BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 2002-01 BP Cherry Point Cogeneration Project	)	EXHIBIT 45.0 (PW-T)

WHATCOM COUNTY'S PREFILED TESTIMONY
WITNESS # 45 : Paul Wierzba, Ph.D., P.Eng.

Q: Please introduce yourself to the Council.

Ans: My name is Paul Wierzba. I am a founder and principal consultant for Trilex Vibroacoustical Corporation based in Calgary, Alberta, Canada. I am a professional engineer registered in the Province of Alberta. I hold a Ph.D. in Mechanical Engineering from the University of Calgary with a specialty in dynamics. My main area of expertise relates to noise and vibration and specifically noise and vibration control of industrial machines and industrial facilitates and installations. Over the past several years most of my professional work experience was related to noise diagnostics, analysis and impact assessment of Oil & Gas and Power Generation facilities. I have responded to numerous noise complaints, performed diagnostic measurements on a number of facilities, carried out detailed noise propagation calculations and modelling for power generation and gas compression installations, and identified noise impact for a number of facilities ranging from small 2 MW cogeneration plants based on Alison gas turbines to large 500+ MW facilities based on Siemens Westinghouse 501F or GE Frame 7FA gas turbines. I have prepared various detailed noise control specifications for power generation and gas compression facilities and designed a number of noise control treatments. I have attached a copy of my résumé hereto (Exhibit A, see EFSEC Ex. # 45.1) for Council's review.

Q: What are the subjects of your testimony?

Ans: In the testimony, I will summarize the findings of my review of the Draft Environmental Impact Statement (DEIS) for the proposed BP Cherry Point Cogeneration facility as it pertains to noise, and whether the noise impact analyses and conclusions presented in the DEIS are appropriate under the circumstances surrounding the project. Specifically, I will summarize the

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findings from my review of the noise model created for the facility for the purpose of the impact assessment, the noise sources used in the model, and will comment on the noise impact on the nearest and most critical points of reception including the nearby heron colony and the staging ground.

Q: What information have you reviewed in this matter?

Ans: I have reviewed the following documents:

1. Chapter 3.9 of the Application for Site Certification – "Noise"
2. Chapter 3.9 of the DEIS – "Noise"
3. Technical Memorandum of Appendix K of the Application for Site Certification – "Summary of Noise Modelling Methodology and Results"
4. Documents associated with the discovery request that the County made of BP
5. Aerial photographs for the area provided by the county
6. Relevant site and area diagrams contained in the DEIS
7. Background noise data collected by the Whatcom County Planning and Development Services.

Q: Did the information give you cause for concern?

Ans: Yes, upon reviewing the information, I had concerns in regard to the way that the noise propagation calculations (modelling) using Cadna A computer software was done and the way that the subsequent noise impact assessment was carried out.

Q: In regard to noise modelling, what specific concerns do you have?

Ans: My concerns related to noise modelling can be grouped into two categories: (1) the actual representation of the facility and (2) the propagation conditions, in particular the meteorological and ground conditions.

In regard to category (1) these are:

- The inlet filter is represented as a suspended barrier/screen. CadnaA computer program does not properly account for the diffraction of sound under the barrier. This may result in excessive screening and under-prediction of far-field levels.
- The HRSG exhausts (stacks) are modeled with "chimney" directivity. The exit flow velocity in the model was set at 30 m/s. This value may be excessive given the typical stack sizes of 18 to 20 feet in diameter and a typical mass flow for Frame 7FA exhaust of 950 lb/s. Excessive stack exit velocities in the model will result in increased directivity correction for the source and lower far-field noise levels from these sources (under-prediction).
- None of the structures in the model, such as buildings, enclosures, HRSG's, etc., are modeled as reflective surfaces. In reality, most of these surfaces will be reflective, particularly at lower frequencies. In complex facilities, the reflective energy component can be significant. Specifying no reflections will tend to under-predict the sound levels.

