Review of the Cricket Valley Energy Draft Environmental Impact Statement: Air Resources Section

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Introduction

Cricket Valley Energy LLP (CVE) is seeking permits to construct a 1000 megawatt natural gas fired power plant at the location of the former Polytech facility in the Ten Mile River Valley (also known as the Harlem Valley), in Dover Plains, NY. The facility will consist primarily of three combined cycle combustion turbines but also includes an auxiliary boiler and smaller combustion sources of air pollutants associated with a fire pump and emergency generators. Egan Environmental Inc (EEI) has been contracted by the Town of Dover to provide an independent review of the project plans from an air quality impact perspective. My academic training is in mechanical engineering (fluid dynamics and thermodynamics), environmental health sciences and in meteorology. I am also an American Meteorological Society Certified Consulting Meteorologist. I have been a specialist learning about and consulting on air pollution matters for nearly 40 years with work for clients from industry; federal, state and local regulatory agencies; research institutes; industrial trade associations; environmental organizations; universities; and law firms. The air pollution regulations that CVE must comply with are complex and multi faceted. I will attempt to describe key aspects of the process and comment on the relevance of aspects of the project based upon my professional experiences.

My review has focused on the air pollution portions of the project as detailed in ***Section 4 – Air Resources*** section of the ***Draft Environmental Impact Statement*** (DEIS) and associated support information dated December 2010.

I met with the Town of Dover officials and representatives of CVE and visited the proposed site and surrounding area on December 2, 2011. Subsequently, I requested and obtained copies of correspondence that CVE and their air consultant, ARCADIS have had with the regulatory agencies NYDEC, the USEPA, the National Park Service, and environmental agencies in the neighboring states of Massachusetts and Connecticut and Pennsylvania. I also requested and obtained the electronic computer files of the input data to the mathematical dispersion modeling and the output calculations produced that support the compliance demonstrations required for the permit application. After a preliminary review of the findings of the DEIS, I requested further calculations from ARCADIS to provide more detail on the air quality impacts of the proposed facility on specific locations of interest to the north, east and south of the CVE site. ARCADIS has been responsive to my requests for information and clarifications.

Overview of the Air Quality Permitting Process.

The relevant air regulations have grown in complexity with time and a large number of demonstrations are needed to show compliance. The following overview has the purpose of assisting the Town of Dover in understanding the implications of some of the technical issues addressed in The DEIS.

The air quality permitting process for new sources follows mandates from the federal Clean Air Act and New York state regulations. New York State has been *delegated* authority by the federal EPA to establish and enforce its own air quality regulations. Under the Clean Air Act, state regulations cannot be less stringent than federal EPA regulations.

Air quality regulations have undergone major changes over the past decade and continue to evolve with new knowledge of environmental and health-related effects and with technological advances in measurements, modeling methods and in emissions control technologies. Each of the air quality regulations that the CVE must comply with are described in Section 4.1 of the DEIS.

Compliance with the air pollution regulations requires a combination of the application of pollutant specific emissions control technologies together with mathematical and measurement based demonstrations that the ambient air concentrations predicted to result from emissions will be less than specified values identified by the National Ambient Air Quality Standards (NAAQS) and also by allowable values specified by the Prevention of Significant Deterioration (PSD) regulations aspects of New Source Review (NSR). The regulations have stringencies that depend upon whether an area surrounding a potential new source is in attainment (complying) or nonattainment with the NAAQS established for each of the 'Criteria' Pollutants (Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO) , Particulate matter having an aerodynamic diameter less than 10 microns (PM_{10}), Particulate matter having an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), Volatile Organic compounds (VOCs) , Lead and Ozone. 'Criteria' pollutants are those that the USEPA reviews and may set ambient air standards for on a more or less continuous basis from a public health standpoint. The allowable values have different averaging times (e.g, 1 hour, 24-hour, annual averages) associated with health related exposure durations. The pollutants will also have specified allowable frequencies of occurrence (e.g. no more than once per year at any location, or for example, in the case of $PM_{2.5}$, "the 3-year average of the 98th percentile of 24-hour concentrations at each population–oriented monitor within an area must not exceed 35 micrograms per cubic meter (ug/m3)".

For a yet-to-be built source, the determination of compliance is by the use of atmospheric dispersion modeling. New pollutants are added to the lists on the basis of health effects and economic studies. The two most recently added pollutants include $PM_{2.5}$ and Carbon Dioxide (CO_2), a greenhouse gas. In addition to naming new pollutants, EPA periodically revises the allowable concentration levels and averaging times and allowable frequency of occurrence for the criteria pollutants. Most recently, the USEPA set new one- hour duration NAAQS for Nitrogen dioxide (NO_2) and also for Sulfur dioxide (SO_2). In addition, the new standards have caused the regulatory agencies to place renewed attention to assuring that the NAAQS are complied with during short periods of increased emissions, especially associated with the start up and shut down of equipment. Changes in regulations and new, associated guidance for compliance demonstrations are a key reason that there is considerable correspondence between CVE and the regulatory agencies about this project.

