

LEE COUNTY AD HOC COMMITTEE

Ron Conderman, Chairman
Craig Buhrow
Mike Pratt
Gene Bothe
Tom Fassler

Keith Bolen
Alan Pfeifer
Steve Robery
Chris Henkel, Zoning Officer
Alice Henkel, Clerk

The Lee County Ad Hoc Committee met on Wednesday, February 23, 2011, at 7:00 p.m. in the Old Lee County Courthouse, Dixon, Illinois. Chairman Ron Conderman called the meeting to order and Clerk Alice Henkel called the roll. The following members were present: Craig Buhrow, Mike Pratt, Gene Bothe, Tom Fassler, Keith Bolen, Alan Pfeifer, and Steve Robery.

Chairman Conderman asked if there were any changes or corrections to the minutes from the January 25, 2011 meeting. There were none. Gene Bothe made a motion to approve the minutes, and Mike Pratt seconded it. All were in favor.

Chairman Conderman stated the purpose of the meeting was further discussion of noise, and there was a speaker present. Keith Bolen introduced Leslie Frank, a noise expert from HFP Acoustical Consultants Corp. Mr. Frank gave a presentation to the Zoning Board of Appeals in June 2010 with regards to Mainstream Renewable Power's Shady Oaks project, located in Lee County.

Mr. Frank had prepared a PowerPoint presentation, a copy of which is attached to these minutes. A copy of the presentation on a compact disc is available at the Lee County Zoning office.

Mr. Frank defined sound to be "something that is physically made" and defined noise as being "unwanted sound." In order to have an unwanted sound, there must be a receptor (the person) that is listening to the sound and does not like the sound.

HFP Acoustical Consultants Corp. (HFP) has been provided all forms of industrial and environmental assessments for the last 35 years. The company employs 26 professionals who include some PhDs, Masters, and professional Engineers. It worked on approximately 4,000 projects. The majority of the time HFP has been retained by industry; however, HFP has been retained by the public a significant amount of times when there is funding.

HFP tries to provide an independent presentation and also tries not to take one side or the other. Rather, it tries to present the technical facts to the committee and the public so that each may learn and be able to make their own choices.

Mr. Frank stated he has a Bachelors Degree in Mechanical & Environmental Engineering from the University of Hartford (Connecticut), which has the only undergraduate degree program in Acoustics in North America. He also has a Masters Degree in Engineering

Acoustics from Pennsylvania State University (Penn State) which has the largest graduates' degree program in Acoustics in the world.

Mr. Frank started and for 31 years has successfully run a company that is involved with environmental assessments of noise control from industrial facilities.

Mr. Frank presented a slide showing all types of sounds and the measure of each sound in decibels (dBA).

Mr. Frank provided the definition of some technical terms. One term that will be frequently seen is L_{eq} (Equivalent Sound Level) which he explained is a time-energy average.

In order to remove subjectivity and create objectivity, modern instrumentation takes an energy average of all sounds, whether it be a one-hour or one-minute L_{eq} , and it averages that energy over that time period, therefore removing the personal bias.

As a sound fluctuates up and down, the meter integrates that sound and comes up with a single number which is that sound's equal amount of energy. If another sound had that same equal amount of energy, it would judge it to be equivalently as loud.

Mr. Frank stated that pretty much all regulatory bodies in the world today have switched over the past 20 years to L_{eq} ; and it has been judged by psychological studies to have the best correlation to human annoyance to sound.

Mr. Frank explained that the Illinois Pollution Control Board was created in 1970 by the Environmental Protection Act. It has jurisdiction over various types of industrial noises in the State.

Illinois has one of the strictest state regulations in the Country, and it uses octave-bands. The State requires the measurement all of the 8 octave-bands, which includes low to mid to high pitched sounds, to assess compliance. Illinois does not use dBA to assess compliance.

Mr. Frank said that the sound-frequency spectrum for a typical wind turbine, when run through the Illinois State requirements, comes out to be around 51 dBA. He asked that everyone keep this figure in mind throughout this presentation.

The following, which Mr. Frank discussed individually, have noise regulations/noise legislation: the Federal Energy Regulatory Commission, U.S. Department of Transportation, U.S. Bureau of Land Management, U.S. Federal Highway Authority, U.S. Federal Aviation Administration, and U.S. Department of Housing and Urban Development.

Regarding federal jurisdiction, the Federal Energy Regulatory Commission (FERC), which is a part of the Department of Energy, regulates interstate natural-gas pipelines. The pipeline must cross state boundaries.

The point of reception is commonly known as the Noise-Sensitive Area (NSA) which generally means residential areas or residential homes. It does not include parks or other areas.

FERC uses the day-night sound level (L_{dn}) as its measurement. L_{dn} was a concept that EPA developed in the 1970s. It means there is more of a penalty of noise, about a 10 dBA penalty in the nighttime hours compared to the daytime hours. He said a facility which would pass the legislation during the daytime could flunk significantly during the nighttime because of the 10 dBA penalty.

