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June 22, 2017

Via Electronic Mail and Federal Express Delivery

Todd Anthony Bianco, EFSB Coordinator
RI Energy Facility Siting Board
89 Jefferson Boulevard
Warwick, RI 02888

Re: Invenergy Thermal Development LLC's Application to Construct and Operate the Clear River Energy Center in Burrillville, Rhode Island
Docket No.: SB-2015-16

Dear Mr. Bianco:

On behalf of Clear River Energy LLC and the Clear River Energy Center Project ("Invenergy"), enclosed please find an original and three (3) copies of Invenergy's Responses to the Rhode Island Department of Health's First Set of Data Requests.

Please let me know if you have any questions.

Very truly yours,

ALAN M. SHOER
ashoer@apslaw.com

Enclosures

cc: Service List

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

IN RE:	Application of Invenergy Thermal Development LLC's Proposal for Clear River Energy Center	Docket No. SB-2015-06

CLEAR RIVER ENERGY LLC's RESPONSES TO
THE RHODE ISLAND DEPARTMENT OF HEALTH'S FIRST SET OF DATA REQUESTS

REQUEST 1: The Clear River Energy Center (CREC) application included an analysis of projected increases in electric and magnetic field impacts associated with the addition of a third set of transmission lines. That analysis showed that the proposed new lines would not significantly increase the strength of the electric fields, but, under peak load conditions, would increase magnetic fields within 100 feet of the Right of Way.

- *Please supply an update to that analysis, which includes the magnitude and location of electric and magnetic field impacts associated with the most current proposed configuration.*

RESPONSE 1: An update to that analysis is included in an EMF Report, entitled "Clear River Energy Center Project – Exponent Project No. 1507086.000," dated December 28, 2016, prepared by Exponent, attached as **Exhibit A**.

RESPONDENT: William Baily, Exponent

DATE: June 22, 2017

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

IN RE: Application of Invenergy Thermal Development LLC's Proposal for Clear River Energy Center

Docket No. SB-2015-06

CLEAR RIVER ENERGY LLC's RESPONSES TO
THE RHODE ISLAND DEPARTMENT OF HEALTH'S FIRST SET OF DATA REQUESTS

REQUEST 2: The noise analysis submitted as part of the CREC application reported modeled noise impacts associated with construction and operation of the proposed facility at five neighboring locations.

- *Please provide an update of that analysis which shows the magnitude of the noise impact at each of those locations, as well as maximum offsite impacts.*

RESPONSE 2: A memorandum entitled "Supplemental Information Regarding Noise Questions Raised by RIDOH," prepared by Michael Hankard, dated June 21, 2017 is attached as **Exhibit B**. This memorandum provides an update of the analysis showing the magnitude of the noise impact at each of those locations, as well as maximum offsite impacts. Additionally, this memorandum addresses additional noise questions raised in the Rhode Island Department of Health's ("RIDOH") original advisory opinion, dated September 12, 2016.

RESPONDENT: Michael Hankard, Hankard Environmental

DATE: June 22, 2017

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
ENERGY FACILITY SITING BOARD

IN RE: Application of Invenergy Thermal Development LLC's Proposal for Clear River Energy Center

Docket No. SB-2015-06

CLEAR RIVER ENERGY LLC's RESPONSES TO
THE RHODE ISLAND DEPARTMENT OF HEALTH'S FIRST SET OF DATA REQUESTS

REQUEST 3: In the CREC application and subsequent documentation, the applicant stated that the facility will store 40,000 gallons of 19% aqueous ammonia and listed several measures that would be implemented to minimize the potential for and to mitigate the consequences of an accidental ammonia release, including a concrete containment area, passive controls to reduce surface area, and ammonia sensors. The applicant also provided documentation of inputs to a toxic-endpoint analysis using the ALOHA model.

- *Please provide information about any changes in the facility proposal that affect the amount or concentration of ammonia that will be stored, the number or location of storage tanks, delivery methods or the planned safety measures. In addition, if the ALOHA model has been run again, please supply RIDOH with the documentation of the inputs for that model run.*

- *Please also provide the information listed above concerning any changes to plans for delivery and storage of compressed hydrogen, fuel oil, and other hazardous or flammable substances at the facility.*

RESPONSE 3: For information regarding any changes in the facility proposal that may affect the ammonia analysis, please see a memorandum, entitled "Clear River Energy Center RIDOH EFSB Advisory Opinion Responses," prepared by ESS Group, Inc., dated April 20, 2017, attached as **Exhibit C**. (This memorandum also addresses additional environmental questions raised in the RIDOH's original advisory opinion, dated September 12, 2016.) Additionally, a revised ALOHA analysis, prepared by ESS Group, Inc., is attached as **Exhibit D**.

There has been only one change for the plans for the delivery and storage of compressed hydrogen, fuel oil and other hazardous or flammable substances at the facility. The fuel oil storage tank design has been modified from two one million gallon storage tanks to a single two million gallon tank and the tank location has changed which relocated the tank to an area closer to the Clear River Energy Center facility and further away from wetlands.

RESPONDENT: Michael Feinblatt, ESS Group, Inc.

DATE: June 22, 2017

CLEAR RIVER ENERGY LLC
By its Attorneys,

/s/ Alan M. Shoer
Alan M. Shoer, Esq. (#3248)
Richard R. Beretta, Jr. Esq. (#4313)
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Tel: 401-274-7200
Fax: 401-751-0604
Dated: June 22, 2017

CERTIFICATE OF SERVICE

I hereby certify that on June 22, 2017, I delivered a true copy of the foregoing responses to the Rhode Island Department of Health's 1st Set of Data Requests via electronic mail to the parties on the attached service list.

/s/ Alan M. Shoer

405180\003\863208.v2

SB-2015-06 Invenergy CREC Service List as of 06/19/2017

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File an original and 10 copies with EFSB: Todd Bianco, Coordinator Energy Facility Siting Board 89 Jefferson Boulevard Warwick, RI 02888 Margaret Curran, Chairperson Janet Coit, Board Member Assoc. Dir., Div. of Planning Parag Agrawal Patti Lucarelli Esq., Board Counsel Susan Forcier Esq., Counsel Rayna Maguire, Asst. to the Director DEM Catherine Pitassi, Asst. to. Assoc. Dir. Plann. Margaret Hogan, Sr. Legal Counsel	Todd.Bianco@puc.ri.gov; Kathleen.Mignanelli@puc.ri.gov; Patricia.lucarelli@puc.ri.gov; Margaret.Curran@puc.ri.gov; janet.coit@dem.ri.gov; Catherine.Pitassi@doa.ri.gov; Margaret.hogan@puc.ri.gov; susan.forcier@dem.ri.gov; rayna.maguire@dem.ri.gov; Parag.Agrawal@doa.ri.gov;	401-780-2106
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EXHIBIT A

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December 28, 2016

George Bacon
ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, MA 02451

Subject: Clear River Energy Center Report
Exponent Project No. 1507086.000

Dear Mr. Bacon:

At the request of ESS Group, Inc. (ESS), Exponent has evaluated the electric and magnetic field (EMF) levels associated with the operation of the Clear River Energy Center (CREC) transmission line. It is Exponent's understanding that the transmission line is to connect the CREC gas-fired combined-cycle electric generating facility proposed to be located in the Town of Burrillville, Rhode Island, within the property of an existing gas compressor, to National Grid's Sherman Road Substation.

To deliver the electricity generated by the CREC project to the nearby substation, a 0.8 mile 345-kV interconnection transmission line will be constructed on a new ROW between the switchyard within the CREC facility and the existing 345kV ROW owned by The Narragansett Electric Company (TNEC), located west of the CREC facility. This new ROW will be contained wholly within 67 acres of land area that will be purchased from the Spectra Energy Algonquin Compressor Station site (Spectra) and is a subset of a 730-acre Spectra-owned site that currently contains the Burrillville Compressor Station.

From the point of connection with the TNEC ROW to the Sherman Road Substation about 6 miles to the northeast, the new 345-kV 3052 transmission line will be constructed adjacent to two existing 345-kV National Grid transmission lines. The location of the new transmission interconnection of the 3052 Line (XS-1, green line), as well as the locations of the 3052 Line in existing cross sections XS-2 (orange line) and XS-3 (blue line) are shown in Figure 1.

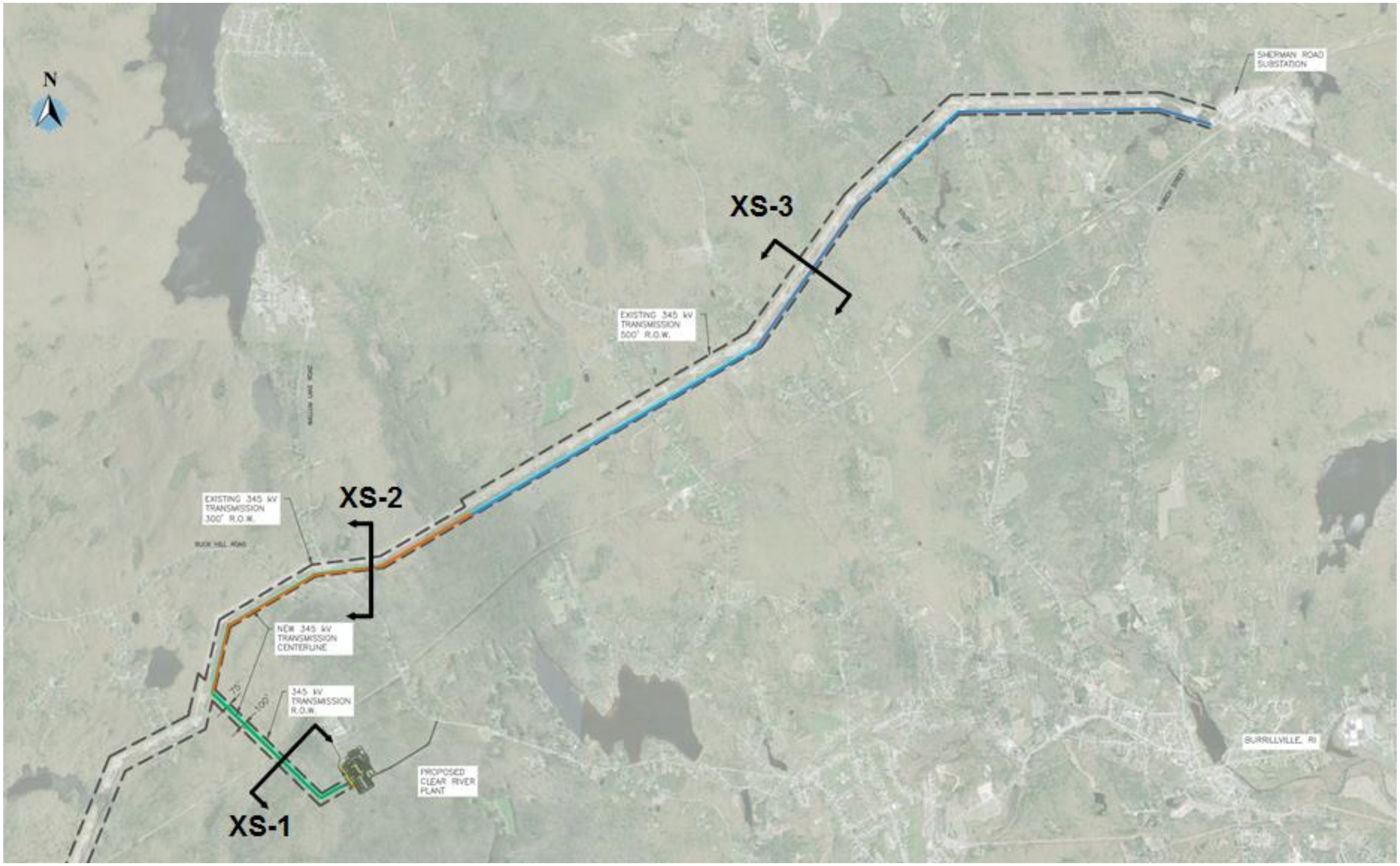

Figure 1. Map showing the location of the interconnection line from the CREC generating facility (XS-1) and sections of the proposed route of the 3052 line on the existing right-of-way (XS-2 and XS-3).