The CVE project area is classified as attainment for each of the NAAQS except for ozone. If an area is nonattainment for a pollutant, the most stringent control technologies called Lowest Achievable Emissions Reductions (LAER) must be applied to new sources and a regional control strategy involving emissions offsets must be implemented by the governing agencies. Ozone in the troposphere is considered a regional pollutant requiring a broad based control strategy, as the agencies recognize that achievement of compliance will require reductions for all source categories (e.g. transportation, industrial, etc.) and controls across large geographic regions. Ozone is primarily formed by chemical reactions of nitrogen oxides and VOCs in the presence of sunlight. The regulatory strategy for controlling ozone therefore requires controls on emissions of these two pollutants. The permitting process also triggers compliance demonstrations with other, non criteria pollutants, notably Hazardous Air Pollutants (HAPS) and regulations relating to visibility impairment, acid rain deposition, impacts on soils and vegetations and greenhouse gases. All these regulations are addressed in the DEIS. My comments will focus on the demonstrations of compliance with the NAAQS and NSR rules as these are commonly the most controversial.

The following sections of this report discuss how CVE is complying with the NSR regulations.

Control technologies required to be employed and emission reductions required for New Source Review.

New Source Performance Standards (NSPS) were established early on in the development of EPA regulations that set limits on process type emission rates (e.g. lb/MMBTU) for different source categories. They remain in effect and include provisions relating to emissions measurements and reporting requirements. They have , however, been largely superseded in stringency by the advent of requirements under New Source Review for 'top down' determinations for Best Available Control Technology (BACT) for attainment areas and Lowest Achievable Emissions Reductions (LAER) for new sources in nonattainment areas and newer requirement for continuous emissions monitoring (CEMS). The DEIS notes that the selected control technologies associated with LAER for NOx emissions are 7.5 times as stringent as those required by NSPS. Similarly, the use of natural gas will result in emissions of SO2 that are about 1/30 the rate limit officially required by NSPS for new combustion turbines. Therefore, the current day primary focus of the determination of required control technologies is demonstrating that controls meet the requirements of BACT and LAER for each pollutant. The top down process forces a source to review data on control technologies that the states archive and that the EPA archives in the RACT/BACT/LAER/Clearinghouse (RBLC) on the applicability, cost, and performance of control methods and equipment. BACT determinations can consider economic, energy and environmental factors whereas LAER is more stringent and determined by what is achievable for the source type.

For sources in nonattainment areas, regulations require the application of LAER. For the CVE project controls meeting LAER requirements need to be applied to emissions of NOx and VOCs. LAER has been determined for each type of source at CVE. Tables 4-8 through 4-11 of the DEIS summarize the control technologies and emission limitations resulting from the BACT/LAER determinations for each pollutant and for each category of source emissions. The BACT and LAER analyses include consideration of emission during start-up and shut-down emissions. The diesel and black start generators will be using Ultra Low Sulfur Diesel (ULSD) fuel in accordance with the top down approach to evaluating control technologies. The specific top down comparisons made are available in the appendices to the DEIS. The results of these determinations seem reasonable to me and compare well to what I understand is current practice. The NYDEC is in a position to review the results in terms of prior permitting in NY.

Ambient Air Quality Assessments

For New Source Review, the USEPA has adopted regulations that depend upon mathematical modeling of air pollution transport and dispersion in the atmosphere to demonstrate compliance with ambient air quality goals. The demonstrations of compliance with ambient air quality goals have three key aspects. The first and most important is that predicted ambient air concentrations not exceed the National Ambient Air Quality Standards (NAAQS) and NYSDEC AAQS defined for each criteria pollutant and for each associated averaging time. The demonstration for compliance must include not only the new source to be permitted but also consideration of the contributions of all other permitted sources in the area and also so called 'background' ambient air concentrations which may be quantified by measurement data. These demonstrations of compliance require the use of both mathematical dispersion modeling and also ambient air measurement data. Emissions inventory data and ambient air measurement data from New York and neighboring states are generally used by CVE for these purposes.

The Prevention of Significant Deterioration (PSD) rules apply to locations in attainment with the NAAQS and go further than the NAAQS to limit the allowable increases of pollutant concentration that any proposed facility may contribute to existing air quality levels, These allowable increments have been set in the range of 20% to 40% of the NAAQS for the same averaging times. To comply with these allowable increments, new sources must not only employ adequate control technologies but may also limit the size or throughput of new facilities.

The third factor that, in practice, limits the emission of new facilities is the adoption in recent years of 'screening' criteria that encourage applicants to compare predicted ambient air concentration increases with established Significant Impact Levels (SILs) and Significant Monitoring Concentrations (SCMs) for different pollutants. The SILs have been established by the USEPA and are set in the range of 1 to 5% of the NAAQS concentrations. There are significance levels for both modeling and for ambient air monitoring concentrations (SMCs). If a predicted impact is less than a specific significance level, the source contributions are considered 'de minimis' and the source would not be required to make certain modeling or measurement demonstrations. SILs and SMCs were originally established as a way to help sources expedite the permitting process by eliminating requirements of lesser air quality importance. In practice, however, sources often seek to not exceed the values by application of controls or by downsizing projects. CVE applied for and obtained a waiver from the pre-construction monitoring requirement on the basis of showing that the predicted facility impacts were below the SMCs for each pollutant. This waiver is commonly granted in areas of relatively clean air.

In the discussion that follows, I have avoided repeating information that is detailed in the DEIS and assume that the reader has access to that document as well as the supporting documentation and associated calculation summaries which include wind roses and maps showing isopleths of constant predicted concentrations in the study area.