Mr. Frank said that since some facilities run the same, day or night, you have to go back and determine an equivalent number that would just pass the requirements, that number being $48 \frac{1}{2}$ dBA. If a facility operated at $48 \frac{1}{2}$ dBA during the day and at $48 \frac{1}{2}$ dBA at night, it would exactly equal 55 dBA. Therefore, if you have a pipeline running through your area and there is a compressor station, $48 \frac{1}{2}$ dBA is the regulated level.

Mr. Pratt asked Mr. Frank if there is an upper limit to L_{eq} . Mr. Frank stated L_{eq} is a measurement index. It is a method of measurement similar to degrees Fahrenheit.

The lower limit is 0 dBA which is the threshold of hearing at which a young adult in a controlled university laboratory environment would just be able to hear sounds. Regarding the upper limit, the loudest sound physically possible on earth is 155 dBA. At that point the pressure fluctuation is the same as the atmosphere.

The L_{eq} is a measurement index or is like degrees Fahrenheit without the number attached.

Mr. Pratt referred to the slide entitled, "Energy Equivalent Sound Level – L_{eq} " (Slide #6, page 1 of attached presentation). He wanted to know if there was a sharp increase in sound and a sharp decrease in sound, could you still come up with an average that is acceptable.

Mr. Frank referred to a residence that has a background sound level of 25 dBA that experiences the noise created by a passing freight train with a sound level of 90 dBA. In this case, the L_{eq} would be about 68 or 70 dBA.

Mr. Frank explained that L_{eq} would severely penalize that higher-leveled sound. Most of the studies that have been done around the world that people's reaction or human response to noise are best correlated by L_{eq} .

In extreme cases, such as the train scenario, it doesn't work as the methodology falls apart; however, it is still used.

Also in reference to this slide, Mr. Robery wanted to know if the dotted line represents the State standard, approximately 51 dBA, and there are peaks in the sound over time that

exceed that standard, would those peaks be considered in the determination whether the sound is or is not acceptable.

Mr. Frank said the high peaks are considered and so are the low peaks. A facility would be allowed a few instances where the sound would be louder as long as it's balanced by a few instances that it is a bit quieter. That is what L_{eq} does, it energy-averages so that there is one number to be used as an indicator.

Some of these peaks are due to weather conditions. During the measurement time, from the start time to finish time, it's acceptable to have lower and/or higher levels of sound so long as it's energy-averaged to be within an acceptable range.

Mr. Robery wanted to know if an ordinance specified an L_{eq} and there is a time-varying sound level, they would actually allow higher levels sound than the L_{eq} because it's being averaged out by the lower levels of sound. Mr. Frank said this applies to shorter instances.

Sound levels that exceed the standard receive a much higher penalty than sound levels that fall below the standard.

Mr. Frank feels the State of Illinois is a bit vague in terms of its use of L_{eq} . At some points it says it does use L_{eq} , and at some points it doesn't say anything. Under modern terminology, one would assume they infer to mean L_{eq} but a lawyer may argue otherwise. Also, if L_{eq} is not used, then what should be used to measure sound levels? That is why most interpretations are based on L_{eq} .

Mr. Buhrow wanted to know if Mr. Frank was talking about the State level and/or the Federal level. Mr. Frank said he was talking about the State of Illinois.

Mr. Pfeifer wanted to know if there is a standard deviation with L_{eq} . Mr. Frank said, yes, there are statistics involved; however, standard deviation talks about percentile exceedances, or what percentage of time something exceed the standard. L_{eq} is an energy-average. L_{eq} is similar to standard deviation but a concept all to its own.

Sound is logarithmic. Each time the sound level is increased by 10 dBA, the sound is perceived to be twice as loud. Also, every time the sound level is increased by 3 dBA, the energy is doubled.

In terms of noise, the U.S. Department of Transportation (DOT) regulates interstate oil pipelines. Even though DOT issues licenses and such, they have no sound level limit specified as of yet.

Mr. Frank explained that the U.S. Bureau of Land Management (BLM) is mostly for native lands. For highways, gas pipelines, or transmission lines run through areas that are controlled by the BLM, the continuous sound level limit is 48 ½ dBA.

Even though gas pipelines are usually regulated by FERC, they are regulated by BLM when they pass through areas controlled by BLM.

The U.S. Federal Highway Administration (FHWA) basically controls any federally funded highway, from the Interstate to State highways or even local roads if they receive federal funding (usually not the case).

The FHWA has a maximum sound level of 67 dBA during the worst hour, usually rush hour. President Kennedy started the interstate highway millions of people are impacted by highway noise.

The Federal government decided at the time that 67 dBA was reasonable to control noise. If sound levels exceed 67 dBA, barriers would have to be built, land would have to be bought out, or the separation would have to increase.

The U.S. Federal Aviation Administration (FAA) has switched their indices recently. It used to use Noise Exposure Forecast.

For new airports or new housing developments, the FAA has a maximum sound level of 58 ½ dBA. Nothing can be done about existing airports, which is about every major airport in the Country. Additionally, nothing can be done about the hundreds of thousands people who living near airports all over the Country.