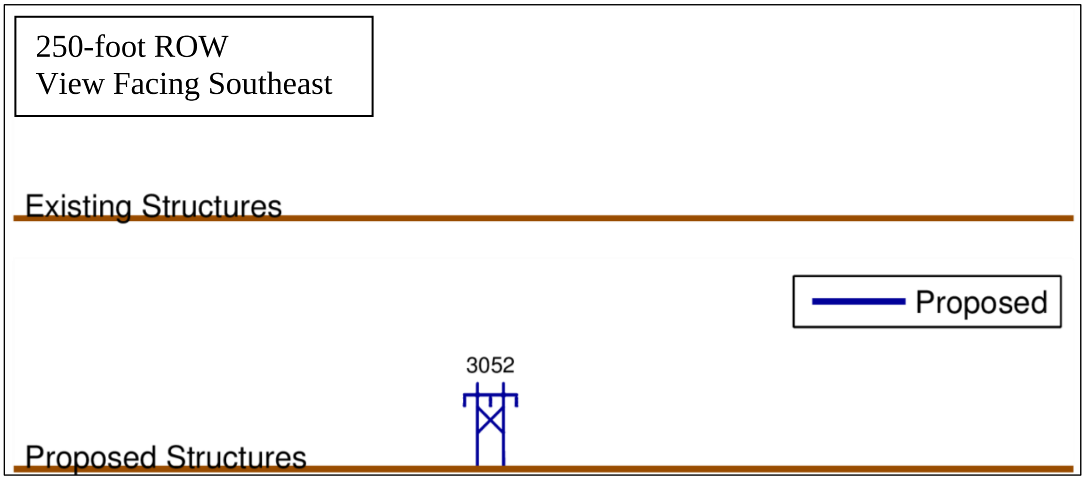

Figure 2. Configuration of the proposed Line in XS-1.

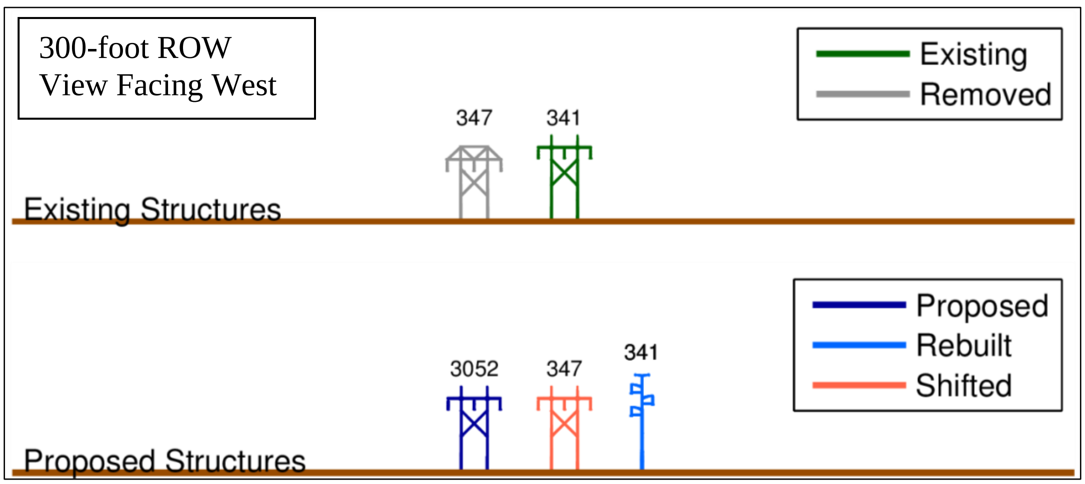

Figure 3. Configuration of the existing and proposed Lines in XS-2.

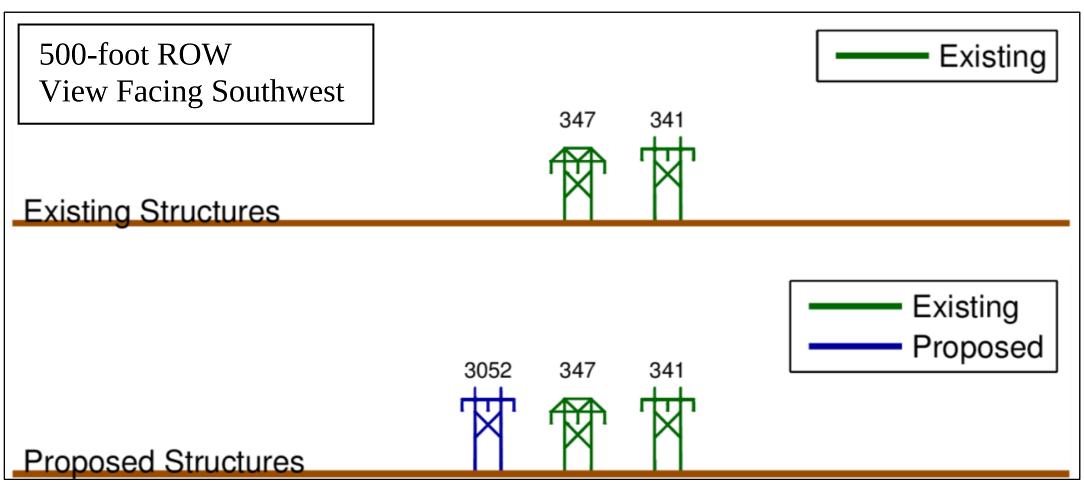

Figure 4. Configuration of existing and proposed Lines in XS-3.

In the first section (XS-1, approximately 0.8 miles long), the 3052 interconnection transmission line will be constructed on H-frame structures on a new 250-foot wide ROW, approximately 75 feet from the northern ROW edge, as shown in Figure 2. In the second section of the route (XS-2, approximately 1.6 miles long), the ROW is 300 feet wide and existing 341 Line will be rebuilt on a new set of vertical delta monopoles 73 feet west of the existing centerline and 57 feet from the west ROW edge. The existing 347 Line will be shifted west and will be installed on the existing (to be vacated) H-frame towers currently supporting the 341 Line. Finally, the 3052 Line will be constructed on a new set of H-frame structures, placed at the same centerline as the existing 347 Line as shown in Figure 3. In the third route section (XS-3, approximately 4.4 miles long) two existing 345-kV National Grid transmission lines (Lines 341 and 347) are situated on a 500-foot wide ROW. The 345-kV 3052 Line is proposed to be constructed on H-frame structures approximately 200 feet from the eastern ROW edge and 85 feet east of the existing centerline of the 347 Line as shown in Figure 4.

The following sections provide background information on EMF; a description of the methodology used to calculate EMF levels; and a discussion of the relevant guidelines and standards for EMF levels. Finally, the calculated EMF values are summarized and compared to relevant guidelines and standards.

Electric and Magnetic Fields

Transmission lines, distribution lines, household appliances and equipment in our homes, workplaces, and other locations (i.e., any source of electricity) produce both electric fields and magnetic fields. Most electricity in North America is transmitted as alternating current (AC) at a frequency of 60 Hertz (Hz), i.e., it changes direction and magnitude in a continuous cycle that repeats 60 times per second. The fields from these AC sources are commonly referred to as power-frequency or extremely low frequency (ELF) EMF.[1]

Electric Fields

Electric fields are created by the voltage on the conductors of transmission lines. The strength of project-related electric fields in this report is expressed in units of kilovolts per meter (kV/m), which is equal to 1,000 volts per meter (V/m). Virtually all objects are conductive—including fences, shrubbery, and buildings—and thus can block electric fields. In general, the intensity of an electric field diminishes with increasing distance from the source and in the case of transmission lines that decrease is typically in proportion to the square of the distance from the conductors, so the electric-field level decreases rapidly with distance. As the voltage increases, the electric-field level increases; and is independent of the current flow on the line.

[1] The EMF described in this report are quasi-static (non-propagating) fields, not to be confused with higher frequency electromagnetic fields (e.g., fields produced by mobile phones).

Magnetic Fields

Magnetic fields are created by current that flows in transmission line conductors. The strength of magnetic fields in this report is expressed as magnetic flux density in units of milligauss (mG), where 1 Gauss (G) = 1,000 mG. Magnetic fields are not blocked by conductive objects as are electric fields; however, similar to electric fields, the intensity of magnetic fields diminishes with increasing distance from the source. In the case of transmission lines, magnetic fields also generally decrease with distance from the conductors in proportion to the square of the distance.

Magnetic fields depend on the current flowing in transmission line conductor, whereas electric fields depend on the voltage on the conductors. Since the current flow varies depending upon the patterns of power demand on the bulk transmission system, the current, expressed in units of amperes (A), and the magnetic field it generates, also varies. As the demand for electricity varies on a given day, throughout a week, or over the course of months and even years the magnetic field varies. Therefore, current flow is often described as annual peak load (producing the highest magnetic-field level that might occur for a few hours or days during the year) and annual average load (a good prediction of the magnetic field on any randomly selected day of the year).

Transmission Line Loading

Modeling calculations are provided for both average and peak loading for both pre- and post-CREC configurations. According to ESS, the new 3052 Line will be among the most efficient gas-fired generation plants in New England and therefore is expected to be dispatched at near full capacity the majority of the time. The 3052 Line has therefore been modeled at full capacity (approximately 1046 Megavolt-amperes [MVA]) for both average and peak modeling cases.

Average loading for this report is defined as the loading level which is most likely to occur on the 347 and 341 Lines on a randomly-selected day of the year when the overall New England electrical transmission system is operating at a typical or average operating condition. The peak loading level represents the level of loading that will occur on the 347 and 341 Lines when the overall New England electrical transmission system is generating and using the peak amount of electricity such as on a hot summer day or an especially cold winter day. Due to the complex system dynamics of the New England transmission system the load carried by the existing 347 and 341 Lines is expected to be greater when the New England transmission system is at an average operating condition than when the New England transmission system is at a peak operating condition.

Both 347 and 341 Lines are included in the group of transmission lines that comprise the New England East-West Solution Interface which is one of the key interfaces in New England.[2] The 347 and 341 Lines are therefore different from many transmission lines in that they are as likely to be

[2] http://www.ct.gov/csc/lib/csc/pendingproceeds/docket_424/424_application/v5_ex4_interstate_csc_application-_component_updated_needs_assessment.pdf

carrying electricity from east to west as they are from west to east. Therefore, in order to characterize the magnetic field levels on the ROW, both lines are modeled for two separate cases: the "east-to-west transfer" case and the "west-to-east transfer" case. For each of these transfer cases, and for both pre-CREC and post-CREC configurations, National Grid provided Exponent with the loading levels expected for the 341 and 347 Lines for the New England electrical transmission system operating both at average and peak operating condition. The loading for all lines is shown in Table 1 for the pre-CREC configuration and Table 2 for the post-CREC configuration in which CREC is operating at full generating capacity and the New England electrical transmission system operating under an average and a peak operating conditions.[3]

Table 1. Pre-CREC transmission line loadings.