Mathematical Modeling of Ambient Air Quality Impacts

Mathematical simulations of atmospheric transport and dispersion phenomena must be performed in accordance with EPA's Guideline on Air Quality Modeling. This is a document that is formally updated periodically by EPA after public notice and after EPA reviews comments made at the Conferences on Air Quality Modeling required by the 1977 Clean Act Amendments to be held every 3 years. The EPA will hold the 10th of these conferences in March of this year. EPA also periodically updates its guidance through bulletins and activities of its Modeling Clearing House.

EPA's currently recommended atmospheric dispersion model for calculating air quality impacts within 50 km of a stationary source is the AMS/EPA Regulatory Model Improvement Committee (AERMIC) Model, AERMOD. This model was promulgated in 2006 and replaced a series of different models that were required for applications to sources in both simple and complex terrain settings. AERMOD is an advanced Gaussian plume type model with improvements primarily in the parameterization of how winds speeds and turbulent mixing rates vary as a function of height above the ground surface. It requires the use of a terrain preprocessor to obtain topographic information and a land use characterization program, AERSURFACE, to determine the values of three surface input parameters which determine the wind and turbulence profiles as a function of height above ground. Theses parameters characterize the surface roughness, the surface reflectivity of incoming solar radiation (albedo) and the importance of surface moisture in the transfer of heat to the air above the surface (Bowen Ratio). AERMOD is generally recommended for sources located in flat as well as in mountainous terrain settings. Prior to the acceptance of AERMOD, sources in areas where the heights of nearby terrain features exceeded the height of the source's stack top were required to use screening models or refined complex terrain models. Screening models are designed to overestimate the maximum expected concentrations through the use of conservative sets of assumed worst case meteorological conditions. A facility could be permitted if the impacts computed with a screening model were small enough. Refined models were called for if predicted concentrations did not pass the screening model values. Refined models require the use of a year or more of appropriate representative meteorological data. This is generally interpreted as requiring one year of onsite data or five years of data from a nearby representative airport.

Phenomena of importance in estimating air pollution impacts in complex /mountainous terrain.

The key factors that determine the impacts of sources located in complex terrain settings are the height of the effluent plume relative to the height of receptors (locations of interest) on the high terrain and the distance to those receptors. The height of the effluent plume is determined by the plume rise of the effluent above the physical height of the stack top. The plume rise is a function of the buoyancy of the effluent plume which is determined by the exhaust flow rate and temperature of the emissions vented through the stack as well as meteorological factors-most importantly the wind speed and ambient temperature at stack top and the temperature lapse rate in the layer of the atmosphere above the stack top. Plume rise is an important aspect of the plume trajectory at all locations but especially for sources near high terrain. Higher plume rises will occur when the CVE facility is has all three units running and the releases are hot compared to the ambient temperature. Lower plume rise would occur when only one unit is operating . Of course, the emission rates are lower during those operating conditions. The regulations require that air quality impacts be calculated for the full range of loads and ambient conditions.

The magnitude of the impact on complex terrain is also a function of the atmospheric turbulence levels which act to dilute a plume and mix it vertically. The highest ground level concentrations are expected to occur when the plume is in a stable atmospheric layer below or slightly above a downwind high terrain feature. Therefore, the impacts may be larger under reduced load conditions because the plume rise would be lower than under full load conditions. I will comment on this later in my discussion of some of the modeling results performed for the CVE facility.

Downwash of an effluent plume occurs when the air flow over an object must make a sharp change of direction and 'separates' on the downwind side a phenomena that causes increased turbulence. Building downwash is the most common and must be addressed to comply with EPA's Good Engineering Practice (GEP) rules that limit the credit that a source may take by constructing a tall stack. These rules are addressed in the DEIS and result in a formula based GEP height of 282.5 feet. A related concern in complex terrain is downwash that might occur on the lee side of a high terrain feature. As stated above, it occurs most commonly downwind of buildings and structures having sharp corners. It is less likely to occur and be less vigorous for flow over terrain features. Terrain induced downwash was a controversial issue in the permitting process for the proposed Rocky River power plant in New Milford, CT. As I note later, the topography of New Milford is quite different from that of Dover, NY. EPA does not recommend a mathematical model to estimate the effects of terrain induced downwash. Because downwash introduces mixing that would dilute an effluent plume, it is generally considered to result in relatively lower ground surface concentrations than would result if the plume from the same source were heading toward the terrain rather than away from it. I think that this is the case with west winds flowing over West Mountain toward the CVE site.

Another aspect of dispersion modeling common in valley settings is the preference for the wind directions to flow along terrain contours rather than across them. For example, winds at higher levels, say associated with prevailing winds from the southwest will tend to be turned by valley sidewalls to go more northward. Similarly, northwest winds within the valley, especially at lower elevations in the valley, will tend to turn the wind to blow more toward the south. However, the prediction of how often and to what degree these effects of channeling will affect the magnitude and directions of winds within and above a valley is beyond current meteorological flow modeling technologies. Measurements are generally needed to obtain that information.

Meteorology and terrain features

CVE has chosen to use five years of meteorological data from the Poughkeepsie Dutchess County Airport (KPOU) as the meteorological input data for this application.

The reason for choosing this set over the others is that KPOU is in a parallel valley that is also oriented north–south and it is the closest NWS airport with data. EPA guidance calls for the use of meteorological data that is representative of the meteorology at the potential location of the source. Because of the complexity and uniqueness of the terrain, none of the NWS sites, in my opinion, would produce a meteorological data set that is representative of the conditions in Dover. I therefore raise a question of whether onsite data should instead be required for this application. First I will discuss why KPOU meteorology is not representative of the meteorology of the proposed site. Then I will address how much of a difference in the final findings of the DEIS that the use of onsite data might make.