The U.S. Department of Housing and Urban Development (HUD) requires a maximum outdoor sound level of 58 ½ dBA for federally-funded housing projects or to receive federally-funded loans for housing projects. The source of noise can be from anything, such as roadway, railway, or aviation.

U.S. States that have “intense” noise legislation are Colorado, California, Illinois, New York and New Jersey. New Jersey has recently adopted stricter noise legislation.

The reason Illinois is considered more strict than 45 other States is because of the octave-band requirements which means meeting the requirements in each and every frequency. Illinois does not have dBA requirement.

Most of the State requirements are property line limits. There are many nuisance noise ordinances; however, nuisance means it’s up to a judge.

With octave-band requirements, Illinois regulates the sound levels at all frequency levels. For a facility to be in compliance with the State of Illinois, it would have to meet the requirements at each frequency level.

Illinois is also tougher at low frequencies. For facilities that produce low-frequency sound, it makes it a little more onerous to meet.

The State of Illinois has not yet specifically distinguished wind farms to be different from any other industrial facility.

In Canada, Canadian legislation is more provincially controlled. Only five provinces regulate sound. The provinces and restrictions for industrial facilities at rural receptors are:

- a. British Columbia Oil and Gas Commission: 40 dBA L_{eq}
- b. Alberta Energy Resources Conservation Board (Noise Control Directive): 40 dBA L_{eq}
- c. Manitoba Guidelines for Sound Pollution: 48 dBA L_{eq}
- d. Ontario Ministry of the Environment: 45 dBA L_{eq}
- e. Nova Scotia Department of the Environment: 55 dBA L_{eq}

Europe is known for extremely strict noise legislation. In Germany, there are more wind turbines than in any other country in the world. The nighttime restriction is 35 dBA L_{eq} .

The fixed noise limit for Denmark is 45 dBA L_{eq} . In Sweden, the limit is 40 dBA L_{eq} .

France and Great Britain are using new indices known as L_{90} (France: $L_{90} + 3$ dBA; Great Britain: $L_{90} + 5$ dBA). It is a statistical level. In relation to L_{eq} , L_{eq} would probably be a few decibels louder than that. It does not provide a maximum number. It requires the measurement of the sound, determination of the background sound level, plus a few decibels.

The concept is good because the louder the ambient sound, the louder the industrial noise is allowed to be. If the background noise is already loud, then the facility can be a little bit louder than the existing noise. If there is minimal background noise, the facility can be a little bit louder than the existing noise.

It is difficult to administer because it requires background noise surveys at almost every residence. Also, sound levels vary from day to day, depending on the weather and such, again making it difficult to administer.

The regulatory bodies that have implemented this concept have found themselves in very lengthy and very expensive reviews in order to make it work.

The International Electrotechnical Commission (IEC) is an organization made up of experts from around the world of which the major world powers contribute to. They come up with methods for determining sound levels, such as what type of microphone should be used. They do not determine the levels, only the measurement procedures for determining sound levels.

In the 1970s, it was determined that the Office of Noise Abatement and Control and the U.S. Environmental Protection Agency (EPA) would “promulgate” noise regulations,

which means they would make recommendations for any federal agency or state to follow. They did not impose requirements, only recommendations to be used as a guide.

The “Levels Document” was created. It cites sound levels that are necessary to protect the public with a reasonable margin of safety. The conclusion was that if industries meet the sound level of 48 ½ dBA, the majority of the public would be reasonably well protected against annoyance. Other standards have been developed from this.

When EPA did this study, it realized the environmental effects of noise can cause annoyance. It recognizes that it can cause sleep-disturbance and stress, interference with speech communication, and adverse health effects. All of this was taken into account when the EPA established its limit of 48 ½ dBA.

The Swedish EPA did a study on the Effects of Wind Turbine Noise on Populations. Part of the study determined the percentage of the population that “noticed” but were not bothered by the wind turbine sound at different dBA levels and the percentage of the population that was “annoyed,” or bothered, by the wind turbine sound at different dBA levels. There were a higher percentage of people who “noticed” the wind turbine sound as opposed to those who were “annoyed” by the wind turbine sound (Slides #21 & 22, page 4 of attached presentation).

The effects of weather and seasons have a huge impact on sound. Ground attenuation is the ability of the soft and porous ground to absorb sound as it is propagating, or traveling, from the sound source to the receiver.

The quietest ground, or the ground which absorbs the most sound, is freshly fallen snow. The loudest ground, or the ground that absorbs the least amount of sound, is hard, frozen snow. The data exists to calculate this common aspect.

During the summertime, ground that is mushy and highly saturated with water is also very reflective, similar to hard, frozen snow in the winter. The ground is not able absorb sound because it has absorbed so much water.

These differences can be from +3 dB to -10 dB (Slide #23, page 4 of attached presentation). That is a 13 dB change which is like night and day in terms of sound level. They are mostly at mid-sound frequencies, not high frequencies or low frequencies.