		East-to-West Transfer				West-to-East Transfer			
		Average		Peak		Average		Peak	
Line	Voltage	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR
347	345	597.3	-74.3	368.7	-64	-343.4	-8.2	-274	-15.1
341	345	306.8	-25	77.5	-40.7	-399.4	20.6	-389.6	5.4

Table 2. Post-CREC transmission line loadings.

		East-to-West Transfer				West-to-East Transfer			
		Average		Peak		Average		Peak	
Line	Voltage	MW	MVAR	MW	MVAR	MW	MVAR	MW	MVAR
347	345	742.6	-69.7	553.1	-64.4	-202.6	-23.1	-151.9	-27.3
341	345	236.5	-19.7	54.7	-30.8	-449.9	19.8	-424.8	5.1
3052	345	-1024.1	213.5	-1024.1	213.5	-1024.1	213.5	-1024.1	213.5

* The 3052 Line was modeled at 1046 MVA for both average and peak loading cases.

Table 1 and Table 2 indicate that the loadings of both the 347 and 341 Lines are expected to be greater during periods when the New England electrical transmission system is operating at an average operating condition than when the New England electrical transmission system is operating at a peak operating condition. This is because the loadings on the 347 and 341 Lines are strongly influenced by the amount of excess power available to be transferred from west-to-east or east-to-west within the New England electrical transmission system. When the New England electrical grid is operating under a peak operating condition, the majority of power generated is used locally and there is less excess power available for transfer on the East-West Interface, than when the New England electrical transmission system is operating at a typical or average operating condition.

[3] Average loading levels were calculated from ISO 2019 90/10 Shoulder Peak loading levels by National Grid for a transfer of 2600 MW for east-to-west transfer and 1600 MW for west-to-east transfer. Peak loading levels were calculated from ISO 2019 90/10 Summer Peak loading levels for a transfer of 1750 MW for east-to-west transfer and 1100 MW for west-to-east transfer.

Therefore, the power carried by the existing 347 and 341 transmission Lines expected to be lower during periods when the New England electrical transmission system is operating under a peak operating condition than it is during average operating condition.

Phase optimization

Where two or more transmission lines share a ROW, the level of EMF will depend on the specific arrangement of the conductors of each circuit. In many circumstances the field levels at the ROW edge (or elsewhere) can be minimized by a careful selection of these phases in a phase-optimization analysis.[4] In the present case, XS-1 contains only a single circuit, so choice of phasing has no effect on the calculated magnetic fields for that cross section and the choice of optimal phasing depends only on analysis of XS-2 and XS-3. Following analysis of the calculated magnetic-field levels in XS-2 and XS-3 at the edges of each ROW for average loading, considering both the east-to-west and west-to-east transfer cases, the optimal phasing for the 3052 Line was determined to be A-B-C (from south to north). This phasing minimizes the maximum magnetic-field level at ROW edge for the east-to-west transfer case, and results in a magnetic-field level at ROW edge that is within 3 mG of the minimum possible value for the west-to-east transfer case.[5] This A-B-C phasing (from south to north) was applied when computing the EMF levels for all post-CREC calculations.

Methodology

To characterize the potential effect of the proposed operation of the new 3052 Line on the existing EMF levels, Exponent modeled the levels of these parameters under pre-CREC and post-CREC configurations. EMF levels associated with line operations under various projected loading cases discussed above were calculated using computer algorithms developed by the Bonneville Power Administration, an agency of the U.S. Department of Energy, which have been shown to accurately predict field levels near transmission lines.[6] The inputs to the program for the existing and proposed transmission lines were provided by National Grid, and include the voltage, current flow, phasing, and conductor geometries of the lines, as well as their configurations and locations.

Based on these data, Exponent calculated magnetic-field levels at 1 meter (3.28 feet) above ground as the root-mean-square value of the field at each location along a transect perpendicular to the

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[4] Phase optimization is one of the ways to minimize EMF levels consistent with recommendations to apply low cost measures to minimize magnetic fields (see e.g., World Health Organization. Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. Geneva, Switzerland: World Health Organization, 2007).

[5] For XS-2 and XS-3, for the selected optimal phasing, the highest edge of ROW magnetic field level is calculated to occur on the southern ROW edge in XS-2 for the west-to-east transfer case. Relative to the selected optimal phasing, a phasing of B-A-C from south to north would reduce the magnetic field level on the southern ROW edge in XS-2 by approximately 3 mG for the west-to-east transfer case, but would increase the magnetic field level at this ROW edge by approximately 9 mG for the east-to-west transfer case.

[6] Bonneville Power Administration (BPA). Corona and Field Effects Computer Program. Portland, OR: Bonneville Power Administration, 1991.

ROW in accordance with IEEE Std. C95.3.1-2010 and IEEE Std. 644-1994.[7] All transmission and distribution line voltages were assumed to be in phase; both electric fields and magnetic fields were calculated as the resultant of x, y, and z field vectors; EMF levels were calculated along profiles perpendicular to lines at the mid-span point of lowest conductor sag (i.e., closest to the ground); and the conductors were assumed to be located on flat terrain and at maximum sag for the entire distance between structures.

For electric fields, the same line configurations used to calculate magnetic fields were included in the models and a 5% overvoltage condition was assumed for all lines to ensure that the calculated values represent the maximum expected electric field for each of the route sections analyzed.

Standards and Guidelines

Neither the federal government nor the state of Rhode Island has enacted standards for EMF from transmission lines or other sources.

Some other states have statutes or guidelines that apply to fields produced by new transmission lines, but these are not health-based guidelines. New York and Florida, for example, have limits on EMF that were designed to limit fields from new transmission lines to levels produced by existing transmission lines (i.e., to maintain the *status quo*).[8]

More relevant than the various state-enacted guidelines are exposure limits recommended by scientific organizations that were developed to protect health and safety based on scientific reviews and risk assessments. 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 would not be exposed.

The International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have developed standards and guidelines to assess levels of EMF acceptable for safe public exposure. The EMF Reference Levels set by these

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7 Institute of Electrical and Electronics Engineers (IEEE). IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines (ANSI/IEEE Std. 644-1994, R2008). New York: IEEE, 1994; Institute of Electrical and Electronics Engineers (IEEE). IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic, and Electromagnetic Fields with Respect to Human Exposure to Such Fields, 0 Hz to 100 kHz (IEEE Std. C95.3.1-2010). New York: IEEE, 2010.

8 Florida Department of Environmental Regulation (FDER). Electric and Magnetic Fields. Chapter 17-274: FDER, 1989; Florida Department of Environmental Protection (FDEP). Electric and Magnetic Fields. Chapter 62-814: FDEP, 1996; New York Public Service Commission (NYPSC). Opinion No. 78-13. Opinion and Order Determining Health and Safety Issues, Imposing Operating Conditions, and Authorizing, in Case 26529, Operation Pursuant to those Conditions: NYPSC, 1978; New York Public Service Commission (NYPSC). Statement of Interim Policy on Magnetic Fields of Major Transmission Facilities. Cases 26529 and 26559 Proceeding on Motion of the Commission: NYPSC, 1990.

organizations at a frequency of 60 Hz to ensure compliance with Basic Restrictions are summarized in Table 3 below.[9]

Table 3. Reference Levels for whole body exposure to 60-Hz fields: general public.

Organization	Magnetic Fields	Electric Fields
ICNIRP	2,000 mG	4.2 kV/m
ICES	9,040 mG	5 kV/m 10 kV/m*

* This is an exception within transmission line ROWs because people do not spend a substantial amount of time in ROWs, [9]

Results

Magnetic Fields

Calculations at various locations on and beyond the ROW are summarized in Table 4 and Table 5 for all modeled sections. Graphical results of magnetic field calculations are shown in Figure 5 through Figure 7. As expected, the addition of the heavily-loaded 3052 Line to the ROW increases the maximum magnetic-field level on the ROW as well as at the ROW edges. The edge of ROW magnetic-field level in XS-3 where the ROW is very wide, however, remains 12 mG or less under average loading cases. The maximum magnetic-field level under average loading on the XS-2 ROW is similar to that of XS-3, but the narrower ROW width in XS-2 results in higher magnetic-field levels near the ROW edge, primarily on the southern side of the ROW (69 mG) when the 3052 Line is operating. Similarly, in XS-1, the shorter distance from the structures to the ROW edge results in a higher magnetic field level (84 mG) at one ROW edge. It is important to note, however, that even operating CREC at 1046 MVA the magnetic-field levels are all well below the Reference Levels recommended by ICES and ICNIRP.

9 International Committee on Electromagnetic Safety (ICES). IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields 0 to 3 kHz. Piscataway, NJ: IEEE, 2002, reaffirmed 2007; International Commission on Non-ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Phys 99: 818-836, 2010.

Table 4. Magnetic-field levels (mG) calculated at full capacity of the 3052 Line and average loading of the 341 and 347 Lines for both west-to-east and east-to-west Transfer cases.

Section	Condition	Loading Case	Distance from Centerline of ROW				
			- ROW Edge -100 ft.	- ROW Edge	Max on ROW	+ ROW Edge	+ ROW Edge +100 ft.
XS-1	Pre-CREC	East-to-West	N/A	N/A	N/A	N/A	N/A
		West-to-East	N/A	N/A	N/A	N/A	N/A
	Post-CREC	East-to-West	17	84	329	17	6.8
		West-to-East	17	84	329	17	6.8
XS-2	Pre-CREC	East-to-West	6.6	34	204	3.3	0.5
		West-to-East	2.4	17	146	8.0	2.0
	Post-CREC	East-to-West	10	57	372	11	2.2
		West-to-East	16	69	320	22	5.1
XS-3	Pre-CREC	East-to-West	1.3	2.5	204	3.3	0.5
		West-to-East	0.3	0.7	146	8.0	2.0
	Post-CREC	East-to-West	3.8	9.2	369	4.5	1.7
		West-to-East	5.4	12	326	6.2	0.9

Table 5. Magnetic-field levels (mG) calculated at full capacity of the 3052 Line and peak loading of the 341 and 347 Lines for both east-to-west and west-to-east Transfer cases.