The key reason that KPOU is not representative of the CVE location is because the two valleys are separated by West Mountain, a long ridge that runs north south closer to Dover. The height of the ridge exceeds 1000 feet or more than 800 feet above the elevation of KPOU and over 500 feet above the valley floor at the CVE site. The ridge exceeds these elevations for long stretches between Dover and KPOU and the ridge would essentially act to isolate the two areas meteorologically except under relatively strong synoptic scale wind conditions. Strong wind conditions, however are not the ones that generally result in the highest air quality impacts. Rather, it is the occurrences of light winds that are associated with peak predicted and observed concentrations especially in complex terrain settings. The wind roses for KPOU show that the highest frequency of wind directions are from the north for each of the five years of data used from 2005 through 2009. On average they occur about 11% of the time. They are also most likely to be light winds from the north with speeds, less than 7 knots. The year to year similarity of the wind roses is quite remarkable and suggests that the there is a strong local topographical influence associated with these light winds. The dominance of the light north winds at KPOU suggests the importance of drainage winds down the Hudson River Valley, a factor not expected as far east as the CVE site. The Harlem Valley would not have similar drainage forces. Therefore, I believe that the high frequency of the north winds measured at KPOU is unique to that valley. The USEPA raised an issue about the number of calms in the original meteorological data set being proposed and advised CVE to reprocess the data using a method (the 1- minute method) that looks at short term wind data under conditions of low speeds to increase the number of non-calm hours in the data base. This was done and the process added many new hours of low wind speeds. When input into AERMOD to estimate concentrations from emissions from CVE, the use of the KPOU data set will result in AERMOD calculating a high frequency of impacts directly south of the plant where the terrain is relatively low. The elevations of the base of the valleys are different: the KPOU anemometer base is 135 ft above sea level while the CVE location base is at 436 feet in the Harlem Valley. I would expect to see a higher frequency of winds from the southwest through northwest associated with the prevailing upper level wind directions and a lower frequency of winds from the north than is shown in the KPOU wind roses. The meteorological conditions most likely to be different between Poughkeepsie and the CVE site are the frequencies of wind from different directions. Perhaps of next importance would be the wind speeds where I would expect the elevation difference would cause the winds to be on average somewhat higher in Dover than at KPOU. Differences in the frequency of occurrence of wind directions are most likely to show up in the annual average predictions.

Often in areas of complex terrain, regulatory agencies have required sources to gather onsite meteorological data for a period of a year. For demonstrations support and accuracy purposes, I think that this would be a good idea for the CVE site.

There is another aspect of representativeness of KPOU and the CVE site which is dealt with in the application. That is whether the values of the model input surface parameters (roughness length, Bowen Ratio and the albedo) are appropriate and similar. Recent guidance from EPA calls for using the surface parameters for the area surrounding the meteorological tower where measurements are made as opposed to the surface parameters at the site of a potential new source. The reason is that the wind speed measured at a tower depends upon the surface conditions in the vicinity of the tower. This is because the turbulence and wind speed profile (how wind speed varies with height above the ground) is dependent upon how vigorously turbulence mixes the wind from upper levels of the atmosphere down to the anemometer level. Of the three surface parameters in the near field of an anemometer, the roughness length is the most important in this regard. EPA guidance requires that the value used in AERMOD be determine by the roughness within only 1 km of the Automated Surface Observation Stations (ASOS) anemometers used at airports. Meteorologists will argue, however that the conditions that determine the dispersion of emissions from a facility site far from an airport should be determined by evaluating the surface conditions in the vicinity of the source instead of at the anemometer location. Ideally, the source and the anemometer would be located at the same place. The agency correspondence with CVE shows that this question of choice of the surface parameters was raised by the USEPA. The proposed resolution was to have AERMOD run with both sets of surface conditions and utilize the more conservative results in the permit application. This was done and the KPOU predicted higher concentration values. Table 1 shows how the choice affects the maximum concentrations for each of the pollutant averaging times for emissions Case 3, a full load case. On average the use of KPOU surface conditions results in values about 40% higher than the use of onsite surface conditions. So, from the Dover community point of view, use of the KPOU surface conditions data produces more conservative results.

Air Quality Modeling Results Interpretations -Compliance demonstrations.

The dispersion modeling results show that for all pollutants and all averaging times the maximum predicted impacts from CVE emissions are at high elevations on the east facing slopes of West Mountain. Table 4-3 of the DEIS summarizes the values of the Significant Impact Levels and the Allowable PSD increments for the criteria pollutants. The comparison of the AERMOD predictions of these concentrations with the SILs is provided in Table 4-21. The results show that the predicted concentrations are below the SILs for all pollutant-averaging times with the exception of the 1-hr SIL for NO_2 and the 24 hour average and annual average SILs for $PM_{2.5}$. If the concentrations are below the SILs the applicant is not required to perform further analyses for that pollutant/averaging time combination. If the predicted concentration exceeds the SIL then the applicant must expand the modeling effort to include other major sources to assure that the PSD increments are not consumed. In addition, the applicant must show that the inclusion of all other important sources and the inclusion of background air quality concentrations will show compliance with the NAAQS.