Mr. Robery wanted to know how sound source that is elevated 400 feet in the air can affect the effects of the ground. Mr. Frank stated that the higher the source, the effect will be less pronounced.

For wind turbines, the effect of soft snow to crusty snow, from crop to no crop, will be not as pronounced as the numbers depicted in the slide (Slide #23, page 4 of attached presentation), but it will still exist.

Another aspect deals with wind direction. The Theory of Acoustics says if you are crosswind to a sound source, there is not much of an effect. However, being upwind from a source or downwind from a source has a significant effect on sound.

If a person is downwind from a sound source, at greater distances, can experience at 25 dB increase due to the wind, especially wind at higher velocities (Slide #24, page 4 of attached presentation).

Again, these aspects are known and have been proven mathematically. Also, they can be calculated with international standards. Numerous controlled studies have been done to prove these numbers.

Another aspect concerning the environment is thermal gradients. There are inversions or lapse conditions. In the early morning hours, the sun radiates heat down to the earth via solar radiation. The earth then becomes warm and convects heat upwards (a convector is like a radiator in a home). It takes a while before the temperature profile becomes uniform.

In the early morning hours, just after the sun has come over the horizon, the air currents are warmer near the ground than they are above. This causes the sound wave front to bend because the speed of sound is dependant upon temperature. The bottom goes faster than the top, and the sound literally bends upwards, moving the sound high in the air.

In the evening, the sun stops radiating heat down to the earth. The earth stops convecting heat upwards, and the air is warmer up in the air than down low like in the morning. This causes the sound wave front to bend downwards which forces the sound down onto a receptor. This effect lasts a couple of hours. A facility that is two miles away may seem noticeably louder than it would seem in the early morning or mid-day hours.

Computer noise modeling allows all these mathematical factors to be entered and accounted for. When a project is designed, these models can be created ahead of time using existing mathematical data, allowing industries to plan around and avoid possible noise issues.

A conclusion that can be made is measuring sound for compliance purposes is very involved and requires a lot of careful thought.

Mr. Pratt wanted to know if there are mathematical models that can determine how far away from a source a sound will travel during it's worst time (when sound it loudest). Mr. Frank said that can be determined.

Mr. Frank also noted that it is important to consider if a source should be assessed at its worst time, average time or better time. Some jurisdictions specify which time; however, the Illinois Pollution Control Board does not. The reasonable professional assumes average conditions should be assessed, which is summer, 70 degrees Fahrenheit, 60% relative humidity, and low winds. However, if an area experiences different averages, then different considerations need to be made.

Mr. Robery wanted to know if the Illinois Pollution Control Board standards regulate noise inside the home or outside of the home. Mr. Frank said it always considers outdoor sound levels. All state, federal and worldwide agencies consider outdoor sound levels with the assumption that a building stops a certain amount of sound (average 15 – 20 dB of sound for a residence).

It has been determined what sound levels one must have inside in order to sleep undisturbed. They then add the 15 – 20 dB to account for the residence. This results in a sound level limit for outside noise.

Also, studies show that people are more bothered by intervening sounds inside than outside. A person may be more bothered by an outdoor sound that can be heard indoors because he may not want to hear that sound while in the comforts of his home. He may not be bothered by this same sound when he is outdoors because he may feel it is a sound that is acceptable to hear while outdoors.

Mr. Robery stated that one thing people complain about is they can't sleep with their windows open. He feels this make sense since a noise will be 15 dB louder with the window open. Mr. Frank said that a standard construction home, even with open windows, will still stop about 10 dB of sound. A home with thermal-pane windows will stop about 20 dB of sound, or with single-pane windows will stop about 10 dB.

Mr. Frank says there have been instances where air-conditioning has been used to mitigate noise issued. The resident is able to keep the windows shut, minimize an outdoor noise. Also, the air-conditioner creates a sound that helps mask the outdoor noise.

Computer Noise Modeling is the ability to take all referenced effects into account so that sound effects can be predicted ahead of time. It is used to determine wind turbine sound level contributions.

The software, or computer program, predicts changes to environmental sound levels before the turbines are in place. It is possible, as is done for all forms of industry including wind turbines, to do the mathematical model before construction to make sure facility will be compliant with sound regulations. Knowing ahead of time what the situation is going to be is good practice for industry who wants to design once and not have to come back and move things.

It is also a level of insurance for residents who want to get some level of satisfaction that the company will do what it has said it will do. Mr. Frank was not talking about how loud it is, as that it up to the regulation, but rather the fact the company will actually achieve that.

Over the years, Mr. Frank has gotten the impression from industry that it is not so much designing to meet a low number that worries them, they just want to be told once what to do, they want to meet it but they don't want to have to come back again and again to try

to make changes. He feels it is a “triple-win” scenario because industry wins because they can get the project done right the first time; it is a win for residents because they at least get some assurance; and it’s a win for the regulators because they do not have to get involved in disputes.

Computer models are being used by many parties to show a method proposed compliance.

The State does not require computer modeling. The State does its measure after the product is complete. Once the facility is up and running, it has to meet the regulations. If it doesn’t, the facility can’t operate.

