BEFORE THE STATE OF WASHINGTON

ENERGY FACILITY SITE EVALUATION COUNCIL

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| In the Matter of Application No. 2006-01:<br>ENERGY NORTHWEST;<br>PACIFIC MOUNTAIN ENERGY CENTER | **EXHIBIT** __ (EBH-T) |

**APPLICANT'S PREFILED TESTIMONY**

**WITNESS: ERIC HANSEN**

## Introduction

**Q. Please state your name, current employment position and business address.**

A. My name is Eric Hansen. I am a Senior Consulting Scientist with Geomatrix Consultants, Inc. The business address is: 3500 - 188th Street SW, Suite 600, Lynnwood, WA 98037.



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## Scope and Summary

**Q. Please describe the scope and provide a summary of your testimony in this proceeding?**

A. My testimony addresses air quality issues, including anticipated emissions limits, emissions control technology proposed by PMEC, how PMEC differs from natural gas-fired generating facilities from an air permitting perspective, and the air quality impact analyses we have conducted as part of the air quality permitting process. Integrated Gasification Combined Cycle (IGCC) plants gasify solid fuel on site to create a synthetic form of natural gas called syngas. Syngas has different burning properties from natural gas, so it requires different emission limits. Through installation of emission controls, though, PMEC will be able to meet emission limits that are far lower than those for the two existing U.S. IGCC plants. Emissions modeling and analysis conducted to obtain an air quality permit shows that air emissions from PMEC at these levels will meet applicable standards and not adversely impact air quality in the region.

## Air Quality Permitting and Impacts

Introduction

**Q. Please describe your qualifications for testifying about air quality permitting and impacts of the project, as well as your role in the project.**

A. I have a bachelor's degree in Physical Oceanography and a Master of Science degree in Civil Engineering, both from the University of Washington. I have been an air quality consultant since 1978. I have worked on numerous air quality studies and permit applications, including four that fell under EFSEC's jurisdiction: the Creston coal fired power plant (circa 1980); the Transmountain Pipeline project (circa 1981); the Chehalis Generating Facility (mid and late 1990s); and the Sumas 2 Generating Facility. A current resume is attached as Exhibit __ (EBH-1).



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I am currently a Principal with Geomatrix Consultants, Inc., working from an office in Lynnwood, Washington. Geomatrix is a company of approximately 400 employees, with engineers, geologists, and scientists working in offices throughout the United States.

I was task manager for the air quality and environmental noise components of the Application for Site Certification and for the PSD permit application. I received support from air quality experts at Geomatrix and URS, including Ken Richmond (Class I air quality modeling), Eric Albright (Class II air quality modeling), and Kristen Wallace (environmental noise) of Geomatrix, and Todd Royer, Julie Mitchell, and John Lague of URS (initial BACT analysis, emission calculations, and Class II modeling).

Sources of Emissions

**Q. What are the sources of emissions to the atmosphere at PMEC?**

A. The primary sources of air pollutant emissions at PMEC are the two combustion turbines. Except for changes to the combustors to accommodate syngas, which has less energy per cubic foot of gas than natural gas, these combustion turbines are virtually the same as those EFSEC has permitted for generation projects at Cherry Point, Sumas, Satsop, Chehalis, and Wallula.

There are also several other emission sources at PMEC, but during normal operation emissions from these other units are minor. These other emissions sources include: an auxiliary boiler fired with natural gas, used during startup and shutdown; two cooling towers; a diesel fired generator that provides emergency electrical power; a tank vent oxidizer that oxides off gases, such as oxidizing hydrogen sulfide to $SO_2$; a flare that operates only with a



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pilot light except during startups, shutdowns, and malfunctions; and fuel handling during the unloading and conveying the solid fuel stock (coal or petroleum coke). All of these emission sources are found at natural gas-fired combustion turbine based plants with the exception of the tank vent oxidizer, solid fuel handling, and the flare.