The results shown in Table 4-21 of the DEIS when compared with the allowable PSD increments in Table 4-3 show that the predicted maximum impact values are well below the allowable PSD increments. At the time of writing, EPA has not proposed values for the allowable PSD increments for the new 1-hour averaging times for NO_2 or SO_2. However, if the EPA were to follow previous practices of setting PSD increments at about 25% of the NAAQS, we could expect that the new PSD increments will be about 50ug/m3. If that were the case, the NO_2 increment but not the SO_2 increment would be calculated to be consumed in the high terrain areas of West Mountain.

The modeling of other sources shows that the large power plants to the west of CVE contribute to the high values predicted on West Mountain but not at the same time. When this occurs, since it would require an East wind for CVE to contemporaneously contribute, the impact of CVE is de minimis.

The results in Table 4-21 when compared with the NAAQS in Table 4-1 show that the NAAQS will be met for all pollutant/averaging times. The discussion on pages 4-72 through 4-74 of the DEIS explains that since the geographic area in nonattainment for ozone, the criteria for approval of the 1 –hr NO_2 impact is that the contribution of the new sources be shown to be less than the SIL value of 7.5 ug/m3.

In addressing the high 1-hr average predictions of NO_2, CVE utilizes the Plume Volume Molar Ratio Method (PVMRM) which models the amount of NO_2 produced by including the role that ozone has in producing NO_2 from NOx emissions. CVE chose to use default parameter values in these calculations which results in conservative predictions.

A more complicated situation described on pages 4-69 through 4-72 occurs with $PM_{2.5}$ where maximum CVE impacts are also predicted above the SILs at West Mountain. The modeling shows that the impact of other modeled sources brings the total 24 hour impact to 31 ug/m3 compared to the standard of 35 ug/m3- showing compliance but not with a large margin of safety. I have a concern, however, that might be addressed with further analyses that other similar relatively high impacts might be predicted to the east of the CVE site due to the contributions of the other sources and background concentrations.

Analysis of air quality impacts at selected locations of interest

The focus of the compliance demonstrations performed by CVE is to show that the predicted air quality impacts CVE are less than the allowable incremental values of New Source Review and, when combined with the impacts of all other sources, that the NAAQS are maintained. The modeling results clearly show that the highest predicted values are in the high elevations of West Mountain, about a mile or so to the west of CVE. I thought it would be of interest to look further at the facility impacts to the east of the proposed site in residential areas. I was especially interested in the values predicted at the schools, at locations where the topographic map indicated structures or residences in high terrain to the east and southeast and at a couple of high terrain areas where I expected higher concentrations would be predicted. Although the DEIS appendices include maps of the predicted isopleths of concentrations in all directions, the grid resolution did not allow me to easily identify values at these specific points. I therefore requested that ARCADIS provide additional calculations at 20 specific latitude and longitude locations which I chose from a topographic map. I requested that calculations be made for the full load condition with all units operating (Case 5) , a partial load condition also with all 3 units (Case 8) that were associated with the maximum predicted concentration in Table 4-21 of the DEIS. I also asked for results for a nominal case for only one unit operating (Case A). Case A had relatively low predicted concentrations as expected. Tables 2 through 4 summarize the results for the Cases 5 predicted concentrations for annual averages, the high-second-high 24 hour averages and the peak one hour predictions. Tables 5 through 7 show the results for Caser 8 respectively with all units operating. The Tables show the locations and elevations of the selected receptors. Also included in the tables for reference purposes, is the peak value reported in the DEIS, the SILs, and the NAAQS for each pollutant/averaging time combination. One can see that the concentrations are well below the maximum values predicted in Table 4-3 of the DEIS, associated with impacts on West Mountain. The values are also well below the SILs with the exception of the NO_2 1- hour average value. The annual average concentrations predicted at the elementary schools in Dover and Wingdale are low at a small fraction of 1ug/m3. Those predicted in the area of the High and Middle schools are larger but still low. When comparing the Case 8 results with those from Case 5, we see that three turbines at partial load do not produce larger impacts than at full load -evidence that maintaining plume rise is not a critical matter in these areas. I note also that the annual average predictions at the Golf club are not especially high, despite the high frequencies of north winds seen in the KPOU data set.

Comparison of Modeling results with Sempra's proposed power plant in New Milford, CT.

I am familiar with the topographic setting and the dispersion modeling that was performed associated with the proposal to permit The New Milford Energy (NME) power plant in New Milford, Conn in 1999 that was also to be located in a complex terrain setting. The permit application for that plant never went forward. Members of the Dover community have asked me to comment on the differences between that proposed project and that of CVE. Table 8 below compares what I believe are the key factors. First of all at NME, high terrain within a half mile of the site would have towered above the stack top and consequently dispersion modeling predicted high concentrations on that terrain. The Connecticut Siting Council was also expected to require that the facility have the capability to burn a backup fuel in case of disruptions to the natural gas supply. The burning of fuel oil would have resulted in sufficiently higher concentrations of particulates to make it not be able to meet the PM_{10} allowable increment.

There were also concerns about terrain induced downwash that would increase the ground level concentrations with winds flowing across Candlewood Mountain and that might cause elevated concentrations on the downwind side of the mountain. The proponents of the plant did have some wind tunnel tests performed to address this latter issue but the results were, to my knowledge, not incorporated into the permit application.