- Exhibit B, attached hereto (EFSEC Ex.# 45.2), shows the listing of all the sources used in the computer model. Attention is directed towards the column designated as "Attenuation" in the table designated as "Point Source". A single number attenuation was applied to a number of sources. It is uncertain as to what these attenuations represent. Specifically, the sound power for the boiler feed water pumps "BFP" was decreased from the original 111.6 dBA to 108.6 dBA. In the past, I have seen boiler feed water pumps that were measured at as much as 112 dBA sound power. At the same time, the burner skid sound power was adjusted from 110 dBA to 115 dBA.
- All the vertical area sources of the facility (side walls of various building like structures) are modeled with K0 coefficient set at 3. It is uncertain as to why this was done. A review of sound power levels for various sources such as different enclosures, or HRSG body/transition, suggested that the noise sources in the model are in line with those commonly used. The feature will tend to increase the far-field noise levels in the direction of radiation (along the vector normal to the area source) by 3 dB.
- The sources representing load compartment discharges were not present in the model. On standard enclosures these sources have been listed at levels as high as 112 dBA sound power.
- The wooded areas around the plant (the north, west and south) were represented in the model as areas with ground absorption constant G = 1, i.e., fully absorptive. Such a representation is not viewed as appropriate, particular during the nighttime periods when frequent thermal inversions occur. Additionally, the sizes on these areas as set in the model were too extensive as compared to the aerial photographs. In my view these areas should be left specified with the same ground absorption as the rest of the surrounding area for additional safety factor. Alternately, G = 0.5 could be specified. This tends to under-predict the sound levels at the far-field receivers, which are beyond or within the wooded areas.

In regard to category (2) the following are the main concerns:

- The ground absorption used in the model, set at G = 0.5, is viewed as too high. According to Dr. Stenberg, during late winter and early spring period, which is of importance to area herons, the ground in the area is saturated with water. Furthermore, surface water is present within the wetlands to the north of the site. Correspondingly, G = 0.2 is viewed as more representative. ISO 9613 tends to yield excessive ground attenuation with high values of G and many in the field prefer to perform calculations under fully reflective ground conditions (G = 0). High value of ground absorption G tends to reduce the noise levels at the far-field receptors.

  To demonstrate the effect of the some of the concerns listed above, particularly the ground absorption effect, the noise model used by Hessler Associates was modified with the following changes: HRSG stack exit velocity was reduced from 30 m/s to 22 m/s, the ground absorption in the wooded areas was changed from 1 to 0.5, the remainder of the area ground was set at 0.2. Table below shows the results of this comparison.

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Receiver	Sound Levels Original Model		Sound Levels Modified Model	
	dB(A)	dB(C)	dB(A)	dB(C)
Birch Bay	25.5	48.3	27.6	48.5
DP-1	46.0	63.8	48.6	64.4
DP-10	39.8	58.7	42.6	59.3
DP-11	39.0	58.2	42.0	58.9
DP-12	59.8	73.4	61.5	73.9
DP-13	47.3	64.8	51.4	66.0
DP-14	43.1	61.1	45.9	61.7
DP-15	35.3	55.5	38.1	56.1
DP-16	33.9	54.7	36.8	55.2
DP-17	33.8	54.7	36.6	55.2
DP-18	29.8	51.7	32.4	52.1
DP-2	40.6	59.5	43.5	60.1
DP-3	46.3	62.9	49.0	63.6
DP-4	39.4	58.5	42.2	59.1
DP-5	40.1	58.8	42.8	59.5
DP-6	40.5	59.0	43.1	59.7
DP-7	40.3	58.8	42.6	59.3
DP-8	33.7	54.4	36.5	55.0
DP-9	38.1	57.4	41.0	58.0

It is observed that the changes increased the levels at the critical receptors (7, 10, 11, 13, 14) by between 2 and 4 dB(A). The C-weighted levels were not as affected.

- The model did not consider meteorology in sound level predictions. The discussion on the area meteorology is provided in the Exhibit C. See EFSEC Ex. #45.3. Without accounting for meteorological conditions, ISO 9613 was designed to predict long-term average noise levels under mild temperature inversion condition and light winds blowing from source to receiver. This is approximately equivalent to using Concawe prediction method with atmospheric stability class E and no wind, which as per the discussion of Exhibit C (EFSEC Ex. #45.3) represents a median level during nighttime hours. Correspondingly, the expected noise levels at the points of reception would be below those 50% of the time and exceed them 50% of the time. The median levels are viewed as too low for proper impact assessment. It is believed that predictions made using Concawe method with the stability class F and wind speed from source to receiver of 3m/s would yield more suitable results for the purpose of impact assessment. Such settings would effectively cover 90% of all adverse conditions.

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Q: What other issues and/or concerns have you observed in regard to the noise impact analyses and conclusions presented in the DEIS?

Ans: Firstly, the background noise levels for the area were not appropriately established. This made it difficult to perform proper noise impact assessment (see Exhibit E for discussion; EFSEC Ex. #45.5). In the original Golder study, single 15-minute spot measurements were taken at various, undisclosed times of day and night. Such short duration measurements are viewed as insufficient to assess the background levels. Hessler Associates performed proper background level measurements at four selected locations, however, only A-weighted levels were recorded. Furthermore, it appears that Hessler Associates arrived at background levels by averaging L90 measurements for both daytime and nighttime periods. It is believed that noise impact should be gauged relative to the nighttime background levels only. Since daytime ambient sound levels are typically considerably higher than the nighttime values, incorporating those into the overall averages produces artificially high levels of the ambient.

