Estimation of Health Effects/Costs

- Evaluated the draft 5 stack SOP (11/18/07) and draft 2 stack SOP (1/18/08)
- 5-Stack Analysis – evaluated the next-to highest operating scenario allowed by the permit for maximum modeled concentrations (at least one scenario in this permit would have produced higher modeled concentrations)
- 2-Stack Analysis– evaluated the highest permitted operating scenario for maximum and average modeled concentrations
- Health effects assessed for PRGS-related concentrations, only

Estimation of Health Effects/Costs (continued)

- AERMOD (an EPA approved computer program) was used to model emissions of PM from the Potomac River Generating Station
- Modeled air concentrations are input into BenMAP (a computer program developed by EPA) and effect estimates and costs are selected from the programs database
- Health impacts were evaluated for $PM_{2.5}$ contributions from a scenario based on those presented in one of the proposed SOPs

Estimation of Health Effects/Costs (Continued)

- BenMAP allows users to explore a multitude of scenarios, using the same peer-reviewed process that the EPA uses to evaluate new air standards.
- The software can be used to:
  - **Compare benefits across regulatory options**
  - **Estimate health impacts and costs of existing air pollution levels**
  - **Estimate health benefits of alternative ambient air quality standards**
  - **Perform sensitivity analyses of health or valuation functions, as well as other inputs**

"*BenMAP: Clarifying the Effects of Pollution Regulation*"
(www.abtassociates.com/environment)

5 Stack SOP Emission Scenario
Potential Health Effects and Cost

Health Effect	Annual Predicted Cases	Direct Costs U.S. 2007$ by Case	Direct Costs Totals 2007$
Premature mortality - all cause	4.10	7,648,032	31,353,106
Chronic bronchitis	3.99	410,043	1,635,498
Nonfatal heart attacks	6.89	42,564	293,163
Respiratory	2.68	65,221	47,535
Cardiovascular	0.77	26,100	19977
Asthma-related ER visits	3.11	316	984
Acute bronchitis	3.86	72	278
Upper respiratory symptoms	49.01	32	1,555
Lower respiratory symptoms	50.67	19	965
Asthma exacerbations	46.33	89	4,136
Work loss days	1045.25	217	226,324
Minor restricted activity days	5569.83	61	341,573
Total Direct Costs 2007 Dollars			33,952,808

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5 Stack SOP: Estimated Total Costs of Health Effects (in 2007 US Dollars)

- Total Estimated Costs for Health Effects

$665 million (net present value; NPV) for maximum modeled concentrations

  - value is for a thirty year period
  - based on the next-to highest operating scenario
  - for the population of ~**4,700** within 800 meters of PRGS.

2 Stack SOP Emissions Scenario
Potential Health Effects and Cost – **Maximum** Emissions Scenario

Health Effect	Annual Predicted Cases	Direct Costs U.S. 2007$ by Case	Direct Costs Totals $2007
Premature mortality - all cause	4.47	7,648,032	34,236,470
Chronic bronchitis	4.30	409,965	1,763,957
Nonfatal heart attacks	7.16	42,549	304,722
Respiratory	2.98	69,813	55,411
Cardiovascular	2.41	53,965	65,660
Asthma-related ER visits	3.93	316	1,241
Acute bronchitis	4.20	72	302
Upper respiratory symptoms	55.21	32	1,752
Lower respiratory symptoms	55.96	19	1,066
Asthma exacerbations	58.57	89	5,230
Work loss days	1075.21	207	222,904
Restricted activity days	5910.78	61	362,489
Total Direct Costs 2007 Dollars			37,090,209

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2 Stack SOP Emissions Scenario Potential Health Effects and Cost – **Average** Emissions Scenario

Health Effect	Annual Predicted Cases	Direct Costs U.S. 2007$ by Case	Direct Costs Totals $2007
Premature mortality - all cause	0.88	7,646,234	6,705,747
Chronic bronchitis	0.82	409,565	337,809
Nonfatal heart attacks	1.65	44,183	72,717
Respiratory	0.47	62,140	8,154
Cardiovascular	0.37	59,217	10,745
Asthma-related ER visits	0.75	314	236
Acute bronchitis	1.13	72	81
Upper respiratory symptoms	8.22	32	261
Lower respiratory symptoms	10.81	19	206
Asthma exacerbations	7.84	89	700
Work loss days	172.27	207	35,714
Restricted activity days	983.22	61	60,283
Total Direct Costs 2007 Dollars			7,241,308

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2 Stack SOP:
Estimated Total Costs of Health Effects
(in 2007 US Dollars)

Total Estimated Costs for Health Effects

$727 million (NPV) for maximum modeled concentrations

- 90% Confidence Interval for Mortality indicated probability of actual value between 1.86 – 6.82.
- values are for a thirty year period based
- Highest permit allowed operating scenario
- population of ~**4,700** within 800 meters of PRGS.
- Values calculated with a threshold

2 Stack SOP Operating Scenario Estimated Total Costs of Health Effects (in 2007 US Dollars)

Total Estimated Costs for Health Effects

$142 million (NPV) for average modeled concentrations

- values are for a thirty year period
- highest permit allowed operating scenario
- population of ~**4,700** within 800 meters of PRGS.
- Values calculated with a threshold
- Mortality effects were also estimated without the assumption of a threshold
- Results for the Average concentrations would be double without a threshold
- Incidence of Mortality estimate for Average not using a threshold = **1.98** with an associated $15 million

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DOE Special Environmental Analysis: Estimated Total Costs of Health Effects (in 2007 US Dollars)

Total Estimated Costs for Health Effects

$3.6 billion (NPV)

- value is for a thirty year period
- based a projected operating period evaluated in the DOE SEA
- Estimate was for a population equivalent to the Eastern United States.

Comparison of 5-Stack, 2-Stack and DOE Analyses

- Annual Predicted Cases of Mortality (30-99 yrs)
  - 5 Stack = 4.10 (within the 800 meter grid)
  - 2 Stack = 4.47 (within the 800 meter grid)
  - DOE SEA = 23 (a population = eastern US)
- Direct Costs Totals for Mortality and Morbidity(in 2007 dollars)
  - 5 Stack = $ 31,353,106
  - 2 Stack = $ 34,236,470
  - DOE SEA = $ 175,812,000
- Direct Costs from 2007 to 2037 (Net present value in 2007 dollars)
  - 5 Stack = $ 665,448,614
  - 2 Stack = $ 726,968,089
  - DOE SEA = $ 3,626,919,864

What about Baghouse Technology?

- Baghouse technology could reduce PM2.5 emissions by 60%
- A 60% reduction of modeled concentrations would reduce the **Maximum Mortality estimate to 2.8 predicted cases**
- estimated cost of ~ $21 million vs. $34 million for one year (in 2007 dollars)
- Savings of mortality-related costs of $13 million /year

Summary

- The evaluation of health effects was designed to review scenarios allowable under the proposed SOP
- Estimates of incidences represent a probability and not actual death.
- It may under- or over-estimate actual risk.
- 2006 NAAQS for Particle Pollution RIA findings:
  - All but one of the expert elicitations indicated higher levels of mortality than those estimated using the C-R function from the Pope 2002 study
  - The next closest expert elicitation value was almost double that calculated using the Pope C-R, and most were over 3 times that estimated using Pope 2002.