Recommendations

The new 1–hr averaging time standards for NO_2 and SO_2 are more stringent in terms of compliance demonstrations than the other averaging times for other pollutants. The DEIS and agency correspondence shows that for NO_2 in particular, compromises were made to use a three year average of the Thomaston measurements rather than the maximum value over a three year period to show compliance when background concentrations are included. Although I think it unlikely that the 1-hr NO_2 NAAQS would be violated in the populated areas of Dover, the fact that the contributions from the sources of NOx to the west that contributed with the interactive modeling to the high values predicted on West Mountain suggest that these contributions could also be important to locations east of the proposed site. I would recommend therefore that a NO_2 monitor be located in the vicinity of the High and Middle schools in Dover. Such a location would serve two primary purposes. It would be a better indicator of background concentrations generally and could replace the use of Thomaston, CT data for analyses of the impacts on the high terrain of West Mountain with east winds. Measurements at the high school could also confirm that the contributions from CVE were below the SILs when winds are from the southwest. A properly sited anemometer in the same area would provide the data needed to establish the relationships of the NO_2 measurements with the above wind direction considerations. A lower priority suggestion would be to add a capability of measuring $PM_{2.5}$ also at the High School. Compliance with the new $PM_{2.5}$ 24-hour and annual average standards is a problem for many locations throughout the US. Measurements would establish more reliable background values for use in assessment of compliance with the $PM_{2.5\ NAAQS}$ and also confirm that the contributions from the CVA are minimal. I would recommend that the measurement program be initiated before construction so as to obtain at least a full year of "before" data. The program should then extend for a full year after the facility is in full production.

Conclusions

I have reviewed the CVE DEIS and associated back up files and correspondence supplemental and supplemental modeling information from ARCADIS.

I find that the demonstrations for compliance follow regulatory procedures and are complete and seem to be without errors. The determination of required emissions control technologies follows detailed regulatory guidance and will result in LAER being applied to emissions of NOx and VOCs that will reduce emissions these pollutants that contribute to the formation of regional ozone. The DEIS and subsequent information list the offsets being taken to meet the States' goals of reducing emissions contributing to ozone in the region. The top down BACT analyses applied to the other criteria pollutants also are complete and include regulatory concerns for assuring controls are applied to smaller sources to start up and shut down operations that may pose compliance problems for short duration ambient air standards.

The modeling demonstrations for compliance with the NAAQS follow current EPA guidance for the use of the AERMOD model and the associated AERMET and AERSURFACE preprocessors. I discuss my reservation about the use of the Poughkeepsie Dutchess County Airport (KPOU) meteorological data set for the analysis as I do not believe that is representative of the local meteorology at the proposed CVE site. However, comparative modeling performed by ARCADIS shows that the use of KPOU surface parameters with KPOU wind data produces more conservative results than if the surface parameters for the CVE site were used with the KPOU wind data. This is not to say, however, that onsite wind measurements with the local surface conditions would necessarily produce less conservative results. This is because the frequencies of winds from all directions would change which in the modeling would alter not only the predicted impacts of CVE but also of all the other external sources brought into the analyses with interactive modeling.

So, a question comes down to how much of a difference one would expect in AERMOD results if one had onsite meteorology at the CVE site. The frequency of winds and the wind speeds are likely to be different because the site is in a different valley. My expectation is that because the base of the Harlem Valley is higher than the anemometer at KPOU, the wind speeds at stack top and higher elevations will be somewhat higher. Differences in the measured frequencies of wind directions would have the greatest effect on the annual average predicted concentrations. In looking at Table 2, one sees that the predictions of annual average concentrations are well below the SILs. Thus, it would take a substantial increase of the measured wind frequencies from the west to threaten the SILs and alter the interactive modeling needs. My recommendations for suggesting a measurement program for NO_2 and $PM_{2.5}$ concentrations in the vicinity of the High and Middle schools is based upon recognizing that the estimates of the background values of these compounds, which are an essential part of the NAAQS compliance demonstrations, came from very remote locations and that there is an opportunity to improve the basis for and assure the compliance demonstration with ambient measurements of these pollutants.

Table 1. Comparison of Normalized Maximum Concentrations-Emission Case 3

Pollutant	Averaging Time	Local CVE Site Surface Characteristics	KPOU Airport Surface Characteristics	Ratio KPOU/Local CVE
NOx	1 HR	22.56	30.09	1.33
NOx	Annual	0.25	0.39	1.56
CO	1 HR	13.73	18.31	1.33
CO	8 HR	5.2	6.49	1.25
SO2	3 HR	2.33	3.57	1.53
SO2	24 HR	0.72	0.91	1.26
SO2	Annual	0.051	0.08	1.57
PM	24 HR	2.83	3.58	1.27
PM	Annual	0.2	0.31	1.55
Average				1.41

