, bromine or chlorine may cause violent spattering.

11. TOXICOLOGICAL INFORMATION

Toxicity

Acute Oral Toxicity
LD_{50} Rat:.....350 mg/kg bw
LD_{50} Cat:.....750 mg/kg bw
Acute Toxicity, Other Routes
LD_{LO} Rabbit:.....10 mg/kg bw
Skin Irritation / Corrosion
Rabbit:.....Corrosive at 20% but not 10%
Eye Irritation / Corrosion
Rabbit:.....Irritating
Genetic Toxicity *in vitro*
Gene Mutation *E. Coli*:.....Negative
Genetic Toxicity *in vivo*
Gene Mutation *Drosophila melanogaster*:....No evidence for mutagenicity

Ecotoxicity

Acute Toxicity to Fish
LC_{50} *Cyprinus carpio*:.....1.34 – 1.70 mg un-ionized NH_3/L (48 hr semi-static)
Acute Toxicity to Aquatic Invertebrates
LC_{50} *Daphnia magna*:.....32 mg NH_4OH/L (48 hr static)
Chronic Toxicity to Fish
LC_{50} *Ictalurus punctatus*:.....37.5 ppm (8 days)

Source: TFI Product Testing Program April 2003

12. ECOLOGICAL INFORMATION

a. Ammonia is harmful to aquatic life in very low concentrations and may be hazardous if it enters water intakes.
b. Local health and wildlife authorities, as well as operators of water intakes in the vicinity, should be notified of water releases.
c. Waterfowl toxicity may occur at elevated concentrations.
d. Ammonia does not concentrate in the food chain.
e. The conversion of ammonia to nitrites/nitrates by bacteria in aquatic systems can reduce the concentration of dissolved oxygen (referred to as nitrogenous oxygen demand).

Effect on water treatment process: Chlorination will produce chloramines, which are more readily detected by taste and odor.

Note: See Ecotoxicity information in section 11.

13. DISPOSAL CONSIDERATIONS

Reclaim as fertilizer if possible. Otherwise, waste must be disposed of in accordance with federal, state, and local environmental control regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and Canadian TDG Act

Shipping Name:	Ammonia solutions, (*more than 10% but not more than 35 % ammonia*)
Hazard Class/Division:	8
Label Code:	8 Corrosive Liquid
Product Identification Number (PIN):	UN2672
Packing Group	III
OSHA Label Required:	Yes
RQ (Reportable Quantity):	1000 pounds (as NH_4OH)
TDG Reporting Quantity:	5 kg or 5 liters

15. REGULATORY INFORMATION

Controlled Products Regulations Classification:
D-1B: Toxic (Acute Lethality); E: Corrosive

OSHA: This product is considered a hazardous material under criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200 (Toxic; Corrosive).

CAA Chemical Accident Prevention:
Ammonia solution with a concentration less than 20% is not subject to the provisions of 40 CFR Part 68.

CERCLA Hazardous Substances List:

a. RQ (Reportable Quantity): 1000 pounds (as NH_4OH)
b. Regulation: "Designation, Reportable Quantities, Notification" - 40 CFR Part 302

SARA TITLE III:
Ammonia (including ammonia solution) is subject to the reporting requirements of Section 313 "Specific Toxic Chemical Listings" 40 CFR Part 372. Terra is required by 40 CFR Part 372.45 to notify certain customers as to which of its mixture or trade name products contain those chemicals. The purpose of that notification is to ensure that facilities that may be subject to the reporting requirements of Section 313 and that use products of unknown formulation will have knowledge that they are receiving products that contain chemicals subject to those reporting requirements.

16. OTHER INFORMATION

May 5, 2003:	This MSDS was written to comply with ANSI Standard Z400.1-1993.
July 1, 2003:	Added toxicity information from the TFI Product Testing Program April 2003.
October 4, 2006:	Added NFPA hazard classification information and updated isolation / protective action distances per ERG 2004.
February 16, 2007:	Created separate MSDS for 19% Aqua Ammonia.

The information and recommendations herein are taken from data contained in independent, industry-recognized references including but not limited to NIOSH, OSHA, ANSI, NFPA, DOT ERG, the TFI Product Testing Program, Global Engineering Documents, MEDITEXT, HAZARDTEXT, SARATEXT, CHRIS, OHM/TADS, and IRIS. Terra Industries Inc. makes no guarantee, warranty or other representation concerning this substance, since conditions of its use are beyond the control of the company. Terra Industries Inc. disclaims any liability for loss or damage incurred in connection with the use of this substance.