BEFORE THE
PUBLIC SERVICE COMMISSION
OF MARYLAND

In the Matter of the	)	
Application of Catoctin Power, LLC	)	
for a Certificate of Public Convenience and	)	Case No. 8997
Necessity To Construct a 600 MW Generating	)	
Facility in Frederick County, Maryland	)	

DIRECT TESTIMONY OF MARK E. GARRISON

Q. PLEASE STATE YOUR NAME, OCCUPATION, AND CURRENT POSITION.

A. My name is Mark Garrison. My business address is Environmental Resources Management, Inc. (ERM), 350 Eagleview Boulevard, Suite 200, Exton, Pennsylvania 19341. I am an air quality meteorologist with ERM, and am a Partner in the firm. A statement of my educational background, occupational history, and professional qualifications is appended to this testimony as Appendix A.

Q. WHAT IS YOUR RELATIONSHIP WITH THE DEPARTMENT OF NATURAL RESOURCES POWER PLANT RESEARCH PROGRAM (PPRP)?

A. I have been working on PPRP projects for the past nine years, while at my current position with ERM. I serve as a senior air quality scientist on all air quality dispersion modeling projects that ERM conducts for PPRP. In my present position, I conduct modeling on behalf of PPRP to investigate air quality impacts from power plants. I lead the evaluations of PSD and other impact assessments that are part of the CPCN process for new and modified power plants in Maryland. My work for PPRP also includes investigations of the long-range transport of NO_x and SO_2 emissions from power plants in Maryland and in the eastern United States, and investigations of the effect of new modeling techniques on predicted air quality impacts from power plants.

Q. PLEASE EXPLAIN YOUR ROLE WITH RESPECT TO THE CATOCTIN POWER PROJECT.

A. I am responsible for the evaluation of air quality impacts of the Catoctin Power Project, and I am the principal author of sections of the PPRP report entitled *Interim Draft Environmental Review of the Proposed Catoctin Power Project* (DNR Exhibit __(DHB-2)) dealing with air quality impact evaluations. These sections can be found in Sections 4; in particular, Section 4.3.4 (addressing NAAQS and PSD increment compliance); Section 4.3.5 (addressing other impacts including impacts in Class I areas) Section 4.5 (addressing nitrogen deposition impacts); Section 4.6 (addressing ozone impacts); Section 4.7 (addressing impacts from the accidental release of aqueous ammonia); and Section 4.8 (addressing impacts from toxic emissions from the cooling tower) of the ERD. I am also sponsoring Section 6.1, addressing potential future cumulative air impacts from nearby power plants.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. To assist PPRP and the Maryland Department of the Environment Air and Radiation Management Administration (ARMA) in its evaluation of the proposed Catoctin Power Project, I and ERM staff under my direct supervision reviewed the air quality impact evaluations submitted by Catoctin Power. In my testimony, I will summarize findings of our review of the air quality impact evaluations of the Catoctin Power project's proposed emissions.

Q. WHAT SOURCES OF INFORMATION DID YOU USE IN YOUR AIR QUALITY ANALYSES?

A. The principal information sources for the analyses and reviews that I conducted on behalf of PPRP were Catoctin Power's application for a Certificate of Public Convenience and Necessity (CPCN) dated

February 25, 2004, and subsequent Responses to Data Requests and Supplements prepared by Catoctin Power. In addition, for specific portions of the analyses, U.S. EPA guidance documents and information from the air quality engineering and scientific literature were used in specific analyses, as detailed in DNR Exhibit__(DHB-2).

Q. WHAT SPECIFIC PARTS OF THE IMPACT ANALYSES WERE YOU RESPONSIBLE FOR?

A. I was responsible for all of the dispersion modeling reviews and analyses related to project impacts on the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments, and on the Class I air quality related values (AQRVs). All of these reviews and analyses were conducted by me or under my direct supervision.

Q. WHAT WERE THE OBJECTIVES OF YOUR AIR QUALITY EVALUATIONS?

A. The objectives were to evaluate the environmental impacts of the Catoctin Power Project air emissions, and to assess compliance with federal and state air quality requirements related primarily to the PSD and Nonattainment New Source Review (NA-NSR) regulations. Specifically, the evaluation examined: (1) the effects of the project's proposed emissions on the NAAQS and PSD increments; and (2) additional assessments of the impacts on soils and vegetation, including impacts in "Class I" areas.

In addition to the impact assessments related to PSD and NA-NSR, we also examined (1) potential impacts from the use of wastewater treatment plant effluent, which may contain small quantities of toxic compounds, in the proposed plant's cooling tower; (2) potential impacts of a hypothetical accidental release of aqueous ammonia from a truck delivering the material to the site; and (3) potential cumulative impacts from multiple new power plant sources locating in close proximity to the Catoctin plant.

Q. HOW WERE THESE OBJECTIVES ACCOMPLISHED?

A. ERM evaluated potential emissions to determine regulatory applicability, reviewed the modeling conducted by Catoctin Power to verify results that were reported in their application, and conducted additional modeling to supplement the analyses submitted by Catoctin Power. In general, the additional modeling was conducted to provide a more thorough evaluation of the environmental impacts of the project's proposed emissions than was provided in the Catoctin Power CPCN application. I provide further details on the reasons for conducting the additional modeling, and the results of this modeling, in the testimony that follows.