Control Technology & Emission Limits

**Q. How will PMEC control emissions of criteria pollutants?**

A. Energy Northwest is committed to using technologies that will ensure PMEC will have significantly lower emissions than other solid fueled power plants and existing U.S. IGCC plants. For coal or petroleum coke-fueled power plants, oxides of nitrogen (NOx) and oxides of sulfur (primarily sulfur dioxide, or $SO_2$) are the two pollutants of primary concern. Energy Northwest proposes to use Selective Catalytic Reduction (SCR) to control NOx emissions. SCR is the NOx control technology that is considered “best available control technology” (BACT) for the natural gas fired combustion turbines permitted by EFSEC. SCR will reduce NOx emissions to 3 ppm, which is equivalent to the BACT emission rate for many natural gas power plants and far exceeds control achieved by existing U.S. IGCC plants and solid fuel fired power generating plants.

To control $SO_2$ emissions, PMEC will use Selexol technology to remove sulfur from the syngas. Energy Northwest proposes to achieve 30 ppm sulfur in the syngas on an hourly basis and 10 ppm sulfur on an annual average. This is only 2-3 times higher than the sulfur levels found in pipeline natural gas and, again, is far better than the control achieved by the two existing U.S. IGCC plants.



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Energy Northwest proposes to minimize emissions of carbon monoxide (CO), small particulate matter (PM10), and volatile organic compounds (VOC) by optimizing combustion and burning clean gaseous fuels.

Operations

**Q. From an air quality perspective, how do facility operations differ from the natural gas-fired generation projects EFSEC has previously approved?**

A. The only substantive difference is the gaseous fuel used to generate electricity. Rather than using natural gas delivered in a pipeline, IGCC plants gasify solid fuel on site to create syngas, a synthetic form of natural gas. This requires that ships, barges, or trains deliver solid fuel feed stock (coal or petroleum coke). The facility must unload, convey, and store the feed stock. Although Best Available Control Technology would be applied to the material handling, small quantities of dust would be generated.

There are virtually no emissions from the gasifiers themselves. The primary product is a synthetic gas consisting primarily of carbon monoxide and hydrogen, which is directed to the combustion turbines. Small quantities of hydrogen sulfide and other gases result from various intermediate steps and storage tanks, but these are safely oxidized by the tank vent oxidizer.

In contrast to natural gas-fired units, PMEC would also operate a flare. Unlike a natural gas-fired generation facility, which can simply close a pipeline valve if the combustion turbines suddenly go off line, an IGCC facility must vent the gas being synthesized by the gasifiers to a flare in the event one or both combustion turbines must suddenly shut down. The flare



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safely burns the syngas. The flares also combust syngas as the gasifiers come on line during a startup.

**Q. Will emissions from PMEC be visible during operation?**

A. We expect that the PMEC air quality permit will prohibit visible emissions, except for water vapor. The heat recovery steam generator stacks (associated with the combustion turbines) will have visible elevated water vapor plumes during periods of high relative humidity. The cooling towers will create larger plumes that are closer to ground level. Typical visible plume lengths from the cooling towers will be less than 130 feet long and less than 100 feet high, but plumes as long as 3300 feet may occur in as many as 6 percent of daytime hours. Visible plumes are most likely to occur when the weather is very damp, foggy or rainy, but these are generally periods when visibility is already obscured.

**Q. What is the plant doing to control mercury emissions?**

A. Mercury occurs naturally in coal and in the crude oil from which petroleum coke is formed. The mercury content of Powder River Basin coal was used for design purposes for PMEC. Typically, mercury concentrations in the Powder River Basin coal are at least 50 percent higher than in petroleum coke. Because the coal has higher mercury concentrations than petroleum coke and because more coal than coke is required for full gasifier production, the Powder River Basin coal was used to conservatively estimate mercury emissions.

Energy Northwest will reduce mercury emissions by installing activated carbon beds specifically designed to control mercury that remains in the syngas after it is processed. The application commits to designing the system to remove 95% of the mercury found in the feed stock. However, Energy Northwest is proposing a permit condition limiting mercury to 90%



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of that in the feed stock, because the design engineers advise that is the highest level of reduction that vendors will guarantee.