Section	Condition	Loading Case	Distance from Centerline of ROW				
			- ROW Edge -100 ft.	- ROW Edge	Max on ROW	+ ROW Edge	+ ROW Edge +100 ft.
XS-1	Pre-CREC	East-to-West	N/A	N/A	N/A	N/A	N/A
		West-to-East	N/A	N/A	N/A	N/A	N/A
	Post-CREC	East-to-West	17	84	329	17	6.8
		West-to-East	17	84	329	17	6.8
XS-2	Pre-CREC	East-to-West	4.8	23	121	1.7	1.1
		West-to-East	1.5	12	138	8.4	2.3
	Post-CREC	East-to-West	11	59	360	4.2	0.9
		West-to-East	15	68	322	21	4.9
XS-3	Pre-CREC	East-to-West	1.1	2.0	121	1.7	1.1
		West-to-East	0.1	0.4	138	8.4	2.3
	Post-CREC	East-to-West	4.0	9.7	359	1.7	1.1
		West-to-East	5.3	12	328	6.0	1.0

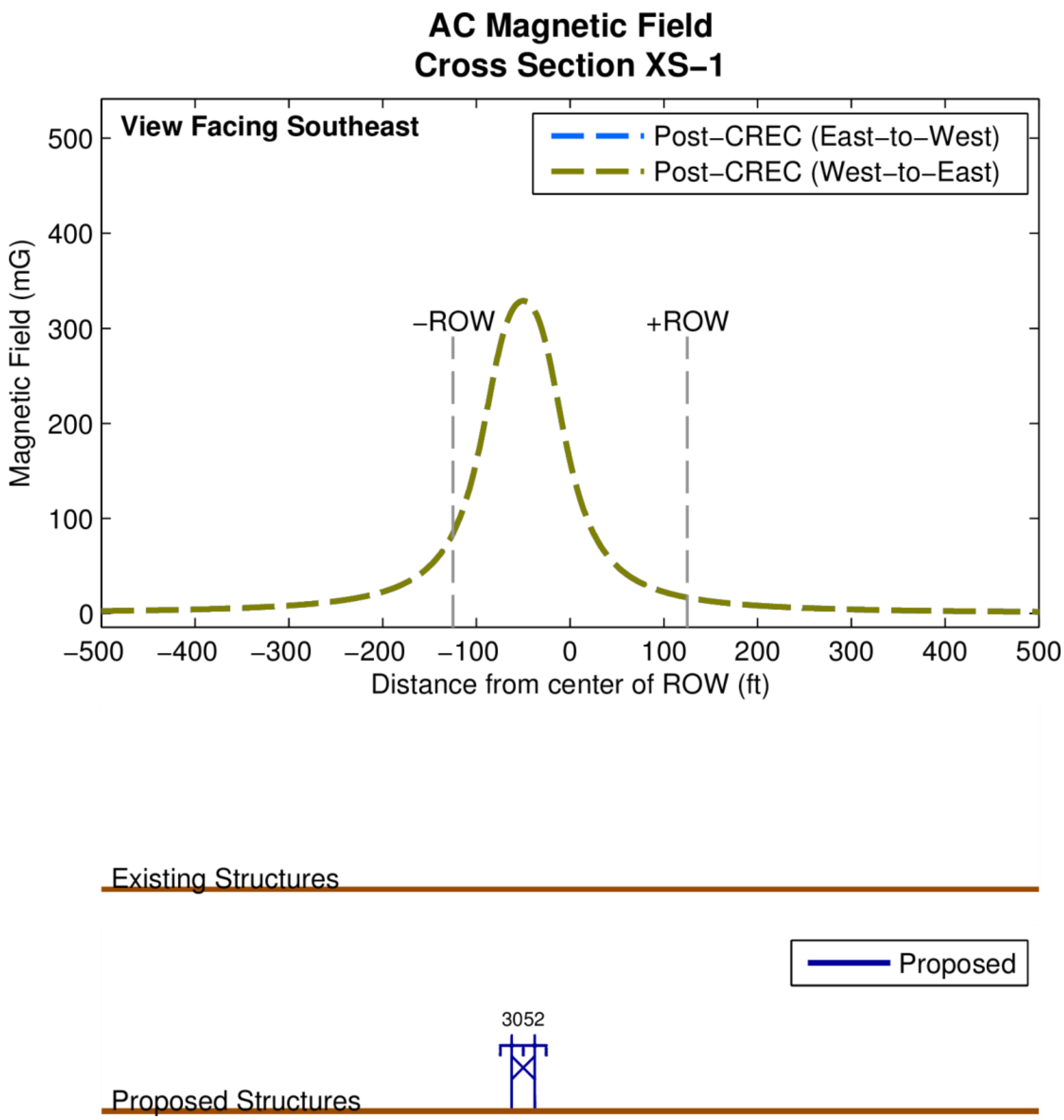


Figure 5. Calculated magnetic-field level at average loading for proposed conditions in XS-1. Note that the east-to-west or west-to-east transfer case will not affect the modeled levels of the magnetic field from the 3052 on the CREC ROW

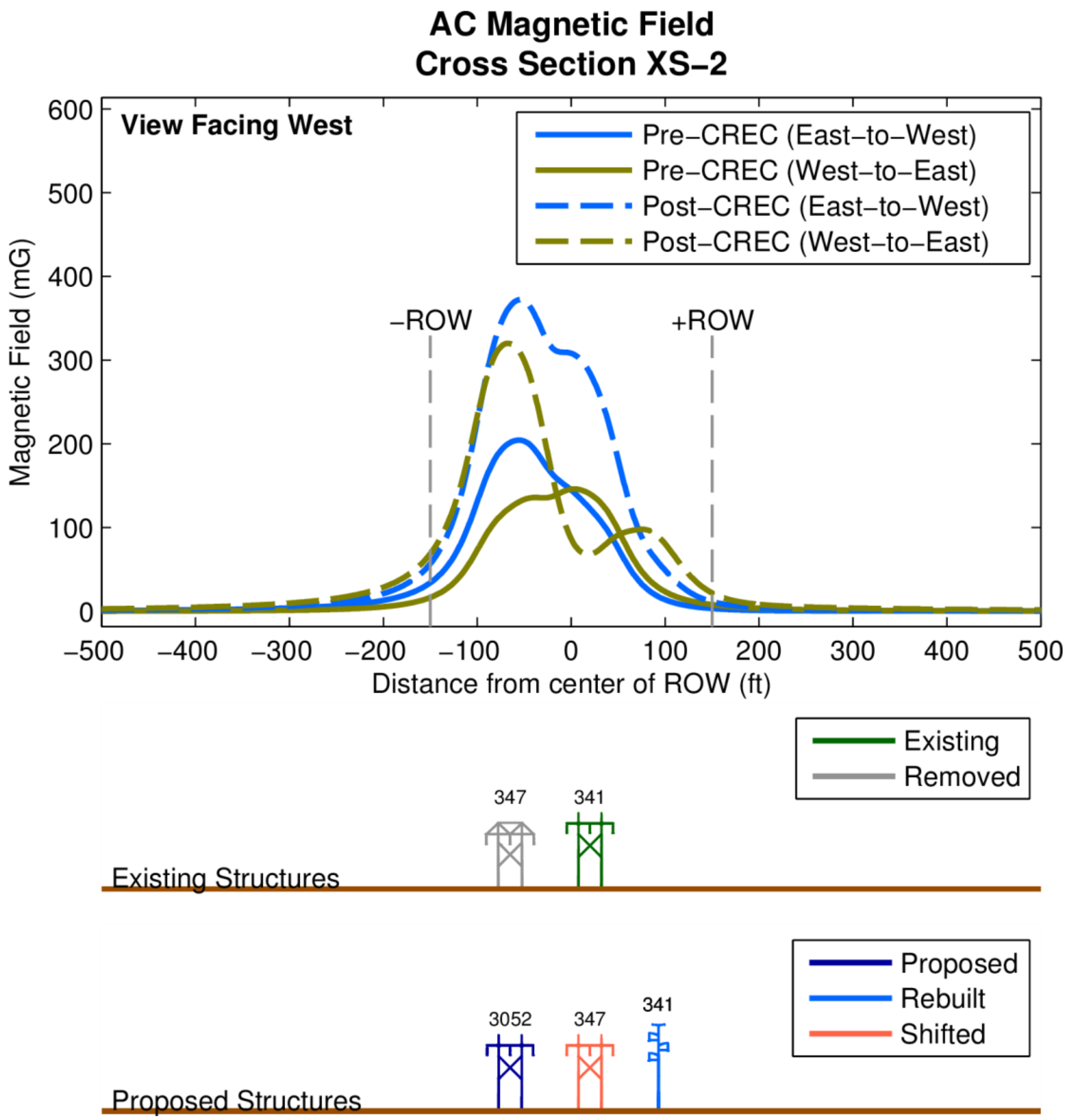


Figure 6. Calculated magnetic-field level at average loading for both pre-CREC and post-CREC conditions and both east-to-west and west-to-east transfer cases in XS-2.

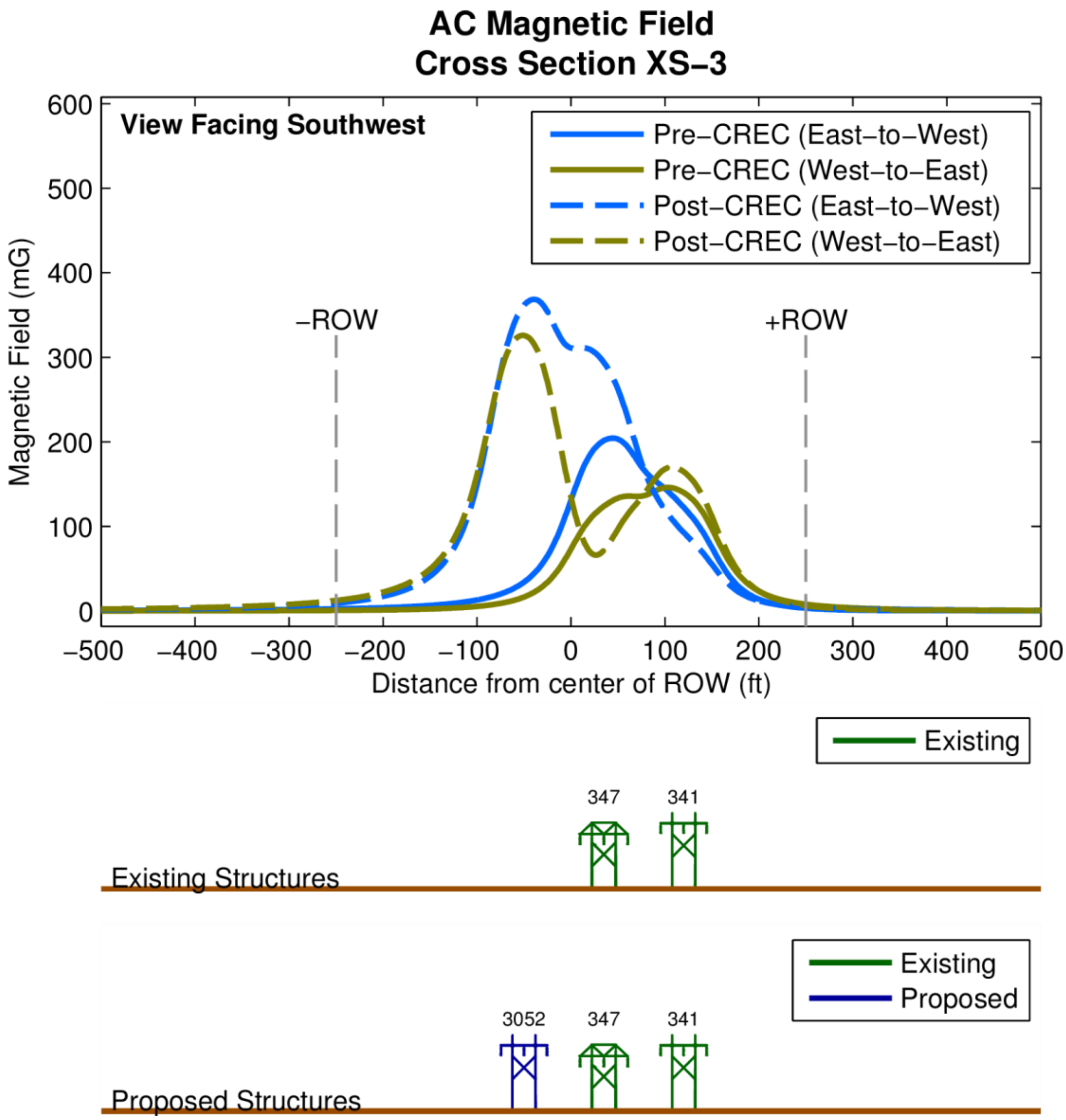


Figure 7. Calculated magnetic-field level at average loading for both pre-CREC and post-CREC conditions and both east-to-west and west-to-east transfer cases in XS-3.

