ATTACHMENT B

Earth Tech, Inc., letter to John Britton, "Proposed Stationary Source Permit to Operate Dated October 19, 2007, Mirant PRGS, Alexandria, Virginia", November 19, 2007

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November 19, 2007

Mr. John Britton
Schnader Harrison Segal & Lewis LLP
2001 Pennsylvania Avenue Suite 300
Washington, DC 20006

RE: Proposed Stationary Source Permit to Operate for the Mirant Potomac River Generating Station, Alexandria, Virginia, Dated October 19, 2007

Dear Mr. Britton:

Earth Tech has reviewed the above referenced State Operating Permit (SOP) for the Mirant Potomac River Generating Station (PRGS). Earth Tech has reviewed this SOP per your request acting on behalf of the City of Alexandria. Earth Tech has proven success in helping public- and private sector customers solve air, water and land quality, waste management and environmental planning, compliance and cleanup challenges. Steve Duda has over 25 years of experience managing and conducting human health and ecological risk assessments and National Environmental Policy Act (NEPA) studies and has provided expert witness support for a variety of environmental issues; Ms. Howard has over 15 years of experience as an Environmental Scientist evaluating chemical impacts to human health; and another contributing author, Dr. Parker, has over 30 years of extensive experience that includes a wide variety of socioeconomic as well as economic feasibility and impact studies, and technical analyses for NEPA studies.

The remainder of this letter (Section I through Section VII) provides a discussion of Earth Tech's review of the SOP.

I. Introduction

Earth Tech reviewed the proposed SOP specifically to evaluate health effects that would result from PRGS emissions of particulate matter equal to or smaller than 2.5 micrometers ($PM_{2.5}$). This review indicates that health effects are likely and that some of the operating scenarios in the SOP would produce potentially unacceptable increases in adverse health effects. These potential increases in adverse health effects are particularly troubling because the technology exists that would reduce emissions of $PM_{2.5}$ and the associated adverse health effects.

II. Health Effects Associated with $PM_{2.5}$

The effects of airborne pollutants are well documented and are the driving force behind air quality regulations. Extensive analyses have been conducted that indicate a wide range of human health and welfare effects linked to emissions of $PM_{2.5}$. Potential human health effects associated with $PM_{2.5}$ range from premature death (mortality) to illness and disease (morbidity). Health effects (e.g., respiratory and cardiovascular symptoms resulting in hospital admissions, asthma exacerbations, and acute and chronic

bronchitis)[1] are linked to long-term (chronic) and shorter-term (acute) exposures to $PM_{2.5}$. These health effects do not begin at any particular level of exposure such as the level established by the National Ambient Air Quality Standards (NAAQS); NAAQS do not represent a zero risk level. In other words, $PM_{2.5}$ does not have a documented threshold level at which health effects begin to occur (Dockery et al. 1993, Pope et al. 1995, and Pope et al. 2002) but rather any increase in $PM_{2.5}$ could result in an increase in health effects.

III. Assessment Methodology

This potential for health effects from PRGS-related increases in $PM_{2.5}$ was evaluated for the purpose of assessing the proposed SOP. Modeled results were based on the "maximum" or "worst-case" operating scenario[2] presented in the SOP for PRGS. This scenario is one of a potential 119 different operating scenarios presented in the SOP and was selected because it represents one of the potential higher-levels of plant impacts (i.e., a "worst-case"). However, there is at least one scenario allowed within the SOP for which impacts would be higher. Impacts based on this scenario were modeled using the U.S. Environmental Protection Agency (EPA) approved AERMOD for receptors within an 800 meter grid around PRGS and for the most highly impacted receptors at the Marina Towers condominium complex. Assumptions for the AERMOD analysis conducted by Alexandria are shown in Table 1. The maximum daily average $PM_{2.5}$ generated for a 365-day period was used to evaluate potential health impacts for the population within the 800 meter grid area including the residents of the Marina Towers.