**Q. Will the plant comply with EPA's New Source Performance Standards and Clean Air Mercury Rule (CAMR) or a state equivalent?**

A. Yes. Based on mercury emissions that are 10 percent of that in the feed stock, Energy Northwest anticipates annual emissions of 58 pounds of mercury. At a gross generating rate of 853 MW, the mercury emission rate would be 0.0078 pounds per Gigawatt hour, or 39 percent of the current mercury limit in federal New Source Performance Standards for IGCC plants. Ecology and EFSEC are currently engaged in rulemaking that could alter this limit at some point in the future. PMEC is participating in the rulemaking process and supports a cap-and-trade approach to controlling mercury emissions from power plants. PMEC intends to comply with applicable state rules developed for controlling mercury emissions from electric generating units.

Impacts

**Q. What type of analysis did you conduct to determine whether PMEC emissions will affect local air quality?**

A. Under the federal and state Clean Air Acts, we use representative pollutants known as criteria air pollutants to judge air quality. The criteria pollutants include nitrogen dioxide ($NO_2$), carbon monoxide (CO), sulfur dioxide ($SO_2$), particulate matter (PM10 or PM2.5), ozone, and lead. The Environmental Protection Agency, the Washington Department of Ecology, and local agencies like the Southwest Clean Air Agency establish acceptable concentrations of these pollutants in the outdoor "ambient" air; these acceptable concentrations, known as ambient air quality standards, are the primary bases for judging air quality.



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A more stringent criterion is the "Significant Impact Level" or "SIL." The SILs represent incremental, project-specific screening levels that Washington uses to evaluate the potential significance of project impacts with respect to maintaining compliance with ambient air quality standards. The SILs are typically only one percent or so of the ambient air quality standard. When concentrations attributable to a new or modified source of industrial air emissions are evaluated and found to be less than the SILs, regulatory agencies conclude that the impact of that new or modified source is insignificant.

Geomatrix applied the EPA-sponsored "AERMOD" air quality dispersion model to simulate how emissions from PMEC sources would disperse in the ambient air. For local modeling, we relied on a year of hourly meteorological data collected at a station operated at Noveon Chemical (about two miles south of the PMEC site). We believe this is an excellent source of meteorological data because it is close enough to the PMEC site to capture the channeling of winds through the Columbia River valley.

Even using worst-case assumptions regarding PMEC emissions, maximum predicted annual average concentrations of $NO_2$, $SO_2$, and PM10 and short term concentration of CO attributable to PMEC sources are less than the SILs. Impacts for emissions of these criteria pollutants from PMEC, therefore, are considered insignificant and no further impacts analysis is warranted. Predicted short-term (1-hour, 3-hour, and 24-hour average) $SO_2$ concentrations and 24-hour average PM10 concentrations, however, exceeded the SILs for some operating scenarios. Further analysis, therefore, was warranted for these criteria pollutants.



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**Q. How did you analyze potential cumulative impacts for $SO_2$ and PM10 emissions?**

A. The "Prevention of Significant Deterioration" (PSD) permitting rules require modeling to consider the cumulative impact of regional industrial sources if predicted concentrations exceed the SILs. Modeled short-term concentrations of PM10 and $SO_2$ exceed the applicable SILs, so we conducted cumulative impact analysis for those pollutants. Geomatrix ran a screening analysis using $SO_2$ and PM10 emission data for more than 100 facilities, using data on actual emissions provided by the Southwest Clean Air Agency; the data had previously been used in scientific studies aimed at understanding the sources of air pollution affecting the Columbia River Gorge. This analysis identified two industrial sources in Oregon and two industrial sources in Washington that have concentrations over the SILs in the same area that PMEC impacts. PMEC worst-case $SO_2$ and PM10 emissions were modeled again with emissions from these four facilities included. The results of this cumulative modeling, plus background concentrations of $SO_2$ and PM10, are displayed in Table 5.1-30, from the March resubmittal, below. The table indicates that total cumulative concentrations of $SO_2$ and PM10 would not exceed ambient air quality standards. This modeling demonstrates that adding PMEC to actual emissions from these existing sources will not result in an adverse impact on air quality for $SO_2$ and PM10 in the area potentially impacted by PMEC emissions.