Electric Fields

Calculations of the electric field at various locations on and beyond the ROW are summarized in Table 6 for all modeled sections. Graphical results of electric-field calculations for the three sections are shown in Figure 8 to Figure 10. As can be seen in Table 6, both the maximum electric-field level on the TNEC ROW as well as the edge of ROW electric-field level stays largely unchanged as a result of this project. The exception to this is the increase in the electric-field level on the western ROW edge in XS-2 where the 341 Line is rebuilt closer to the ROW edge and the field level is calculated to be 1.3 kV/m). Similarly, in XS-1, the shorter distance from the structures to the ROW edge results in a higher electric field level (1.7 kV/m) at one ROW edge. At the edge of the ROW, all electric field levels are well below the Reference Levels recommended by ICES and ICNIRP.[10]

Table 6. Electric field levels (kV/m) with all lines operating at maximum voltage.

		Distance from Centerline of ROW				
Section	**Condition**	**- ROW Edge -100 ft.**	**-ROW Edge**	**Max on ROW**	**+ROW Edge**	**+ROW Edge +100 ft.**
XS-1	Pre-CREC	N/A	N/A	N/A	N/A	N/A
	Post-CREC	0.2	1.7	5.0	0.2	<0.1
XS-2	Pre-CREC	0.1	1.2	7.5	0.4	0.1
	Post-CREC	0.2	1.3	5.2	1.3	0.2
XS-3	Pre-CREC	<0.1	<0.1	7.5	0.4	0.1
	Post-CREC	<0.1	0.1	7.6	0.4	0.1

10 The maximum electric-field level on the ROW is higher than the specified Reference Level for ICNIRP, but is lower than or relatively unchanged from existing conditions. Additionally, with further analysis these field levels are clearly below the ICNIRP Basic Restriction levels in tissue (the actual exposure limits) calculated by methods such as described by Kavet et al., in: “The relationship between anatomically correct electric and magnetic field dosimetry and published electric and magnetic field exposure limits.” Radiate Prot Dosimetry 152: 279-295, 2012.

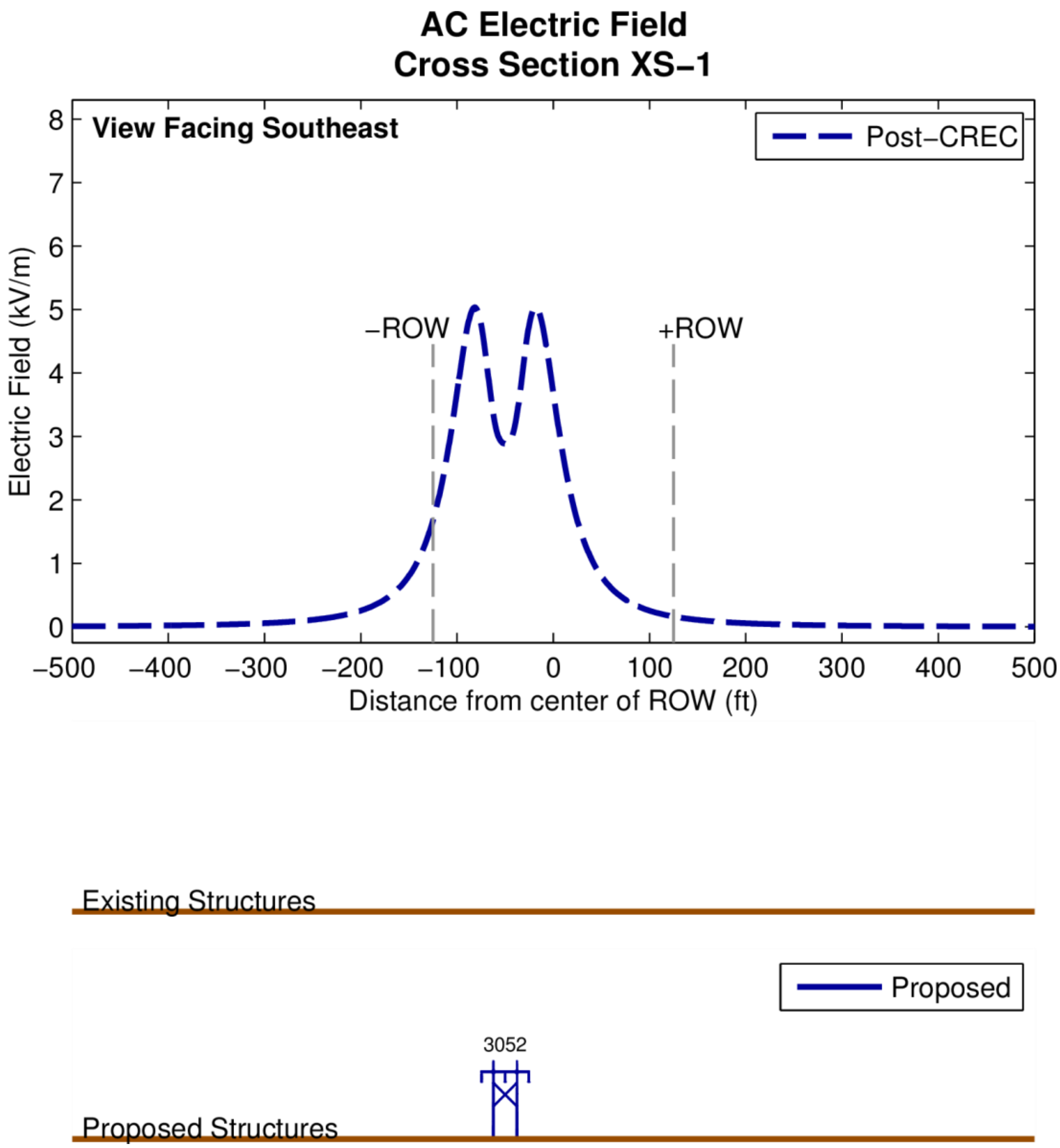


Figure 8. Calculated electric-field level for post-CREC conditions in XS-1.

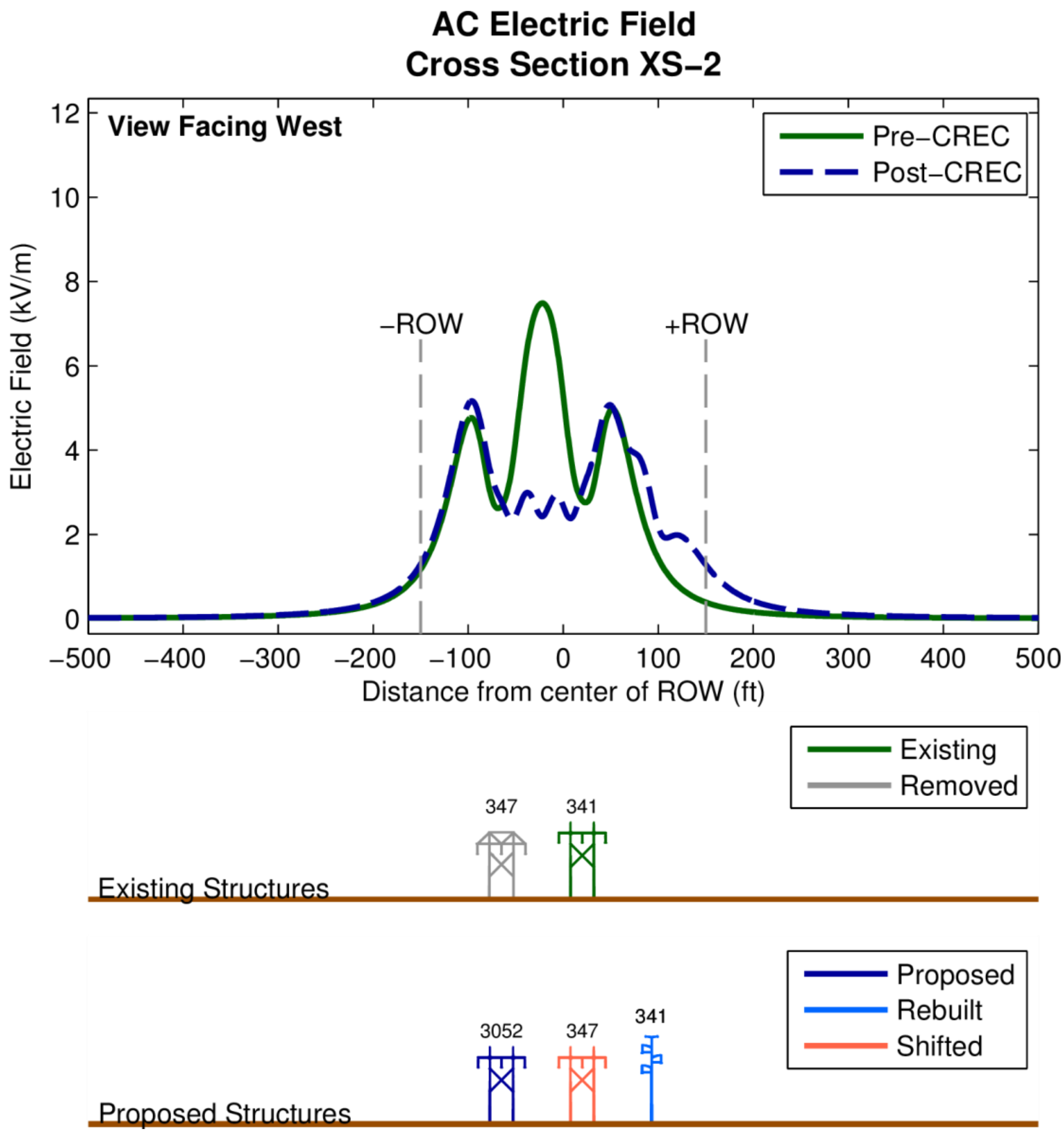


Figure 9. Calculated electric-field level for both pre- and post-CREC conditions in XS-2.