Table 2 Concentrations at Selected Locations-Annual averages Case 5

Case 5 Year 2007, 100% load. 59 degrees F, DB,plus ancilliary equipment						NOx g/s 2.36	PM2.5g/s 1.82	SO2 g/s 0.45
Location Description	Approximate Elevation	Latitude N	Longitude W	Distance From CVE	Compass Bearing to CVE	Maximum Annual Average Concentration	Maximum Annual Average Concentration	Maximum Annual Average Concentration
	Feet	Decimal Degrees	Decimal Degrees	Miles	Degrees -True	ug/m3	ug/m3	ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	0.0167	0.0128	0.0032
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	0.0217	0.0167	0.0041
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	0.0167	0.0129	0.0032
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	0.0376	0.0290	0.0072
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	0.0384	0.0296	0.0073
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	0.0194	0.0150	0.0037
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	0.0096	0.0074	0.0018
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	0.0271	0.0209	0.0052
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	0.0276	0.0213	0.0053
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	0.0271	0.0209	0.0052
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	0.0262	0.0202	0.0050
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	0.0724	0.0559	0.0138
Church Hill	509	39.3150	33.6830	1.75	324	0.0236	0.0182	0.0045
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	0.0181	0.0139	0.0034
Building on dead end	548	43.7070	33.0710	3.92	202	0.0205	0.0158	0.0039
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	0.0845	0.0652	0.0161
High Elevation Structure	615	41.3340	33.4000	1.52	234	0.0381	0.0294	0.0073
Building Complex	352	41.1850	33.8860	1.08	228	0.0405	0.0312	0.0077
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	0.0282	0.0217	0.0054
Golf Club	486	38.4000	34.7650	2.50	358	0.0312	0.0240	0.0059
Value at Location of Predicted High Value from DEIS Table 4-21						0.5700	0.3010	0.1000
SIL						1.0000	0.3000	1.0000
NAAQS						100.0000	15.0000	80.0000

Table 3 Concentrations at Selected Locations- HSH 24 hour averages Case 5

Case 5 Year 2007, 100% load. 59 degrees F, DB,plus ancilliary equipment						PM2.5 g/s 1.82	SO2 g/s 0.45
Location Description	Approximate Elevation Feet	Latitude N cimal Degre	Longitude W ecimal Degre	Distance From CVE Miles	Compass Bearing to CVE Degrees -True	High Second High 24 hour Average Concentration ug/m3	High Second High 24 hour Average Concentration ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	0.0917	0.0227
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	0.1463	0.0362
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	0.0933	0.0231
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	0.2286	0.0565
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	0.2375	0.0587
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	0.1118	0.0276
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	0.0987	0.0244
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	0.2735	0.0676
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	0.2706	0.0669
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	0.2570	0.0635
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	0.1746	0.0432
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	0.5647	0.1396
Church Hill	509	39.3150	33.6830	1.75	324	0.1924	0.0476
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	0.1270	0.0314
Building on dead end	548	43.7070	33.0710	3.92	202	0.1399	0.0346
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	0.7412	0.1833
High Elevation Structure	615	41.3340	33.4000	1.52	234	0.2173	0.0537
Building Complex	352	41.1850	33.8860	1.08	228	0.2585	0.0639
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	0.1646	0.0407
Golf Club	486	38.4000	34.7650	2.50	358	0.1604	0.0397
Value at Location of Predicted High Value from DEIS Table 4-21						3	0.98
SIL						1.2	5
NAAQS						35	365

Table 4. Concentrations at Selected Locations-1- hour averages Case 5

Case 5 Year 2007, 100% load. 59 degrees F, DB,plus ancilliary equipment						NOx g/s 2.36	SO2 g/s 0.45
Location Description	Approximate Elevation Feet	Latitude N cimal Degre	Longitude W ecimal Degre	Distance From CVE Miles	Compass Bearing to CVE Degrees -True	Maximum 1 hour Average Concentration ug/m3	Maximum 1 hour Average Concentration ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	1.6830	0.3209
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	2.7823	0.5305
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	1.6934	0.3229
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	1.7991	0.3431
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	1.6736	0.3191
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	1.3042	0.2487
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	1.1420	0.2178
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	1.7948	0.3422
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	2.1497	0.4099
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	2.1804	0.4157
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	2.0254	0.3862
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	9.1649	1.7475
Church Hill	509	39.3150	33.6830	1.75	324	3.0095	0.5738
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	1.3439	0.2563
Building on dead end	548	43.7070	33.0710	3.92	202	1.5777	0.3008
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	16.1014	3.0702
High Elevation Structure	615	41.3340	33.4000	1.52	234	2.7451	0.5234
Building Complex	352	41.1850	33.8860	1.08	228	2.2031	0.4201
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	2.2338	0.4259
Golf Club	486	38.4000	34.7650	2.50	358	1.9963	0.3807
Value at Location of Predicted High Value from DEIS Table 4-21						68.6	6.8
SIL						7.5	7.8
NAAQS						35	196

Table 5 Concentrations at Selected Locations-Annual averages - Case 8

Case 8:Year 2007, 49% load. 59 degrees F						NOx g/s 1.26	PM2.5g/s 1.22	SO2 g/s 0.24
Location Description	Approximate Elevation	Latitude N	Longitude W	Distance From CVE	Compass Bearing to CVE	Maximum Annual Average Concentration	Maximum Annual Average Concentration	Maximum Annual Average Concentration
	Feet	Decimal Degrees	Decimal Degrees	Miles	Degrees -True	ug/m3	ug/m3	ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	0.0106	0.0103	0.0020
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	0.0146	0.0141	0.0028
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	0.0106	0.0103	0.0020
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	0.0313	0.0303	0.0060
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	0.0314	0.0304	0.0060
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	0.0154	0.0149	0.0029
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	0.0077	0.0075	0.0015
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	0.0219	0.0212	0.0042
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	0.0216	0.0209	0.0041
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	0.0209	0.0203	0.0040
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	0.0195	0.0188	0.0037
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	0.0476	0.0461	0.0091
Church Hill	509	39.3150	33.6830	1.75	324	0.0166	0.0161	0.0032
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	0.0113	0.0109	0.0021
Building on dead end	548	43.7070	33.0710	3.92	202	0.0131	0.0127	0.0025
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	0.0610	0.0591	0.0116
High Elevation Structure	615	41.3340	33.4000	1.52	234	0.0275	0.0267	0.0052
Building Complex	352	41.1850	33.8860	1.08	228	0.0318	0.0308	0.0061
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	0.0203	0.0196	0.0039
Golf Club	486	38.4000	34.7650	2.50	358	0.0219	0.0212	0.0042
Value at Location of Predicted High Value from DEIS Table 4-21						0.5700	0.3010	0.1000
SIL						1.0000	0.3000	1.0000
NAAQS						100.0000	15.0000	80.0000