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**TABLE 5.1-30**
**MAXIMUM PREDICTED CUMULATIVE ANALYSIS**
**CRITERIA POLLUTANT CONCENTRATIONS**

Concentrations in micrograms per cubic meter (μg/m$^3$)

| Pollutant | Averaging Period | PMEC and Regional Industrial Sources[1] | PSD Increment | Over PSD Increment | Back-ground | Total[2] | AAQS[3] | Over AAQS? |
|---|---|---|---|---|---|---|---|---|
| $PM_{10}$ | 24-Hour | 8.14 | 30 | No | 58.0 | 66.1 | 150 | No |
| $SO_2$ | 1-Hour | 691 | None | NA | 136 | 828 | 1,050 | No |
| | 3-Hour | 171 | 512 | No | 96.8 | 268 | 1,300 | No |
| | 24-Hour | 11.3 | 91 | No | 44.5 | 55.8 | 262 | No |

1 Maximum from all normal operating scenarios.
2 Sum of the maximum predicted concentration attributable to PMEC and regional industrial sources contributing significantly in the PMEC impact areas, and the background concentration.
3 AAQS = Ambient Air Quality Standard. The most stringent standard from among NAAQS/WAAQS/OAAQS.

Using actual emissions for this analysis is consistent with Washington Department of Ecology (Ecology) and Oregon Department of Environmental Quality (DEQ) requirements. At this point in the process, however, EPA has asked that the analysis be revised to use allowable or potential emissions rather than actual emissions. This is a very difficult request to honor, because many of the industrial sources in the area have never before been required to determine their allowable or potential emissions.

**Q. How are you responding to EPA's request to reanalyze $SO_2$ and PM10 using potential emissions rather than actual emissions in order to determine that PMEC won't adversely impact compliance with National Ambient Air Quality Standards for $SO_2$ and PM10?**

A. We are working with EPA staff to find a solution to their request. Because neither Washington nor Oregon have the emission data EPA has asked us to use, we have applied scaling factors to the actual emissions data from the Gorge study provided by the Southwest Clean Air Agency. We found that even if we multiply the actual emissions of existing



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sources in the region five-fold, only five more sources than the four we've already included result in significant $SO_2$ and PM10 concentrations in the area PMEC significantly affects. We are now attempting to determine potential emissions from these nine regional sources.

While we cannot be certain of the outcome, we anticipate that the modeling will show compliance with National Ambient Air Quality Standards. This expectation is based on the fact that we have already determined that we could multiply the regional emission inventory by a factor of 12 or more and still show compliance with 24-hour standards for PM10 and $SO_2$, and by a factor of 7 or more and still show compliance with the 3-hour $SO_2$ standard. To satisfy EPA, we will collect or estimate potential emissions from each of the nine contributing sources and document our modeling analysis.

**Q. You have testified that predicted concentrations will be below the ambient air quality standards, but will PMEC worsen air quality?**

A. The federal and state ambient air quality standards are limits set to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Air quality in the region around the PMEC site is in attainment with these ambient standards. The purpose of EPA's "Prevention of Significant Deterioration" permit program is, as its name indicates, to ensure that new sources of air emissions do not degrade air quality to the point where pollutant concentrations are barely in compliance with ambient air quality standards. To accomplish this goal, the PSD program prescribes "increments" of higher concentrations over baseline levels established almost 20 years ago for $NO_2$ and 30 years ago for PM and $SO_2$. Table 5.1-30 also compares predicted incremental increases due to PMEC and other regional sources against the prescribed increments, and demonstrates that the incremental increase in concentrations will not "significantly deteriorate" air quality.



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**Q. Did you evaluate impacts to National Parks and Wilderness Areas?**

A. As part of the PSD air quality permitting process for PMEC, we have conducted regional modeling to characterize impacts to certain national parks and wilderness areas. These relatively pristine "Class I" areas warrant special consideration and evaluation. Consequently, we evaluated pollutant concentrations, deposition, and visibility impacts at Mt. Rainier and Olympic national parks and eight wilderness areas. In addition, we evaluated impacts to the Columbia River Gorge National Scenic Area even though it is not formally classified as a Class I area. The evaluation was conducted using the CALPUFF modeling system and three years of meteorological data covering a geographic area of nearly 85,000 square miles, extending from Port Angeles, Washington to Eugene, Oregon, and from the Pacific Ocean to Yakima, Washington.