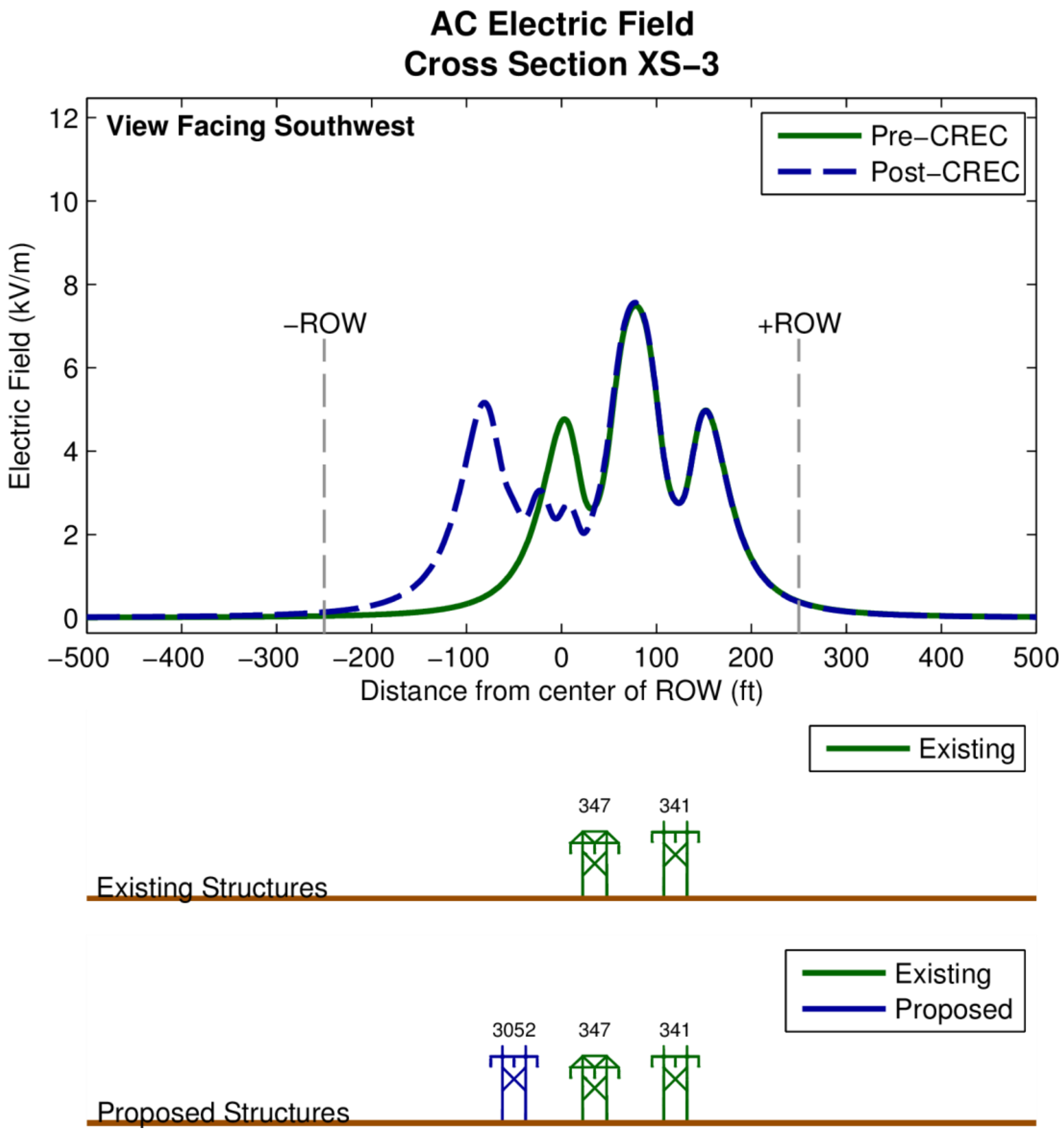


Figure 10. Calculated electric-field level for both pre- and post-CREC conditions in XS-3.

Conclusions

The new CREC is planned to be among the most efficient gas-fired generation plants in New England and for this reason is expected to operate near full capacity the majority of the time. Therefore, the loading on the 3052 Line, and hence magnetic-field levels in all sections, were calculated to increase when the two existing transmission lines are operating at average or peak loading (for either east-to-west or west-to-east transfer cases). On the existing TNEC ROW, the new 3052 Line will be near to the center of the ROW and the selection of optimal phasing for minimizing magnetic-field levels at the ROW edges serves to limit this increase. The new 3052 Line is not calculated to significantly increase the electric-field level at the ROW edge in XS-3 because of the very wide ROW in that section. In XS-2, however, the rebuilding of the 341 Line nearer the west ROW edge is expected to increase electric-field levels somewhat. On the new CREC ROW, EMF levels are similar to those in XS-2 and XS-3, but levels at the northern ROW edge are somewhat higher due to the placement of the new line approximately 75 feet from the northern ROW edge. However, this interconnection will be constructed entirely on private property with no permanent public access. The closest residences are more than 1,000 feet from the proposed transmission line interconnection, and no increase in EMF levels off site is anticipated.

Magnetic-field levels are all calculated to be well below Reference Levels recommended by ICES and ICNIRP. At the ROW edge and beyond where people are more likely to spend significant time, electric-field levels are also well below ICES and ICNIRP Reference Levels. On the ROW, particularly beneath both the existing and proposed transmission lines, the electric-field level is calculated to be higher than the ICNIRP Reference Level but with further analysis is shown to be well below ICNIRP Basic Restriction levels using methods like that described by Kavet et al.[11]

[11] Kavet R, Dovan T, Reilly JP. The relationship between anatomically correct electric and magnetic field dosimetry and published electric and magnetic field exposure limits. Radiat Prot Dosimetry 152: 279-295, 2012.

Limitations

At the request of ESS, Exponent modeled the levels of EMF associated with the proposed 3052 Line. This report summarizes work performed to date and presents the findings resulting from that work. In the analysis, we have relied on geometry, material data, usage conditions, specifications, and various other types of information provided by the client. ESS has confirmed to Exponent that the data provided to Exponent are not subject to Critical Energy Infrastructure Information restrictions. We cannot verify the correctness of this input data, and rely on ESS for the data's accuracy. Although Exponent has exercised usual and customary care in the conduct of this analysis, the responsibility for the design and operation of the project remains fully with the client.

The findings presented herein are made to a reasonable degree of engineering and scientific certainty. Exponent reserves the right to supplement this report and to expand or modify opinions based on review of additional material as it becomes available, through any additional work, or review of additional work performed by others.

The scope of services performed during this investigation may not adequately address the needs of other users of this report for purposes unrelated to project permitting, and any re-use of this report or its findings, conclusions, or recommendations presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied.

If you have any questions or require additional information, please do not hesitate to contact me at 301-291-2519 or bcotts@exponent.com.

Sincerely,

Benjamin Cotts, Ph.D.
Managing Engineer

EXHIBIT B

CREC NOISE: SUPPLEMENTAL INFORMATION FOR RIDOH

TO:	John Niland – *Invenergy*	DATE:	June 21, 2017
FROM:	Mike Hankard – *Hankard Environmental*	PROJECT:	Clear River Energy Center
SUBJECT:	Supplemental Information Regarding Noise Questions Raised by RIDOH		

The following provides supplemental information regarding questions raised by the Rhode Island Department of Health (RIDOH) concerning noise emissions from the proposed Clear River Energy Center (CREC). The questions listed below were raised by RIDOH as part of the Energy Facilities Siting Board (EFSB) process, including the Department's Advisory Opinion dated 9/12/2016 and recent data request dated June 8, 2017. Some of the response information provided below was submitted previously to the EFSB, and some of the information is new or revised.

RIDOH Opinion: "As shown in Table 2, the existing nighttime noise levels measured at all receptors except for M3, as reported in the CREC application, were above the 40 dBA LOAEL. Note that those levels were short-terms measurements and may not accurately represent average nighttime levels measured over a longer period." (Page 10) and "RIDOH does not have sufficient information to support or refute [the assertion that CREC would comply with the WHO standard]." (Page 10, Footnote 9)

CREC Response: A 2009 World Health Organization study of noise in Europe did find 40 dBA as the lowest noise level where any human health effect was noticed in their review of numerous studies. This level is defined as the annual average of each day's 8-hour nighttime average. The maximum noise level expected from the CREC, based on the most recent (February 2017) design of the facility, is 42 dBA. But this is not an annual average. This represents the very loudest condition expected to occur, and assumes, conservatively, that (1) the facility is either starting up or running at full baseload operation 100% of the time, (2) atmospheric conditions are conducive to sound propagation at all times, and (3) and all residences are always downwind of the CREC.

With regard to the operation of the CREC, there will be many nights over the course of the year when the facility will remain at idle from approximately 10:00 p.m. to 4:00 a.m., then go through 30 minutes of start-up, and then operate at full baseload for the remainder of the night (6:00 a.m.) There could also be nights of full baseload operation for 8 hours. If one makes the assumption that 50% of the time the facility will operate at baseload all night, and 50% of the time the facility will be off until 4:00 a.m. and at baseload the remainder of the night (and assumes that ambient noise levels will be approximately 35 dBA when the facility is off), the CREC annual average noise level would be less than 40 dBA.

Regarding atmospheric conditions, some nights will consist of rather calm, stable atmospheric conditions. On these nights, noise travels well, and this is what the predicted noise levels represent. On other nights, the atmosphere will be unstable and noise from the CREC will be barely audible or not audible at all. Most important is wind direction, and the predictions assume that all residences are downwind of the facility. Again, if one makes the conservative assumption that good atmospheric conditions or downwind conditions will occur 50% of the nights, and that on nights of poor propagation conditions the ambient noise level is 35 dBA, the annual average noise level would be less than 40 dBA.

Finally, these conditions have to occur together. On those nights when the CREC is operating 100% of the time, some nights will not have favorable propagation conditions. Thus, CREC noise emissions are expected to be below the WHO guideline when assessed on an annual average basis.

RIDOH Opinion: "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." (Page 10)

CREC Response: In April 2015 the Algonquin Gas Compressor Station was operating in its pre-additional turbine condition. This is when the CREC project conducted ambient noise measurements in the Project area. The results of these measurements are described in the Project's October 2015 noise level evaluation report. As described therein, the measured ambient noise levels were compared to predicted CREC noise levels, including the calculation of total noise levels and noise level differences. Therefore, noise from the pre-modified Algonquin Station was considered in the noise survey, and in the analysis of CREC noise impacts. With regard to the approved additional turbine at the Algonquin Station, the report from Algonquin's acoustical consultant states that noise from the station with the proposed modifications will be no louder than the existing station (Hoover and Keith Report 2976, February 2014). Thus, noise from the modified Algonquin Station was effectively taken into account in both the ambient noise measurements and the analysis of CREC noise impacts.

RIDOH Opinion: "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 [Algonquin] turbine." (Page 10)

CREC Response: Noise levels from the existing Algonquin gas compressor station were measured by that facility's acoustical consultant (Hoover and Keith Report 2976, February 2014). The measured noise level at a distance of approximately 2,000 feet was 50 dBA. This is an equivalent level (L_{eq}), not a weighted 24-hour level (L_{dn}), and was measured with the compressor station operating near full load. This would also be the noise level of the modified Algonquin Station, given that this same report concluded that the modified station would be no louder than the existing station. If one assumes the Algonquin Station operates 24 hours per day the way it did during the measurements, then the average daytime and nighttime levels would each be 50 dBA. Again, these are noise levels at the residence nearest the station (2,000 feet). Noise levels at more distant locations would be lower.

RIDOH Opinion: "RIDOH stands behind its statement that the CREC noise analysis did not consider the increased noise levels associated with the Algonquin equipment that has already been permitted and installed but was not operational at the time that the CREC noise study took place. That upgrade did not replace existing equipment and thus will be associated with additional noise producing equipment. Since permits for future Algonquin upgrades have not yet been filed or reviewed, it is not possible to evaluate the effects that such additional future upgrades would have on noise levels in the area."

CREC Response: As noted above, the report from Algonquin's acoustical consultant's analysis of noise from the proposed station modifications shows that the new station would be no louder than the existing one (Hoover and Keith Report 2976, February 2014).

RIDOH Data Request: The noise analysis submitted as part of the CREC application reported modeled noise impacts associated with construction and operation of the proposed facility at five neighboring locations. Please provide an update of that analysis which shows the magnitude of the noise impact at each of those locations, as well as maximum offsite impacts.

CREC Response: The noise level analysis of both baseload and start-up operations has been updated to reflect the most current design of the CREC (February 2017). The results of this analysis are shown as noise level contours in the figures below. The results at each of the five analysis points are listed in the table below. These levels are approximately 1 dBA lower than those reported in the CREC permit application for baseload operations, due to additional noise mitigation measures being added to the design of the CREC since the application. Refer to the Noise Level Evaluation Report (October 2015) for more information on noise modeling methodology, analysis locations, and input data.