Suitable design targets for the proposed facility reflecting the actual noise impact in the area were not established. A combination of artificially high background noise levels with the sound propagation conditions, which significantly under-predicted the facility noise contribution, created an impression of much lower noise impact on the area than would be expected.

Also, the low frequency component of noise was not considered in sufficient detail. In the Appendix K of the application the C-weighted levels at various receptors are predicted. However, these were checked against the ANSI B133.8 recommended values of 75 to 80 dBC. This limit represents the recommended threshold to avoid complaints related to building vibration induced by airborne low frequency noise. The statement in Appendix K referring to 75 to 80 dBC as a “threshold of perceptibility for low frequency noise and vibration” is not accurate.

Moreover DEIS did not establish any criteria for assessing the noise impact from the proposed facility on the nearby heron habitat and correspondingly such impact was not considered.

Q: In your view, what assessment/design criteria should be considered for the heron habitat?

Ans: The discussion presented in Exhibit D, see EFSEC Ex. #45.4, suggests that assessment criteria applied to the surrounding residences may be appropriate for the heron habitat.

Q: In that case, what is your recommendation for the noise impact assessment criteria?

Ans: The area around the facility, particularly to the north, is fairly quiet. Based on my experience in similarly quiet areas, I found the following to hold true in most cases:

1. Increase of 1 dB in A-weighted levels and up to 6 dB in C-weighted levels is typically unnoticeable.
2. Increase of 3 dB in A-weighted levels and up to 9 dB in C-weighted levels may be noticeable but is not significant. This type of change would have a minimal impact.

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3. Increase of 5 dB in A-weighted levels and up to 12 dB in C-weighted levels will be noticeable. Such a change in level is substantial and may still result in an acceptable impact. Noise related annoyances and complaints could occur.
4. Increase of more than 6 dB in A-weighted levels and 18 or more dB in C-weighted levels will be very audible. Such a change in level is significant and would likely result in annoyances and complaints.

Preferably, Target 2 is used. This implies that on the A-weighted basis, the facility noise emissions are allowed to mach the ambient levels and on the C-weighted basis, the facility noise is allowed to exceed the ambient by 8 dB. If meeting Target 2 proves to be too difficult, Target 3 can possibly be used provided that existing background levels have been properly established on the basis of a multiple night survey.

Q: Given the present design of the proposed facility, how would you rate its noise impact on the most critical points of reception?

Ans: I would rate such impact as very high, particularly towards the receivers to the north.

Q: Why is that?

Ans: To address this point I carried out analysis on the developed noise model. I performed sound propagation calculations using Concawe method with wind speed between 0 and 3 m/s and atmospheric stability class F. Additionally, I set the ground absorption at 0.2 to reflect soil saturation with water/moisture and changed the ground absorption of the treed areas to 0.5. Furthermore, I have established reasonable levels of the existing background noise as shown in Exhibit E. See EFSEC Ex. #45.5. The table below summarizes my findings.

Receiver	Predicted Facility Noise		Existing Background Levels		Difference		IMPACT
	dB(A)	dB(C)	dB(A)	dB(C)	dB(A)	dB(C)	
Bay Road Residences (DP-10)	47.8	61.8	33.0	53.0	14.8	8.8	High
Bay Road Residences (DP-11)	47.4	61.4	33.0	53.0	14.4	8.4	High
Heron Staging Area along Terrell Creek (DP-13)	56.6	68.9	32.0	52.0	24.6	16.9	Severe
Nearest Residence to SE (DP-14)	50.4	63.6	unknown	unknown			unknown
Heron Colony Nesting Area (DP-7)	47.8	61.8	46.0	55.0	1.8	6.8	insignificant
Blaine Road Residences	50.3	63.8	32.0	52.0	18.3	11.8	Very High

In fact, it is possible that the Blaine Road residences and the residence designated as DP-14 may not meet the regulatory requirement of 50 dBA, Leq. It is also observed that given relatively

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high C-weighted ambient levels, the low frequency emissions from the facility will not be of much concern provided that the A-weighted levels are reduced.

END OF TESTIMONY

I declare under penalty of perjury under the laws of the State of Washington that the above testimony is true and correct to the best of my knowledge.

Executed at Calgary, Alberta, Canada , this 7th day of November, 2003.

By: ______________________
Paul Wierzba

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