The health impacts were assessed using the EPA's Environmental Benefits Mapping and Analysis Program (BenMAP). BenMAP is a computer program that integrates a number of the modeling elements used by the EPA to evaluate the benefits of new air regulations (e.g. the Final Clean Air Interstate Rule). BenMAP integrates a number of modeling elements used in previous Regulatory Impact Analyses (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) to translate modeled air concentration estimates into health effect incidence estimates and monetized benefit, or in the case of this analysis, monetized detriment. The initial health effects and costs generated from the model are presented in Table 2.

The cost of mortality from the modeled scenario would be equivalent to a direct cost of over 31 million dollars for just one year for the population within the local 800 meter grid[3]. Additional health effects (i.e., lung disease, asthma, etc.) related to the increase of $PM_{2.5}$ from PRGS would increase the annual health-related costs to nearly $34 million. These health effects and their associated direct costs are presented in

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[1] These effects are well documented through-out the literature and in reviews of the benefits of air regulations conducted by the EPA, for example the *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources* (EPA 2007).

[2] This scenario assumes a rate of primary PM_{10} 0.062 pounds per Million British Thermal Units (MMBtu) at an operational output level assumed to be 30% below the maximum daily impacts allowed under the proposed SOP. This scenario used '2 base' scenario C3E, i.e., 2 boilers operating at the minimum load for 24 hours per day while the draft SOP allows for a '3 base' scenario, in which 3 boilers run at a minimum load for 24 hours per day.

[3] Approximately 5000 people were estimated as living within this grid by PopGrid. The foundation for calculating the population level in the population grid-cells is the 1990 and 2000 Census block data. PopGrid is an application developed by Abt Associates that combines the Census block data with any user-specified set of population grid-cells, so long as they are defined by a GIS shape file. This application is too large to be contained within BenMAP, so the population estimates were estimated with PopGrid by a representative of Abt Associates (personal communication between E. Schreiber of Earth Tech and H. Mahoney of Abt Associates).

Table 2. The net present worth[4] of $PM_{2.5}$ related health impacts for the modeled scenario would be 665 million dollars for the next thirty years. A complete discussion of the assumptions used for air modeling and the health effects assessment will be provided in a report to be completed by January 2008.

IV. Department of Energy Special Environmental Analysis

The U.S. Department of Energy (DOE) performed a Special Environmental Analysis (SEA) for actions taken under DOE's emergency order regarding operation of the PRGS (DOE 2006) that also addressed health effects. DOE evaluated health effects for a broader population using a grid of 36 square miles (approximately 93 kilometers). Assumptions used by DOE to conduct air modeling are shown in Table 1. DOE determined in the SEA that during the operating period from December 1, 2006 to December 1, 2007 plant emissions[5] would result in an increased incidence in mortality of 2.3 adults over 30-years old (within the 36 square mile grid). This health effect would be equivalent to a direct cost of over 17 million dollars for just one year (see cost figures presented in Table 3). DOE presented additional health effects related to the increase of $PM_{2.5}$ from PRGS for the eastern region. These health effects and their associated direct costs are presented in Table 3. The net present worth of $PM_{2.5}$ related health impacts for the next 30 years is over three billion dollars.

V. Uncertainty

The numbers listed in Table 1 derive from only one of the potential worst-case emission scenarios for PRGS; therefore maximum 24-hour impacts may be even higher than estimated. The values presented in Table 1 were estimated based on the maximum 24-hour average as the annual concentration to evaluate mortality effects, they do not include an evaluation of sensitive receptors like infants and the elderly, maximally exposed people (someone that exercises everyday outside) nor do they include an evaluation of other air pollutants like (ozone, hazardous air pollutants, silica, NO_x and SO_2) that could combine to create greater incidence of health effects or increase the severity of the health effects. The EPA has established in its Risk Assessment Guidelines for Superfund (EPA 1989) that a probability of cancer occurrence that is greater than one in one million (1 in 1,000,000) as a result of exposures to contaminants at hazardous waste sites is considered significant. The impacts for mortality estimated for exposures to modeled values of $PM_{2.5}$ by DOE would yield a risk of approximately 16 in one million[6]. Likewise, while the costs used to value health impacts may not apply to all individuals and situations they also do not take into account many secondary costs associated with illness like the loss of productivity of an individual or mental health effects of long illnesses.