The modeling predicts maximum NOx, $SO_2$, and PM10 concentrations in the national parks and wilderness areas attributable to PMEC are well below -- less than 32% of -- the "Significant Impact Levels" (SILs). As discussed above, SILs are screening levels used to evaluate the potential significance of project impacts. The SILs for Class I areas are much more stringent than those that apply outside of such areas. When the modeling predicts concentrations that are below the applicable SILs, no further analysis is necessary under the regulations.

In addition to modeling for impacts to air quality in Class I areas, we also applied the CALPUFF model to predict impacts of sulfur and nitrogen emissions from PMEC on soils, vegetation and aquatic resources in the national parks and wilderness areas. There are no state standards for evaluating these impacts in Washington and Oregon, but the National Park Service has established Deposition Analysis Thresholds (DATs) for nitrogen and sulfur of



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0.005 kilograms per hectare per year (kg/ha/yr). This threshold is based on natural background deposition values culled from various research efforts, a variability factor, and a safety factor that accounts for cumulative effects. The nitrogen and sulfur DATs are not adverse impact thresholds, but are intended as conservative screening criteria that allow the Federal land managers (FLMs) to identify potential deposition fluxes that require their consideration on a case-by-case basis. The regional modeling study predicted deposition rates attributable to PMEC emissions that are no more than half these screening levels within all Class I areas.

Finally, we also examined the potential effect of emissions from PMEC on visibility in national park and wilderness areas, using concentrations predicted by the CALPUFF model. The criterion used to determine a noticeable change in visibility is a 5 percent change in light extinction compared with clean background conditions. The maximum predicted change in extinction in these areas based on three years of simulations was 4.5 percent in the Mt. Hood Wilderness Area. The predicted maximum changes to extinction for the other areas are typically much lower. Based on the screening criterion, the CALPUFF simulations indicate PMEC emissions would not significantly degrade visibility in national parks and wilderness areas.

Although it is not a Class I area under the regulations, we also investigated the Columbia River Gorge National Scenic Area (CRGNSA) using the same analytical tools that we applied to the national parks and wilderness areas. Predicted concentrations attributable to PMEC emissions are higher at the west end of the CRGNSA than in the parks and wilderness areas but are still lower than EPA's proposed SILs. Similarly, deposition of sulfur and nitrogen are higher but are still less than the National Park Service's Deposition Analysis



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Threshold. Finally, there are two days (in three years of evaluation) when there may be a perceptible effect on visibility at the west end of the CRGNSA; the maximum and second highest predicted changes in extinction are 8.68 and 5.16 percent, respectively. Both the highest values occurred in February, when local stations reported 100 percent cloud cover and low ceiling heights. Thus, it is unlikely that the change in extinction would actually cause a noticeable change in visibility.

**Q. How will PMEC emissions affect air quality in the Portland/Vancouver metropolitan area?**

A. As noted above, dispersion modeling indicates that pollutant concentrations fall to insignificant levels within a few miles of the site. Therefore, PMEC would have an insignificant incremental effect on air quality in the Portland/Vancouver area.

We relied on a study conducted by Oregon Department of Environmental Quality and Washington State University to address potential effects on ozone concentrations in the Portland/Vancouver area. That study analyzed ozone concentrations in the region with and without industrial sources of air emissions. The results indicated that, without emissions from industrial sources, some areas would have lower ozone concentrations and some would occasionally have higher ozone concentrations. There was no change in the maximum ozone concentrations observed in the region. The implication of this study is that emissions from PMEC would not compromise the area's current compliance with the ozone ambient air quality standard.

**Q. Will construction of PMEC have an impact on air quality?**



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A. As with any major construction project, there will be a certain amount of fugitive dust and engine emissions from construction equipment during the construction phase. Fortunately, the site topography is relatively flat, so grading for construction is expected to be limited in extent. Furthermore, the predominant wind direction is aligned with the north-south river valleys, which will limit potential impacts on residences nearest the site, which are across the river. In addition, construction activities are subject to requirements to take precautions to limit fugitive emissions, such as by watering and washing truck tires before exiting the construction site, and PMEC has proposed those measures as mitigation.

**Q. Does this complete your testimony?**

A. Yes it does.

**EXHIBIT LIST**

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