Location	Baseload Operation (dBA)	Start-Up Operation (dBA)
M1	41	42
M2	39	40
M3	38	40
M4	38	40
M5	32	34

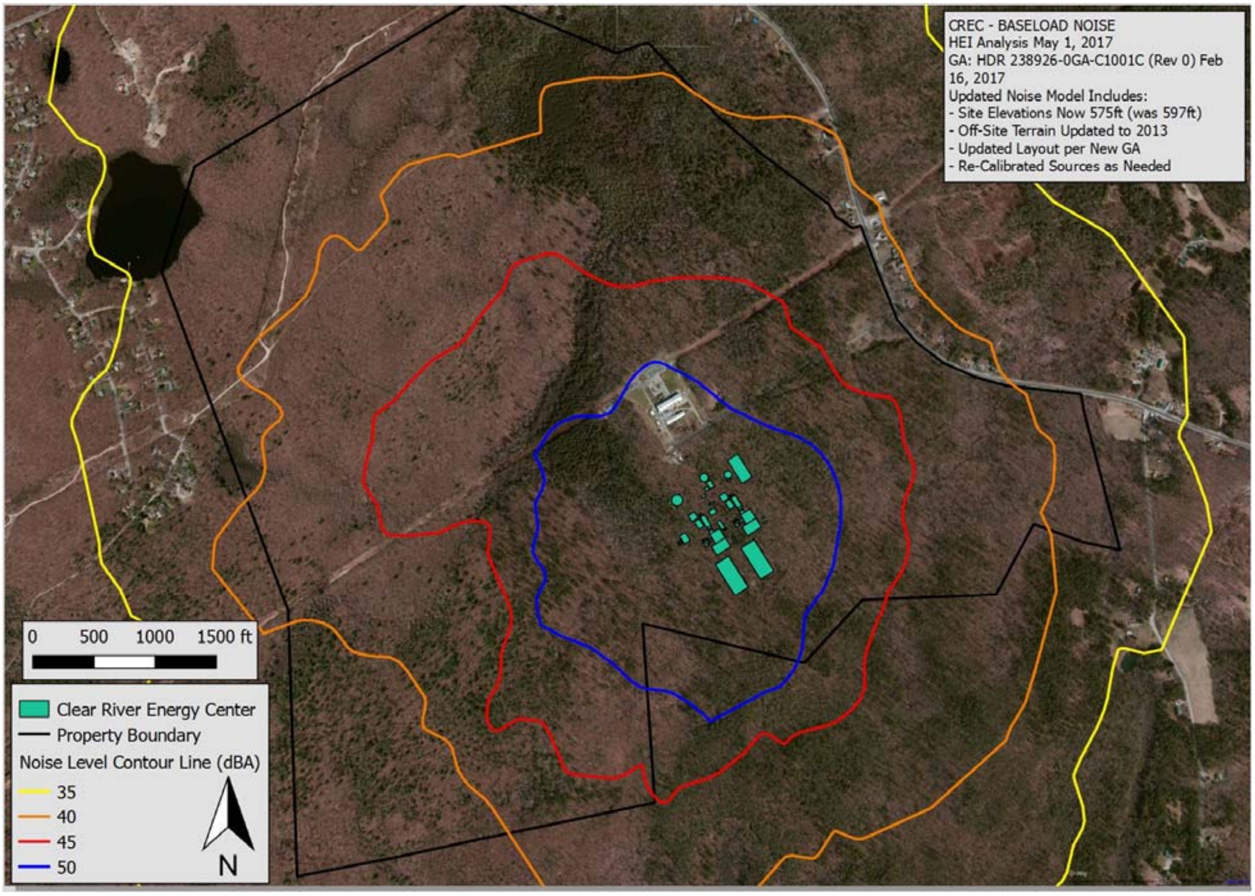


Figure 1 – Noise Level Contours for Baseload CREC Operation

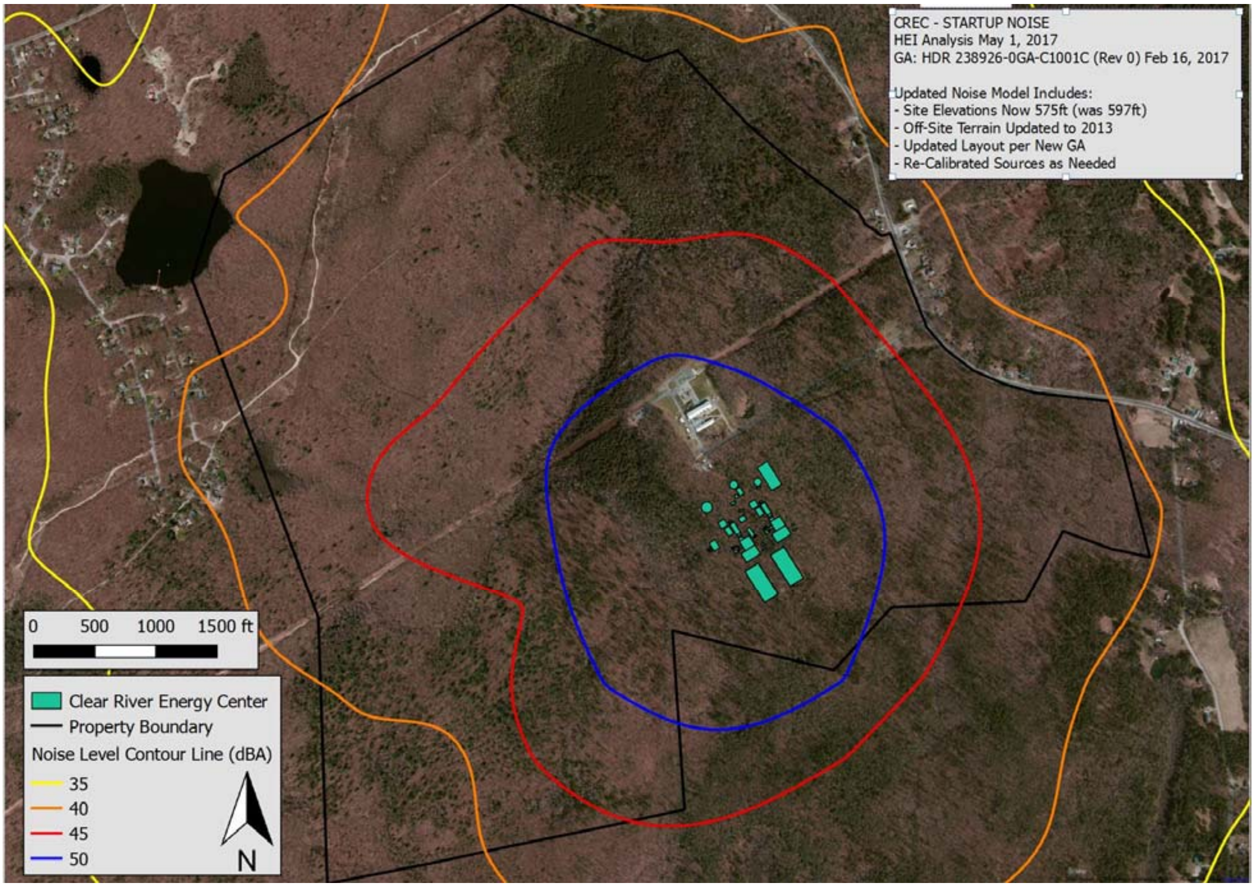


Figure 2 – Noise Level Contours for Start-Up CREC Operation

EXHIBIT C

100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451
p 781.419.7696 f 781.622.2612
www.essgroup.com

MEMORANDUM

TO:	Rhode Island Department of Health	DATE:	April 20, 2017
FROM:	Michael Feinblatt, ESS Group, Inc.	ESS PROJECT NO.:	I108-013.04
SUBJECT:	Clear River Energy Center RIDOH EFSB Advisory Opinion Responses		
COPY TO:	Invenergy, APS		

The following are responses to specific issues raised by the Rhode Island Department of Health (RIDOH) in its Final Energy Facility Siting Board Advisory Opinion for the Clear River Energy Center project dated September 12, 2016.

ISSUE 3: Drinking Water Quality

Drinking Water Quality

The following comment was made by the RIDOH regarding drinking water quality and Invenergy's response follows:

- No source for process water is currently under consideration; however, regardless of the source of water for the plaint, maintaining the quality of existing drinking water supplies, both public and private, remains a priority. To this end, RIDOH asks to assess the impact of any future proposal on drinking water quality.

- *The CREC Water Plan, dated January 11, 2017, detailed the proposed source of process water for the facility. Process water will be supplied from the Town of Johnston, Rhode Island under a long term water supply agreement and delivered to the facility via public roads by trucks owned and/or leased by the facility. Because the process water will be provided from a municipal water supply system with its own water treatment facility, the CREC process water use will have no impact on the quality of existing public or private drinking water supplies.*

  A RIPDES Construction General Permit Application has been filed with RIDEM for the project, which includes a Soil Erosion and Sediment Control Plan which details how the discharge of pollutants to waters of the State will be prevented during project construction, in accordance with the RI Soil Erosion and Sediment Control Handbook.

  A Stormwater Management Plan has been submitted to RIDEM for the project, which details how stormwater will be managed during CREC operation to prevent the discharge of pollutants to waters of the State, in accordance with the RI Stormwater Design and Installation Standards Manual.

  A Water Quality Certification Application has been submitted to RIDEM for the project. The issuance of the Water Quality Certification for the project by RIDEM will ensure compliance with the State Water Quality Regulations and that the project will not impact the quality of existing public or private drinking water supplies.

ISSUE 5: Emergency Response and Prevention

Ammonia Storage

The following are comments and recommendations made by the RIDOH regarding storage of ammonia at the facility and Invenergy's response to each:

- No documentation was provided to support the statement that the 20% concentration criterion was set by the EPA "because it does not consider aqueous ammonia stored at a concentration less than 20% to pose a public health risk upon release".

- *40 CFR 68 sets forth the list of regulated substances and thresholds for which the chemical accident prevention provision apply. It applies to an owner or operator of a stationary source that has more than a threshold quantity of a regulated substance in a process.*

  According to Table 1 to §68.130, "List of Regulated Toxic Substances and Threshold Quantities for Accidental Release Prevention", the threshold quantity of ammonia at a concentration of 20% or greater is 20,000 pounds.

  §68.120 establishes the requirements for a substance to be added to the list of regulated substances identified in Table 1. According to §68.120, a substance may be added to the list if, in the case of an accidental release, it is known to cause or may be reasonably anticipated to cause death, injury, or serious adverse effects to human health or the environment.

  According to Table 1 to §68.130, ammonia at a concentration of less than 20% is not a regulated toxic substance which requires accidental release prevention planning in accordance with 40 CFR 68 when stored or used in any quantity. Its omission from Table 1 indicates that there is insufficient health and environmental effects or exposure data available to conclude that ammonia at a concentration of less than 20% is known to cause or may be reasonably anticipated to cause death, injury, or serious adverse effects to human health or the environment.

- 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.

- *Invenergy will develop and implement an Operations and Maintenance (O&M) plan for the facility ammonia containment and control systems following their final design and prior to storing any ammonia on-site to ensure that these systems function as designed should an accidental ammonia release occur.*

- Invenergy should establish clear, written emergency procedures.

- *Invenergy will develop and implement an Emergency Response Plan (ERP) for the facility following its final design and prior to storing any ammonia on-site that identifies the staff who will be responsible for implementing emergency response should an accidental ammonia release occur and the appropriate training to be provided for those staff.*

- Invenergy should conduct a worst-case off-site consequence analysis for ammonia storage using more conservative assumptions.

- *Although CREC is not subject the Risk Management Program, a worst-case accidental release scenario was previously completed to assess the potential consequences in the extremely unlikely event of a release of the 19% aqueous ammonia into the containment area. The results of that analysis showed that all of the areas in which the in-air ammonia concentration would exceed the AEGL-1 level are within the Project and/or Spectra site, which is private property not accessible to the general public.*

  The ALOHA model was previously run using Stability Class A and an ambient temperature of 104°F, which was the highest daily maximum temperature for the site during the past three years, which is the ambient temperature required by the "Risk Management Program Guidance for Offsite Consequence Analysis" for the worst-case release modeling. In its Advisory Opinion, the RIDOH recommended that the ALOHA model be run using Stability Class F and at an ambient temperature of 85°F to be more conservative.