[4] Net Present Worth represents costs that are estimated in current dollars, escalated to the time when they would be spent, and then corrected to a present worth using a discount rate (3%).

[5] This scenario assumed a rate of primary PM_{10} 0.055 pounds per MMBtu at an operational output level assumed to be that allowed under the Administrative Consent Order (ACO). The ACO did not allow operation under scenarios that would have impacts as high as they would be under the '2 base' scenario C3E, i.e., 2 boilers operating at the minimum load for 24 hours per day or a '3 base' scenario, in which 3 boilers run at a minimum load for 24 hours per day.

[6] Based on the rate of mortality estimated by DOE in the SEA for a population of 30 and over within 36 square miles of PRGS.

VI. Conclusions

The air modeling, estimation of health effects, and valuation of these effects presented in this letter have several layers of uncertainty. These comments are not meant to function as a definitive scientific assessment of the health impacts from PRGS. However, the magnitude of the health effects and the costs presented herein represent the potential risk of PRGS to the residents of Alexandria. Additionally, these risks appear to be proportionally larger for the population of Alexandria versus the region. Diligence from the regulating community should be requested to ensure that the potential health risks are appropriately managed through both engineering and management controls and that there is transparency in the regulatory permitting process that allows for accountability of the levels set in the SOP.

VII. References

Dockery DW, Pope CA, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BGJ, Speizer FE. 1993. "An association between air pollution and mortality in six U.S. cities". *New England Journal of Medicine* 1993; 329: 1753-1759.

Pope CA, 3rd, Thun MJ, Nmboodiri MM, Dockery DW, Evans JS, Speizer FE, Heath CW, Jr. 1995. "Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults". *American Journal of Respiratory & Critical Care Medicine* 1995; 151: 669-674.

Pope CA, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, Thurston GD. 2002. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association* (JAMA) 2002; 287: 1132-1141.

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U.S. Environmental Protection Agency (EPA). 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002 .Office of Emergency and Remedial Response. Washington, DC. December 1989.

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Should you have any questions, please feel free to contact me at 864-234-3595.

Very truly yours,

Earth Tech, Inc.

Steve Duda
Sr. Environmental Scientist/Program Manger

Leslie Howard
Sr. Environmental Scientist

Attachments

Table 1
Assumptions used in the Concentration Estimates which Support Each of the US DOE SEA's and Alexandria's Estimates of Premature Mortality and Health Effects

	US DOE SEA-04 (Nov. 2006)	Alexandria's Analysis
Region Studied	App. 10 x 10 km grid	800 x 800 m receptor grid
Pollutants Used	Primary $PM_{2.5}$ with an additional sulfate component (assuming conversion of plant's SO_2 impact at a 0.07 conversion rate on 24-hour basis)[1]	Primary $PM_{2.5}$
Rates of Primary PM_{10} Assumed [3]	0.055 lb per MMBtu	0.062 lb per MMBtu
Operational Output	Maximum allowed under 'Operations under the Order' and 'Potential Extension of the Order.'	Scenario which underestimates by approximately 30% the maximum daily impacts allowed under proposed draft SOP. [4]
Time Period Used in Health Effects Calculations	Annualized, grid-averaged value.	Maximum daily estimate.
Downwash Dimensions	US EPA's BPIP-PRIME	Equivalent Building Dimensions
Approximate Maximum Daily Impact of Total $PM_{2.5}$ among all Receptors for Operations Studied[2]	***Total $PM_{2.5}$ = 72 $\mu g/m^3$*** (includes sulfate contribution and fugitive dust sources, although these have a low impact on top of Marina Towers)	***Total $PM_{2.5}$ = 65 $\mu g/m^3$*** (from Primary $PM_{2.5}$ only, no fugitive sources)

Notes:

1. Uses value for maximum PM_{10} 24-hour average in SEA's Table 4.3.1-2, equivalent to 67 $\mu g/m^3$, scaled by 0.75 (for $PM_{2.5}/PM_{10}$) and adds 7% of the 24-hour maximum SO_2 concentration allowed under the order of 314 $\mu g/m^3$
2. Overall highest impact occurs on Marina Towers.
3. US DOE applied a scaling factor of 0.75 to estimate PM2.5 primary emissions from PM10 primary emissions from the stack sources.
4. Used '2 base' scenario C3E, i.e., 2boilers operating at minimum load for 24 hours per day while draft SOP allows a '3 base' scenario, in which 3 boilers run for 24 hours per day).

Table 2
Costs Associated with the Estimated Incidence of Health Effects for the 800 Meter Grid around the PRGS

Health Effect	Study Population	Epidemiological Study Used	Valuation Source[1]	Annual Predicted Cases	Direct Costs U.S. 2000$ by Case	Direct Costs U.S. 2007$ by Case[2]	Direct Costs Totals $2007[3]
Mortality							
Premature mortality - all cause	30-99 years	Pope et al. (2002)	BenMAP	4.10	6,305,055	7,648,032	31,353,106
	Infant (<1 year)	Woodruff et al. (1997)	BenMAP	0.0038	5,720,190	6,938,590	26,367
Chronic Illness							
Chronic bronchitis	27-99 years	Abbey et al. (1995)	BenMAP	3.99	338,040	410,043	1,635,498
Nonfatal heart attacks	18-99 years	Peters et al. (2001)	BenMAP	6.89	35,090	42,564	293,163
Hospital Admissions							
Respiratory		*Pooled estimate:*					
- Chronic lung disease	65-99 years	Moolgavkar (2003) Ito (2003)		0.41	13,764	16,695	6,802
- Chronic lung disease (less Asthma)	18-64 years	Moolgavkar (2000)	BenMAP	0.37	13,720	16,643	6,081
- Asthma	0-64 years	Sheppard (2003)		0.60	8,020	9,729	5,874
- Pneumonia	65-99 years	Ito (2003)		1.30	16,264	22,154	28,778
Cardiovascular		*Pooled estimate:*					
- all cardiovascular		Moolgavkar (2003)					
- Ischemic heart disease	65-99 years	Ito (2003)	BenMAP	0.77	21,503	26,083	19,977
- Dysrhythmia		Ito (2003)					
- Congestive heart failure		Ito (2003)					
Asthma-related ER visits	0-17 years	Norris et al. (1999)	BenMAP	3.11	261	316	984
Other Health Endpoints							
Acute bronchitis	8-12 years	Dockery et al. (1996)	BenMAP	3.86	59	72	278
Upper respiratory symptoms	9-11 years	Pope et al. (1991)	BenMAP	49.01	26	32	1,555
Lower respiratory symptoms	7-14 years	Schwartz and Neas (2000)	BenMAP	50.67	16	19	965
Asthma exacerbations		*Pooled estimate*[4]:					
- Cough		Ostro et al. (2001) Vedal et al. (1998)					
- Wheeze	6-18 years	Ostro et al. (2001)	BenMAP	46.33	74	89	4,136
- Shortness of breath		Ostro et al. (2001)					
Work loss days	18-64 years	Ostro (1987)	BenMAP	1045.25	179	217	225,324
Minor restricted activity days	18-64 years	Ostro and Rothschild (1989)	BenMAP	5569.83	51	61	341,573
Total Direct Costs 2007 Dollars							33,951,460

Total Estimated, *Actual* Direct Costs from 2007 to 2037 = $1,697,663,924

Total Estimated, *Net Present Value, Direct* Costs from 2007 to 2037 = $665,448,614

Notes:

PRGS - Potomac River Generating Station in Alexandria, VA.