In the Netherlands, in Holland, it is a very crowded and congested area. Mr. Frank is working with two Dutch noise control engineers. They rely fully on model. The country has very strict modeling requirements. However, there is no measuring after the facility is complete. Once the model has been proven, the company has permission to construct and operate.

Computer noise modeling covers many parameters: distance dissipation (the way sound spreads with distance); ground attenuation (the effect of sound absorption by the ground); atmospheric absorption (the effect of sound being absorbed by the air); barrier attenuation (noise shielding effect caused by intervening buildings and landforms); wind effects (enhanced sound propagation in downwind directions and attenuated sound propagation in upwind directions).

To build a proper model, it takes several hours of inputting local effects. A person would have to actually go to the site that is being assessed to see what the ground is like, what the moisture content is, and so on.

There are also non-environmental factors to consider. There are sound power levels (how much energy does the turbine make. Most manufacturers have very good data in terms of how loud their sound source is. The data does not cover the environment and will tell you a little bit about distance but not much more than that.

The manufacturers have good data on measurements of their turbines such as different blade configurations, different speeds, etc. Once it is known what turbine is going to be used, data can be gotten from the manufacturer. And even before a vendor is picked, averaged figures or worst-case scenario numbers can be entered into the model.

Wind turbine sound radiation pattern has to do with the way that sound energy radiates away from sound source in terms of its efficiency. Sometimes sound drops off at a very rapid rate and sometimes it drops off at a lesser rate with distance and that has to do with the way it’s generated.

Wind turbine elevation and directivity are also put into the model because different sounds are directional in different ways for wind turbines.

Other factors that are put into the model are screens (buildings); temperature and relative humidity; ground cover types; terrain elevations (dips or rises in the land); algorithm (calculation standard has to do with international standards as to how sounds should be calculated) and time variance (due to wind speed).

The output of a computer noise model for a petrochemical plant can be found on page 6 of the attached presentation, slide #6. Computer models produce isopleths which are curves of equal sound levels. Each line on the model represents a sound level which allows one to see what the sound levels would be at a specific location.

Each model run is for one weather condition, one operating scenario. It can be rerun over and over for different weather condition variables. The predictive ability is there.

A computer noise model can be generated to show how sound will be affected by terrain (Slide #1, page 6 of the attached presentation). The green in the background shows lower sound levels.

With regards to wind turbines, there are different modeling patterns (Slide 2, page 6 of the attached presentation). Single point source is the easiest model and probably the least accurate. The computer model puts one single source point at the top of the wind turbine and assumes all the sound energy is coming from this single point.

The blade tip source computer model puts many sources in a circular pattern following the blade tip because that is where most of the energy comes from. The total sound power is divided by the total number of sources because the sound power has to add up to the same number.

The most accurate computer model uses full area source in which the computer model uses sound source at all points the circular pattern created by the blades, not just the tip. Each of the outer sound sources has a lot more energy than the sources closed to the center of the circular pattern.

A computer model of wind turbine can be found on page 6 of the attached presentation, slide #3.

Computer models of Shady Oaks can also be found on page 6 of the attached presentation, slides 5 and 6. Worst-case scenario was used to generate the models.

It is the State's job to react to compliance measurements or complaints. How often the State sends employees out to do measurements is unknown; how often the State reacts to complaints from the public is unknown; how short-staffed the State is, is unknown. Many times the industrial applicant hires its own expert do to monitoring. This expert's report is then submitted to the State.

In order to do such a survey, a microphone is set up in a field which records for a period of time. There is also a wind station to measure compliance. Compliance testing is pass/fail, there is no in between.

Mr. Bolen asked about the amount of time for which the recording is done. Mr. Frank believes Illinois Pollution Control Board's technical requirement has a 10-minute measurement and a 60-minute measurement.

Mr. Frank stressed the importance of having the proper weather conditions when taking a measure. His company uses valid data. Valid data is when the weather conditions are the right conditions. Normal data is when there is interference by granaries, loud traffic, etc.

Mr. Frank stated that a lot of his information that was presented came from the Swedish EPA and from German studies.

To conclude his presentation, Mr. Frank said that using computer noise modeling during design of wind power projects, provides a viable "desk-top" approach to predict anticipated sound levels; can account for different wind speeds that affect sound generation; can account for seasonal variations and different meteorological and ground cover conditions that affect sound propagation; and can yield accurate prediction of compliance to regulatory requirements or other design targets.

Mr. Fassler asked Mr. Frank how accurate his models have been and if he has gone out and checked. Mr. Frank said that when putting everything together within $\frac{3}{4}$ mile, it is about +/- 1.5 – 2 dBA, and within 3 miles, +/- 3 – 4 dBA. Also, they do go out and check.

Mr. Pratt asked if the decibels in the Shady Oaks models were based on L_{eq} , and they were. Mr. Pratt also wanted to know if the model can be translated to distances. Mr. Frank explained that yes, if a target level was given, he would be able to give you a distance.