Table 6 Concentrations at Selected Locations- 24 Hour Averages Case 8

Case 8:Year 2007, 49% load. 59 degrees F						PM2.5g/s 1.22	SO2 g/s 0.24
Location Description	Approximate Elevation	Latitude N	Longitude W	Distance From CVE	Compass Bearing to CVE	High Second High 24 hour Average Concentration	High Second High 24 hour Average Concentration
		Decimal	Decimal				
	Feet	Degrees	Degrees	Miles	Degrees -True	ug/m3	ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	0.0738	0.0145
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	0.1159	0.0228
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	0.0752	0.0148
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	0.2255	0.0444
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	0.2290	0.0451
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	0.1086	0.0214
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	0.1012	0.0199
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	0.2602	0.0512
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	0.2486	0.0489
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	0.2325	0.0457
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	0.1498	0.0295
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	0.3605	0.0709
Church Hill	509	39.3150	33.6830	1.75	324	0.1564	0.0308
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	0.0956	0.0188
Building on dead end	548	43.7070	33.0710	3.92	202	0.1070	0.0211
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	0.7246	0.1425
High Elevation Structure	615	41.3340	33.4000	1.52	234	0.1870	0.0368
Building Complex	352	41.1850	33.8860	1.08	228	0.2415	0.0475
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	0.1332	0.0262
Golf Club	486	38.4000	34.7650	2.50	358	0.1362	0.0268
Value at Location of Predicted High Value from DEIS Table 4-21						3.0000	0.9800
SIL						1.2000	5.0000
NAAQS						35.0000	365.0000

Table 7 Concentrations at Selected Locations- 1 Hour Averages Case 8

						NOx g/s	SO2 g/s
Case 8:Year 2007, 49% load. 59 degrees F						1.26	0.24
Location Description	Approximate Elevation Feet	Latitude N Decimal De	Longitude W Decimal Degr	Distance From CVE Miles	Compass Bearing to CVE Degrees -True	Maximum 1 hour Average Concentration ug/m3	Maximum 1 hour Average Concentration ug/m3
Elementary School at 9 School St.	401	44.3833	34.7667	4.39	180	1.00	0.19
WINGDALE Elementary School	459	38.9102	33.4795	2.24	328	1.85	0.35
RESIDENTIAL AREA Near Elementary School	388	44.3000	34.4167	4.31	184	1.01	0.19
HIGH AND MIDDLE SCHOOL-Walkway overlooking CVE	563	41.1213	34.4858	0.70	205	1.30	0.25
HIGH AND MIDDLE SCHOOL-Main BuildingT	571	41.1700	34.4233	0.78	206	1.30	0.25
SAW HILL PEAK	820	40.0667	35.6833	0.93	51	1.26	0.24
PEAK Northeast of SAW HILL PEAK	604	40.2333	35.5333	0.71	56	0.88	0.17
HOMES ON RIDGE to Southeast of CVE	554	40.0783	34.1500	0.82	313	1.27	0.24
HOMES ON RIDGE further to Southeast of CVE	578	39.9500	34.0927	0.96	317	1.68	0.32
RESIDENCE further to ESE	579	39.9008	34.0295	1.04	317	1.83	0.35
RESIDENCES even further to ESE	431	40.1978	33.2917	1.40	287	1.89	0.36
HIGH POINT of ridge to east of Elementary School	1246	44.1580	32.5247	4.58	205	7.03	1.34
Church Hill	509	39.3150	33.6830	1.75	324	2.19	0.42
Knoll above Bains Corner	597	44.3320	33.0900	4.58	198	0.97	0.18
Building on dead end	548	43.7070	33.0710	3.92	202	0.98	0.19
Residence? on high terrain	1187	42.7310	31.9650	3.51	224	10.32	1.97
High Elevation Structure	615	41.3340	33.4000	1.52	234	2.09	0.40
Building Complex	352	41.1850	33.8860	1.08	228	1.70	0.32
Residence above Ellis Pond	560	40.8490	33.1080	1.53	257	1.63	0.31
Golf Club	486	38.4000	34.7650	2.50	358	1.26	0.24
Value at Location of Predicted High Value from DEIS Table 4-21						68.6	6.8
SIL						7.5	7.8
NAAQS						35	196

Table 8. Comparison of NME and CVE SETTINGS

		NME	CVE
Capacity	MW	530	1000
STACK BASE ELEVATION	Feet	265	436
STACK HEIGHT	Feet	213	282.5
STACK TOP ELEVATION	Feet	478	718.5
Elevation of terrain within 1/2 mile	Feet	890	530
Terrain elevation at 0.5 mile/Stacktop		1.86	0.74
Dispersion Model		PTMTPA	AERMOD
Model Type		Screening	Refined
PSD Constraining Pollutants		PM10	None
Requirement for Back up Fuel Oil?		Yes	No