Q. PLEASE DEFINE THE TERMS "NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)," "PSD INCREMENT," AND "CLASS I AREAS."

A. NAAQS are ground-level concentrations of pollutants set at levels that the U.S. EPA has determined are protective of the public health and welfare with an ample margin of safety. NAAQS are concentrations of pollutants expressed in terms of micrograms per cubic meter ($\mu g/m^3$). There are currently NAAQS established for six pollutants—nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, ozone, carbon monoxide, and lead. "Particulate matter" is categorized by size (e.g., PM10 represents particulate matter less than 10 microns in diameter; PM2.5 represents particulate matter less than 2.5 microns in diameter). These pollutants are referred to as "criteria" pollutants. State air quality agencies monitor ambient levels of these criteria pollutants to determine whether any particular part of the country is in "attainment" or "nonattainment" with the NAAQS. Attainment areas are those with ambient pollutant concentrations below the NAAQS; nonattainment areas are those with ambient pollutant concentrations above the ambient standards.

PSD increments represent the amount of increase in ambient air concentrations that is allowed to occur due to emissions from new sources in attainment areas. PSD increments have been established for three pollutants: NO_2, SO_2, and particulate matter. Like the NAAQS, increments are expressed in pollutant concentrations ($\mu g/m^3$); however, increments levels are substantially lower than the NAAQS.

EPA categorizes the country into three classes for PSD increment and other purposes: Class I, Class II, and Class III. Each class differs in the amount of growth (that is, increase in emissions from new major sources) that would be allowed before an area experiences significant deterioration in air quality. Most of the country is designated as "Class II" for increment purposes. There are Class II increments that apply to these areas of the country that are evaluated as part of the PSD review process.

Certain national parks and wilderness areas (national parks over 6,000 acres and wilderness areas and memorial parks greater than 5,000 acres) are designated as Class I areas. The Class I increments established for these areas of the country are substantially lower than Class II increments, in order to protect these sensitive environments. The Class I area closest to the Catoctin Power site is the Shenandoah National Park (SNP) in Virginia, managed by the National Park Service (NPS). Two additional Class I areas, located in West Virginia, are the Dolly Sods and Otter Creek Wilderness Areas managed by the U.S. Forest Service. The distances from the Catoctin Power facility to these Class I areas are approximately 78, 170, and 190 kilometers for Shenandoah, Dolly Sods, and Otter Creek, respectively.

Class III areas have the highest increments, theoretically to allow for larger amounts of growth; however, no Class III areas have been established in the U.S. to date.

Q. WHAT IS THE STATUS OF THE AMBIENT AIR QUALITY IN THE AREA SURROUNDING THE CATOCTIN POWER SITE WITH RESPECT TO THE NAAQS?

A. The Catoctin Power facility will be located on a 20-acre tract of land in Frederick County, Maryland, within the 2,200-acre Eastalco Works industrial complex. The air quality in Frederick County, which is designated as Area II (COMAR 26.11.01.03,) is currently in attainment for all criteria pollutants with the exception of ozone. Because of the high levels of ozone found in Frederick County and several other nearby counties during the ozone season (May-October), the County is designated a severe ozone nonattainment area.

In 1997, EPA established a new NAAQS for particulate matter less than 2.5 microns in diameter, referred to as PM2.5 or PM-fine. Court challenges held up the implementation of this new standard, and the area designations with respect to this standard were delayed for several years. EPA recently (June 2004) proposed area designations with respect to the PM2.5 NAAQS. Under this proposal, Frederick County (and several other nearby counties in Maryland, Virginia and Pennsylvania) would become nonattainment areas for PM2.5. Designations will not be finalized until late 2004 or early 2005. If Frederick County remains a designated nonattainment area, the State (the Maryland Department of the Environment, or MDE) will be required to develop a plan to bring the county into attainment. This plan will consider existing as well as any proposed sources that may need to be controlled in order to meet the PM2.5 NAAQS.

PM2.5 is a pollutant that, in some respects, is similar to ozone. Ozone is not emitted directly by individual sources, and precursor emissions (i.e., emissions of NO_x and VOCs that react in the atmosphere to form ozone) that are emitted up to several hundred miles from a nonattainment area can contribute significantly to the area's nonattainment status. PM2.5 is emitted directly by individual sources, but PM2.5 concentrations are also affected by precursor emissions of NO_x and SO_2 that are emitted up to several hundred miles from a source.

Q. WHAT EVALUATIONS RELATED TO NAAQS AND PSD INCREMENTS MUST AN APPLICANT CONDUCT TO MEET PSD REQUIREMENTS?

A. As part of the PSD review, there are two basic requirements that applicants must fulfill for pollutants that will increase significantly. For the Catoctin Power project, these pollutants are NO_x, SO_2, CO, and PM10.