Mr. Pratt wanted to know if a year's worth of weather conditions is used and how do you know if or do you know if you have accumulated enough data to know what it's going to do year-round.

Mr. Frank said that there is a lot of public weather data available from Met towers. A lot of these companies have their own Met tower before they site the turbines. When generating a computer model, you would refer to the company's data or public data.

Mr. Robery said one issue that is currently being discussed is the using of A-weighted versus C-weighted ratings. There are a lot of experts out there, such as Mr. Frank, that indicate that the noise modeling isn't good because it is not accounting for low-frequency sound which is predominate in wind turbines. Mr. Robery asked Mr. Frank to comment A-weighting versus C-weighting.

Mr. Frank had prepared a 10-minute presentation on this matter. A-weighting is defined as the frequency response of the human ear. A-weighting was studied in the 1960s. It's known as the Fletcher-Munson Curve. It was used by OSHA to come up with the Walsh-Healey Act that affects all industrial noise legislation (wearing hearing protection at

work). The A-weighting curve knows exactly the frequency response of the human ear. Any sound which has the same sound level of two different sounds will be judge by people to be equally as loud, regardless of the frequency content.

The human ear's response drops off significantly at lower frequencies. Sounds of very low frequencies but very high levels are not detectable or audible.

C-weighting by definition is more of a flat curve. The sound level meter is a measuring instrument that does not know the frequency response of humans and it has a flat curve. A good microphone, or measuring device, will measure all sounds of a tremendous frequency range, down to the low frequencies.

C-weighting was developed as somewhat of a compromise between A-weighting and flat. Back in the 1950s and 1960s, a lot of research showed that it does not correlate with human hearing.

Only recently has C-weighting become an issue. For years, C-weighting was not used even though the measuring instruments still had a switch for A-weighting or C-weighting. The reason that it is used now is because it is a quick test to see if low frequency sound exists.

Some legislation is starting to say if the difference between the A-weighted measure and the C-weighted measure is around 20 dBA, there is a low-frequency sound problem. The State of Illinois does cover this to some extent and it has stricter requirements at the lower frequencies.

A modern sound level analyzer measures not only dBA, but all the frequencies all at the same time.

The State of Illinois uses "third-octave" sound levels. This means more data and more availability to start seeing data. The State says if you have any energy at any frequency where any particular third-octave band exceeds its neighbor by more than 10, a penalty is assessed.

Mr. Frank stated wind turbines do not make low frequency sound. There are two sounds coming from wind turbines. One sound is the propeller rotating which creates an aerodynamic noise, similar to a ship's propeller or a ceiling fan. This generates mid to higher frequency sound.

About once per second, the blade passes right by the tower, creating a fluff of sound (whooshing sound). That fluff of sound is a result of the blade interacting with the air currents that are coming off the tower. The fluff of sound has a sound spectrum of its own, and it is measured as a mid frequency sound, not a low frequency sound.

By the way sound is generated from the wind turbine, it is really two "superimposed" sounds.

This fluff of sound is so bothersome to people because it is repetitive, similar to the repetitiveness of shadow flicker. It is not, however, a low frequency sound by definition. From a physics perspective, wind turbines really do not make low frequency sound; and their sound can be very accurately modeled because there are no low frequency effects of a wind turbine.

However, the human response is a separate and opposite aspect. The fluff which is actually “aerodynamic modulation” is very annoying to people due to its repetitiveness.

Mr. Robery said that he has read numerous reports from sound experts that do talk about the low-frequency issue and the pulsation effect as well. These experts are not coming to the same conclusion that wind turbines do not create low frequency sound. What he has read, is that the low frequency component is a large portion of the problem in terms of the annoyance factor.

Mr. Frank advised anyone reading the literature that is available to separate out human annoyance to the physics of sound propagation. In the way people react, it is a low frequency sound because people react to the “fluff” in that same way they would react to other low frequency sounds. Mr. Frank said that if psycho-acoustical data (the results of psychologists studying the people affected by noise) is looked at, the wind turbines are very annoying to people.

In terms of human annoyance, aerodynamic modulation is low frequency; however, in terms of sound propagation and modeling, it is not.

Mr. Pratt wanted to know how the State’s octave-band measurement deal with low frequency sounds. Mr. Franks explained that State uses octave-band measurements, which are averaged over 10 minutes or 1 hour, that takes into account the energy average or L_{eq} of the “fluff” sound but does not account for the impulsivity of this sound.

For example, a power plant has a rate of 51 dBA and a wind turbine has the same, a person would perceive the wind turbine to be about 5 dBA louder because of the impulsivity of the “fluff” sound.

The State of Illinois has not accounted for impulsivity yet.

Mr. Robery wanted to know why there are people all over the world who are still complaining about wind turbine noise when there is technical data that can predict noise. He was not saying that the noise affects everyone the same, nor was he saying there is noise problems at every wind farm. He feels it has something to do with population density within a wind farm.

In response, Mr. Frank stated that he doesn’t think any of the federal legislation that he spoke of earlier is designed to create a “no annoyance” situation. He feels that this is due to economics.