1. BenMAP provides several options (when available) for valuing health effects. The sources used were those with values similar to those used to cost the values used to estimate costs for the health effects estimated by DOE in Table 3.
2. U.S. Dollars were adjusted to 2007 values by applying the U.S. Bureau of Labor Statistics inflator from the Consumer Price Index for all urban households.
3. Multiplies the $2007 costs by the number of cases.
4. Asthma exacerbation cough studies Ostro et al. (2001) and Vedal et al. (1998) were first pooled together and then those results were pooled with wheeze and shortness of breath data.
5. Based on 2007 dollars inflated at an assumed annual rate of three percent (3%) each year for the 30 year period.
6. Net Present Value Costs represent costs in 2007 dollars and are estimated by multiplying the total yearly cost by a present worth factor of 19.6 which reflects a discount rate of three percent (3%).

Table 3

Costs Associated with the Expected Incidence of Health Effects for the Eastern United States

Based on the U.S. Department of Energy (DOE) Modeling and Health Assessment (DOE 2006[1])

Health Effect[1]	Valuation Source[2]	Annual Predicted Cases (DOE 2006)[1]	Direct Costs US 2000$ by Case[2]	Direct Costs US 2007$ by Case[3]	Direct Cost Totals $2007[4]
Premature mortality (adults, 30 and over)	Viscusi 1992	23	6,300,000	7,644,000	175,812,000
Infant mortality (infants less than one year)	Viscusi 1992	0.05	6,300,000	7,644,000	382,200
Chronic bronchitis (adults, 26 and over)	Viscusi et al. 1991	13	340,000	412,533	5,362,929
Non-fatal myocardial infarctions (adults, 18 and older)	Eisenstein 2001	31	49,651-126,602	62,499	1,937,475
Hospital admissions - Respiratory (adults, 20 and older)	Agency for Healthcare Research and Quality, 2000	8	12,000-18,000	14,560	116,480
Hospital admissions - Cardiovascular (adults, 20 and older)	Agency for Healthcare Research and Quality, 2000	7	21,000-23,000	25,480	178,360
Emergency room visits for asthma (18 and younger)	EPA 2006	19	300	364	6,916
Acute bronchitis (children, 8-12)	EPA 2006	29	360	437	12,673
Asthma exacerbations (asthmatic children, 6-18)	EPA 2006	440	40	49	21,560
Lower respiratory symptoms (children, 7-14)	EPA 2006	349	15-50	18	6,282
Upper respiratory symptoms (asthmatic children, 9-11)	EPA 2006	267	15-50	18	4,806
Work loss days (adults, 18-65)	EPA 2006	2,488	100	121	301,048
Minor restricted activity days (adults, age 18-65)	Ostro and Rothschild (1989)	14,823	50	61	904,203
Total Direct Costs 2007 Dollars					**185,046,932**

Total Estimated, *Actual* Direct Costs from 2007 to 2037 = $9,252,842,181[5]

Total Estimated, *Net Present Value, Direct* Costs from 2007 to 2037 = $3,626,919,864[6]

Notes:

1. Effects presented in the Special Environmental Analysis for Actions Taken under U.S. Department of Energy Emergency Orders Regarding Operation of the Potomac River Generating Station in Alexandria, Virginia (U.S. Department of Energy November 2006). The number of cases were based on emissions modeled for the PRGS operating period from December 2006 to December 2007 for a population of the Eastern United States.
2. Valuation sources used are those used by the EPA to value health effects in the *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources;* Document number EPA 420-R-07-002, February 2007 except for those cited as EPA 2006, which are from the September 2006 EPA presentation entitled "September 2006 Revisions to the National Ambient Air Quality Standards for Particle Pollution".
3. U.S. Dollars were adjusted to 2007 values by applying the U.S. Bureau of Labor Statistics inflator from the Consumer Price Index for all urban households.
4. Multiplies the $2007 costs by the number of cases.
5. Based on 2007 dollars inflated at an assumed annual rate of three percent (3%) each year for the 30 year period.
6. Net Present Value Costs represent costs in 2007 dollars and are estimated by multiplying the total yearly cost by a present worth factor of 19.6 which reflects a discount rate of three percent (3%).