  Subsequent to the issuance of the RIDOH Final Advisory Opinion, the storage volume of the CREC ammonia storage tank has been reduced from 40,000 to 27,000 gallons. CREC has proposed to employ passive evaporative controls to mitigate the consequences of an accidental release of ammonia from its on-site storage tank. The passive control system will consist of industrial-grade plastic balls placed in the bottom of the containment area surrounding the storage tank. In the event of an accidental release of aqueous ammonia into the containment area, the liquid would pass between the balls and spread out on the concrete base. The floating balls will reduce the area available for volatilization to approximately one-tenth of the total surface area of the liquid. The balls will also block the wind, greatly reducing the wind speed at the surface of the liquid, further reducing the rate of volatilization.

  CREC is also now proposing to utilize a misting system within the ammonia storage tank containment area to reduce the concentration of any aqueous ammonia within the containment area by 33% in the event of a release.

  The results of the revised ALOHA modeling analysis, based on the reduced storage volume and the proposed control systems and using the modeling inputs recommended by the RIDOH, are shown graphically on the attached figure. As shown on the attached figure, even under the most stable wind conditions (Stability Class F), the impact areas are all within the CREC and Spectra property lines, within areas not accessible to the public.

- Appropriate planning should be implemented for a release with off-site consequences.

- *Invenergy will develop and implement a Risk Management Plan (RMP) equivalent plan for the facility following its final design and prior to storing any ammonia on-site that includes safety procedures for potentially impacted sensitive receptors, such as residences, schools, and health care facilities should an accidental ammonia release occur.*

- Planning activities should include an evaluation of impacts of a fire involving the ammonia tank.

- *The ERP and RMP for the facility which will be developed and implemented following its final design and prior to storing any ammonia on-site will include an evaluation of impacts of a fire involving the ammonia tank, including the emergency response procedures to be implemented should such an event occur.*

- Invenergy should coordinate with local emergency responders.

- *The ERP and RMP for the facility which will be developed and implemented following its final design and prior to storing any ammonia on-site will include a plan for coordination with local emergency responders, including the nearest hazardous materials response team. This coordination will include providing local emergency responders with the quantities and locations of all chemicals stored on-site, transport routes and procedures, and the results of the worst-case off-site consequence analyses completed for the facility.*

<u>Compressed Hydrogen Storage, Use, and Transport</u>

The following are comments and recommendations made by the RIDOH regarding facility storage, use and transport of hydrogen and Invenergy's response to each:

- Invenergy should establish clear, written procedures for the periodic inspection, testing and maintenance of all equipment, controls, sensors, etc. related to the storage and use of hydrogen at the facility.

- *Invenergy will develop and implement an O&M plan for the facility hydrogen storage and handling systems following their final design and prior to storing any hydrogen on-site to ensure that these systems function appropriately and as designed.*

- All staff that are involved with the storage, transfer and use of hydrogen should be provided with appropriate training.

- *Invenergy will develop and implement an ERP for the facility following its final design and prior to storing any hydrogen on-site that identifies the staff who will be involved with the storage, transfer, and use of hydrogen and the appropriate training to be provided for those staff. The training, which will include emergency response training and periodic refresher training, will be designed ensure the safe operation and maintenance of the hydrogen storage and handling systems.*

- Invenergy should coordinate with local emergency responders.

- *The ERP for the facility which will be developed and implemented following its final design and prior to storing any hydrogen on-site will include a plan for coordination with local emergency responders, including the nearest hazardous materials response team. This coordination will include providing local emergency responders with the quantities and locations of the hydrogen to be stored on-site, transport routes and procedures, with a focus on planning for any potential impacts on sensitive receptors that could occur in the unlikely event of an incident involving hydrogen on-site or during transport.*

<u>Additional Considerations and Conclusions</u>

The following are additional comments and recommendations provided by the RIDOH regarding facility emergency response and prevention and Invenergy's response to each:

- All potential hazards should be evaluated in a facility-wide RMP-like hazard analysis.

- *Invenergy will develop and implement an RMP equivalent plan for the facility following its final design and prior to storing any hazardous materials on-site that includes an evaluation of all potential hazards, including any potential hazards associated with the use, storage and transport of ammonia, hydrogen, fuel oil, natural gas, and any hazardous waste that may be generated at the facility.*

- All staff that to be involved with emergency response should be identified and provided with appropriate training.

- *Invenergy will develop and implement an ERP for the facility following its final design and prior to storing any hazardous materials on-site that identifies the staff who will be involved with emergency response and the appropriate training to be provided for those staff, including all planned emergency response drills.*

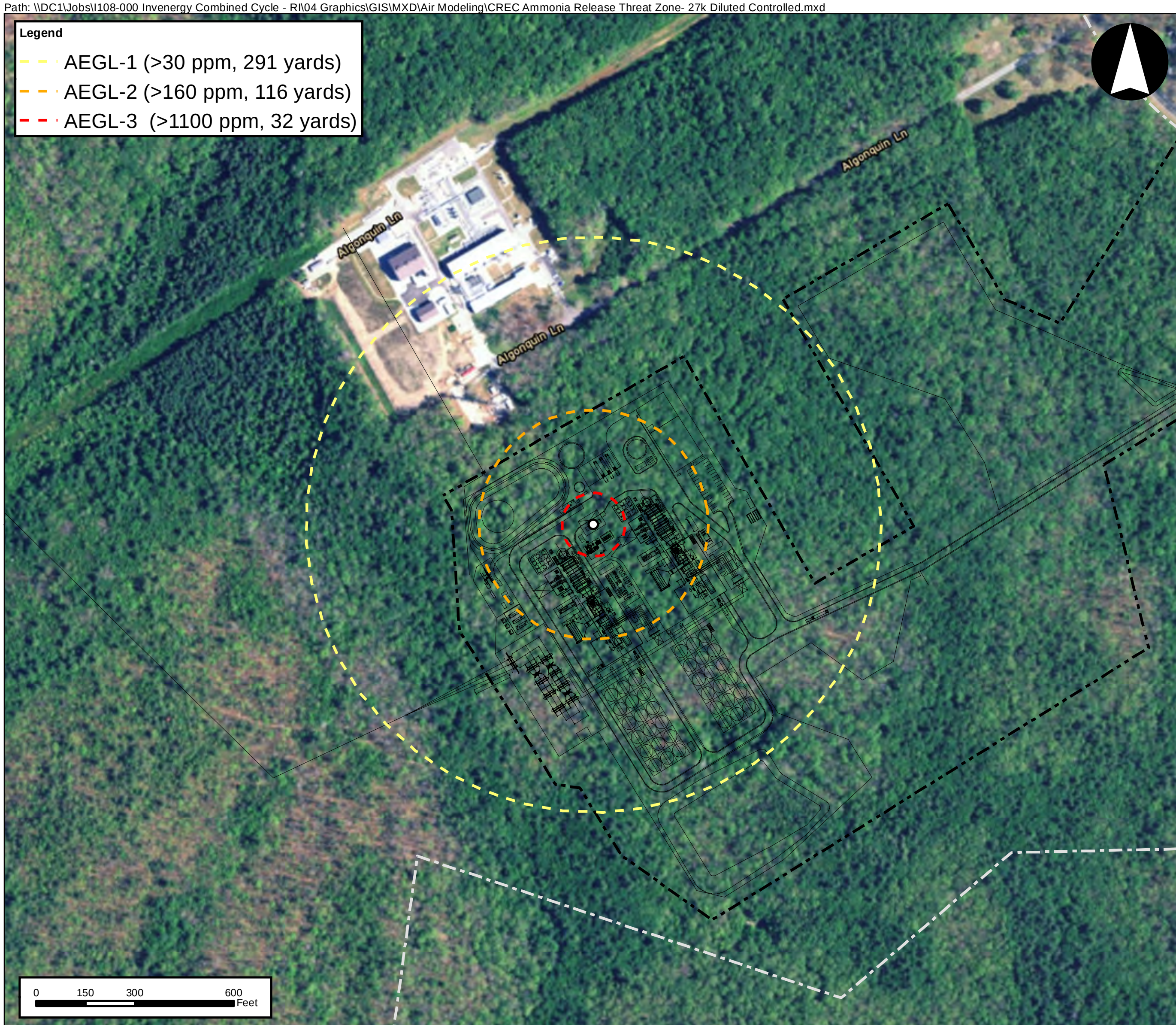
- Invenergy should coordinate with local emergency responders.

- *The ERP and RMP for the facility which will be developed and implemented following its final design and prior to storing any hazardous materials on-site will include a plan for coordination with local emergency responders, including the nearest hazardous materials response team. This coordination will include providing local emergency responders with the quantities and locations of all hazardous materials stored on-site, transport routes and procedures, and the results of any hazard analyses completed for the facility. The ERP and RMP will include special consideration to potential impacts on sensitive receptors, including residences, schools, workplaces, medical facilities, and other places people congregate. Invenergy will provide emergency responders in any towns which could be impacted in the unlikely event of an incident at or during transport to the facility with any additional equipment that they may need to respond to such an event, upon request.*

EXHIBIT D

Path: \\DC1\Jobs\I108-000 Invenergy Combined Cycle - RI\04 Graphics\GIS\MXD\Air Modeling\CREC Ammonia Release Threat Zone- 27k Diluted Controlled.mxd

Drawing Date: 4/19/2017



ALOHA (Area Locations of Hazardous Atmospheres)
Model Parameters:

SITE DATA:
Location: BURRILLVILLE, RHODE ISLAND
Building Air Exchanges Per Hour: 0.34
(unsheltered single storied)
Time: September 19, 2016 2000 hours EDT (user specified)

CHEMICAL DATA:
Chemical Name: AQUEOUS AMMONIA
Solution Strength: 12.73% (by weight)
Ambient Boiling Point: 145.7° F
Partial Pressure at Ambient Temperature: 0.22 atm
Ambient Saturation Concentration: 220,991 ppm or 22.1%
Hazardous Component: AMMONIA
CAS Number: 7664-41-7 Molecular Weight: 17.03 g/mol
AEGL-1 (60 min): 30 ppm
AEGL-2 (60 min): 160 ppm
AEGL-3 (60 min): 1100 ppm
IDLH: 300 ppm LEL: 150000 ppm UEL: 280000 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 0.63 meters/second from s at 3 meters
Ground Roughness: urban or forest Cloud Cover: 5 tenths
Air Temperature: 85° F Stability Class: F
No Inversion Height Relative Humidity: 50%

SOURCE STRENGTH:
Evaporating Puddle (Note: chemical is flammable)
Puddle Area: 180 square feet Puddle Volume: 35910 gallons
Ground Type: Default soil Ground Temperature: 85° F
Initial Puddle Temperature: Ground temperature
Release Duration: ALOHA limited the duration to 1 hour
Max Average Sustained Release Rate: 1.03 pounds/min
(averaged over a minute or more)
Total Amount Hazardous Component Released: 62.0 pounds

THREAT ZONE:
Model Run: Gaussian
Red : 32 yards --- (1100 ppm = AEGL-3 [60 min])
Orange: 116 yards --- (160 ppm = AEGL-2 [60 min])
Yellow: 291 yards --- (30 ppm = AEGL-1 [60 min])

ess group
environmental consulting & engineering services

Clear River Energy Center
Burrillville, Rhode Island

1 inch = 500 feet

Source: 1) HDR, Site Layout, 4/18/2017
2) ESRI, Imagery and Transportation, 2016

Ammonia Off-Site Consequences Analysis with Passive Evaporative Controls (27,000gal Tank w/33% Containment Area Dilution, Stability Class F)