U.S. legislation with noise historically has not come up with a concept that if a facility meets the regulations, people will not be annoyed. Mr. Frank said “this is the nature of our governmental system.”

Mr. Robery noted that in an earlier slide, it showed Germany’s regulatory limit to be 35 dBA because they have more wind turbines. He asked if it would be prudent for a community that is considering or allowing more wind turbines to provide noise guidelines that are more similar to Germany’s guidelines than the current Illinois guidelines.

Mr. Frank explained that he would discredit himself as technical expert if he started giving opinions. He understands what Mr. Robery is saying but it is not up to him to decide what the regulatory limits should be.

Referring back to the Shady Oaks slide, Mr. Pratt said that when the turbines were placed, the wind company met the County’s setback requirements of 1,400 feet. Mr. Underwood of Mainstream Renewable Power confirmed that it did meet the County’s setback requirements.

Mr. Pratt said it looks like the company stayed under 50 dBA.

Mr. Frank explained that the Shady Oaks project stayed approximately 5 dBA below the State’s noise standards for all residences. Worst-case scenario figures were used and State requirements were still met.

Mr. Pratt said that Mr. Frank stated earlier that wind turbines sound about 5 dBA louder because of the impulsivity. By creating a model that about 5 dBA below the State level ensures that the requirements will still be met.

Mr. Buhrow asked how the measurement of 5 decibels equates to the measurement of distance in feet. Mr. Frank believed that 5 dBA would translate into 700 – 800 feet if traveling downwind, or 300 – 400 feet if traveling upwind.

Computer noise modeling is a different concept than just setbacks alone because it allows for the natural vegetation, or lack of natural vegetation, and wind conditions to be modeled to achieve a target.

Mr. Pratt asked if the Shady Oaks project is the only project in Lee County to use computer noise modeling. Mr. Frank said he was not able to answer that question because he does not know. He did say it is becoming more and more common for any type of industrial facility, including wind farms.

Mr. Pratt asked if there is chart with dBA, are they always L_{eq} . Mr. Frank said yes.

Mr. Fassler asked if that dBA is higher at times. Mr. Frank said yes, that it takes into account everything that has been discussed such as wind speed, the turbine spinning, snow, crop, etc.

Mr. Fassler asked if the State goes out and does its measure, can it come up with numbers that exceed the limit. Mr. Frank said yes, and they can get measures that are below the standard.

Mr. Fassler had concerns about the State doing its assessment at the right time. Mr. Frank explained that people who live at the residences that are being assessed know way more about the ground that the people doing the assessment. Mr. Frank trains his employees to listen to the residents so that accurate information is gathered.

Mr. Bolen said that the Shady Oaks project was not a 10-minute assessment. The data was taken from Met tower figures and put into a computer model.

Mr. Frank explained that the State of Illinois requires that a study be done a minimum of 10 minutes or 60 minutes. These models use international standards which he has never seen challenged in a court of law. They are considered to be very acceptable.

Mr. Bolen asked when noise can cause health problems. Mr. Frank said there is Human Health Risk Assessment or Damage to Hearing. Human Health Risk Assessment means the probability of noise causing stress, lack of sleep, lack of appetite, etc.

Separate from that there is the inner ear mechanism. The general number used for which noise causes damage to hearing is about 75 – 80 dBA. If a person was exposed to a constant average of 75 dBA for 40 years, there becomes a risk for hearing impairment.

Mr. Frank stated that the sound a wind turbine makes is so far below the level of human hearing mechanism that there is no chance of damage to the inner ear.

Mr. Robery said that with regards to wind turbines and noise, hearing damage is not a concern. The concerns are the health affects related to sleep disturbance. Some people may say that annoyance is not a health issue; however, if a person is annoyed to point that he or she can not sleep on a regular basis, it becomes a health issue.

With regards to the Shady Oaks project, Mr. Pratt wanted to know how the County can be sure it has met the requirements. Mr. Frank said that usually the owner/applicant does the studies through a private expert or the State requires it; or the State send one of its employees out to do the assessment. He advised that the regulatory bodies of the County should ensure that this assessment happens. He said that the County could decide in its permitting to ask that measurements be done by the owner.

Mr. Pratt wanted to know about complaints from neighboring residents that the noise is unacceptable. Would the State provide its services in such a situation?

Mr. Frank said that based on his experience of working in almost every state, that it does take “a reasonable amount of effort” to get the State to come and perform an assessment.

Mr. Robery wanted to know if sound levels go from an ambient sound level of 25 dBA to the State's regulatory standard of 51 dBA, is it that same as being 5 times as loud as the ambient sound level.

Mr. Frank explained that 51 dBA is an approximate level. This number came from Shady Oaks data for 30 homes. They looked at the average sound level from 30+ turbines. 51 dBA is a good representation for this committee to consider for turbines in this area. If a person went to the State and referenced 51 dBA, the State would not be familiar with this number.

Mr. Frank said that 35 dBA, on an L_{eq} basis, is a good number to use for rural ambience. A person cannot look at just the quietest periods, they have to consider the noise created from the occasional car passing, or dog barking, or even farm equipment.

The day/night sound level for the EPA is a 24-hour average. The nighttime average from most rural studies is 35 dBA.

Mr. Robery said he has a problem with that because Germany's maximum sound level is the same as rural, nighttime noise level. He did not think that this makes sense.

Mr. Frank explained that contribution of the facility is being regulated, not the ambient. When a study is done in a quieter setting, it is harder to separate the two. You have to start doing fancy measurements to separate the two. To get the ambient in very quiet environments, the turbines may have to be shut down or move equidistance down the road if the ambient is controlled by a nearby highway. You have to use a combination of measurements and models to come up with the "contribution" of a facility.

In reality, it adds to the ambient when the ambient is measured. If the ambient was around 50 dBA and a turbine was 50 dBA, together they would be about 53 dBA. However, you have to look at what caused it to go over, the wind turbine or the ambient.

Mr. Pratt asked if 51 dBA for the Shady Oaks project is a result of turbine placement. Mr. Franks believed that to be correct. Mr. Frank said they looked at the 30 closest residences and the contribution of the wind turbines. This was compared to the Illinois requirements and judge that the requirement was around 51 dBA. If the State was to switch from octave-band to dBA for these 30 homes, it would have come up with 51 dBA.

Mr. Robery wanted to know, whether using 25 dBA or 35 dBA for ambient, if 50 dBA is 5 times as loud as 25 dBA or if 35 dBA is 3 times as loud at 50 dBA. Mr. Frank understood where Mr. Robery was coming from.

Mr. Frank said that before he used the 3 dBA adder because that is the way the human ear reacts to energy but that is not what Mr. Robery is talking about. Mr. Robery is talking about "times louder" which to Mr. Frank means human perception.

Mr. Frank goes from an ambient to 50 dBA, he would have to use the “ten” rule he used before. Every time sound levels increase by 10 dBA, the human perceived would be twice as loud. He feels it is safe to say that the Illinois regulations is about 3 times as loud as the rural ambient.

The next meeting was scheduled for Friday, March 11, 2011, at 7:00 p.m. There will be presentation on noise by an expert chosen by Mr. Robery. If no expert is available, the committee will begin to review all previous discussions.

Chairman Conderman took a moment to thank Mark Wagner for his contribution to this committee while he was on it. Mr. Robery submitted Mr. Wagner’s letter of resignation to Chairman Conderman (see attached)

On the motion of Craig Buhrow, and seconded by Mike Pratt, the meeting was adjourned at 9:07 p.m.

Respectfully submitted,

Alice Henkel

By: _____

February 18, 2011

To Whom It May Concern:

Please be informed that, effective immediately, I am resigning my position on the Lee County Ad-Hoc Committee for Wind Turbine Regulations. I have repeatedly expressed my concern that the committee is biased in favor of continued, unbridled wind development in Lee County. Furthermore, I had hoped for a more detailed look into the issues that concern those whose lives have been negatively impacted by wind turbines.

More specifically, I am not in agreement with the rule that public comment is not allowed. Public comment is essential to a process such as this.

Another issue is that in the past, the Zoning Board has objected to considering wind turbine complaints from neighboring county residents. Yet they allow a wind industry employee who resides in another county to sit on the ad-hoc committee. This is hypocritical.

Finally, the process undertaken by this committee may serve only to modify the conditions allowing wind turbine placement in Lee County, rather than to take a serious look at nuisance, health, property rights, and property value issues.

Please allow my resignation from this committee to serve as protest to a process I believe is fundamentally wrong. Only a new committee, representing a cross-section of Lee County residents, should be called upon to take up this task. I myself am a part-time Lee County resident, and I would prefer to give up my chair to a full-time resident at this time, should the committee continue with its proceedings.

Sincerely,
Mark Wagner

02-23-11 AD-HOC Committee
Sign In SHEET

1	Nora Palmer	Elm Grove, WI	414-640-9351
2	_____	MRP	
3	Matt Boss	Mainstream	312 445 3706
4	Rick KETCHUM	AMBOY	815-857-2283
5	Bob Truchess	Nash, Babylon	815-497-3963
6	Marilyn Shuppert	Rural Dixon	815-288-2611
7	Barbara Bolin	Mainstream	815-445-5491
8	Dij R	Michig Ag _____	815-878-8263
9	Charles Egnor	MRP	312-445-3704
10	WALTER PARSONS	Harmon	815-359-5030
11	DONALD SPACHO	OHIO	815 376-7853
12	DAVID GIULIANI	Stelias, IL	815-798-9085 ^{ext 21}
13	Lauren Kruse	Harmon	
14	Bradd Kruse	Harmon	
15	John Kerner	Franklin Grove	
16	Jack Kelly	Franklin Grove	
17	Mark Wagon	Franklin Grove	
18	Bob Lopez	FRANKLIN GROVE	815-456-2584
19	Susan Miller	Ashton	
20	Kelly Robery	Franklin Grove	
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