First, applicants must demonstrate that emissions from the proposed project will not cause or contribute to the violation of any applicable NAAQS or PSD increment. The impact demonstration is conducted through air quality dispersion modeling studies, including comparisons of model-predicted values to EPA's "significant impact levels" or SILs. EPA provides guidance on the type of model or models to use for these NAAQS and PSD increment evaluations.

Second, applicants must conduct an analysis of ambient air quality in the area that the emissions from the PSD source will affect. This ambient air quality analysis is carried out using measured air quality data. The measured data are provided either by the applicant through pre-construction monitoring, or by the use of appropriate, representative data obtained from existing monitoring stations. The degree of ambient impact evaluation required involves a comparison of model-predicted concentrations to EPA's "monitoring *de minimis* levels."

Q. WHAT IS A "SIGNIFICANT IMPACT LEVEL" OR "SIL" AS IT RELATES TO PSD?

A. A significant impact level, or SIL, is a concentration threshold for a given pollutant that serves as an initial test of air quality impacts. The U.S. EPA has established SILs for four criteria pollutants (NO_2, SO_2, CO, and PM_{10}). If emissions from a new source result in concentrations in the ambient air below the relevant SIL, EPA has determined that the emissions in question pose no threat to a NAAQS or PSD increment. If predicted concentrations resulting from pollutant emissions are above a SIL, additional analyses, usually further modeling analyses, are conducted.

Q. WHAT IS A MONITORING "DE MINIMIS LEVEL?"

A. Monitoring *de minimis* levels are ambient concentrations that EPA has established for certain pollutants (SO_2, PM10, and NO_x) to assist in PSD ambient impact evaluations. Model-predicted impacts from a project subject to PSD are compared to the *de minimis* levels (listed in Table 4-14 of (DNR Exhibit__(DHB-2)) to help determine the types of ambient impact evaluations that must be conducted.

Q. WHAT IS THE SIGNIFICANCE OF THE MONITORING DE MINIMIS CONCENTRATION LEVELS?

A. As mentioned, sources subject to PSD must conduct ambient impact analyses using measured air quality data in the vicinity of the project. However, under PSD regulations, a PSD source can obtain an exemption from performing the ambient impact analysis if the source's impact is shown, through modeling, to be less than the *de minimis* concentration levels defined in the PSD regulations. In areas where representative ambient measurements are not available, this exemption allows the PSD source to complete its application without collecting ambient data. The concentration levels are commonly referred to, therefore, as "monitoring *de minimis*" concentrations.

Q. WHAT GUIDANCE IS AVAILABLE FOR SELECTING AN AIR QUALITY MODEL FOR CONDUCTING PSD AIR QUALITY MODELING, AND HOW WAS IT APPLIED FOR THE CATOCTIN POWER PROJECT?

A. The U.S. EPA has published the Guideline on Air Quality Models, which is referenced in the PSD regulations. These guidelines establish preferred models for generalized modeling situations. For the Catoctin project, the preferred model according to EPA's guideline is the ISCST3 model. However, in April 2000, EPA proposed replacing

ISCST3 with the new AERMOD model. AERMOD is the product of a several-year effort to improve the scientific basis of air quality modeling. It has undergone extensive evaluation and peer review, as well as public review as part of the rulemaking process that EPA undertakes to revise the modeling guidelines. Catoctin Power proposed and subsequently utilized AERMOD to determine the effect of emissions from the Catoctin Power project on the NAAQS and PSD increments. Since AERMOD is not yet fully incorporated into the modeling guidelines, PPRP and ARMA sought and received approval from EPA Region III to use AERMOD in place of ISCST3.

Q. WHAT IS THE RECOMMENDED METHODOLOGY FOR EVALUATING THE IMPACTS OF PSD SOURCES ON AMBIENT AIR QUALITY, AND HOW WAS THE METHODOLOGY APPLIED FOR THE CATOCTIN POWER PROJECT SOURCES?

A. The recommended methodology for conducting air quality modeling for PSD sources is contained in EPA's modeling guidelines and in various policy documents. To summarize, PSD modeling must address three important components: (1) receptor locations to determine maximum impacts, (2) meteorological inputs that are representative of the area where the source is located, and (3) source inputs that adequately represent operations and emissions from the sources being modeled.

In the case of the Catoctin Power project, the application addressed these three areas as follows.

(1) A "grid" of receptors was developed that extended to approximately 7 kilometers from the Catoctin site in each direction. Receptor spacing was set to 25 meters along the site boundary; 50 to 100 meters spacing from the site boundary to about 1.5 kilometers; 150 meters from 1.5 kilometers to 3 kilometers; and 250 meters from 3 kilometers to 7 kilometers. Also, a separate receptor grid was developed to incorporate high elevation points in the general area,

centered on Sugarloaf Mountain. A total of 5,751 receptors were analyzed in the model.

(2) Meteorological data measured at Dulles Airport in Sterling, Virginia (located approximately 40 miles south of the Catoctin facility), for a period of five years (1991-1995) were obtained, processed, and used in the AERMOD modeling.

(3) Emissions and stack parameters (exit velocity and temperature) were developed to represent three turbine loads: base or 100%, 75%, and 50% load and three ambient temperatures: -18, 54, and 90°F for each load condition, as well as 104°F for the 100 percent load operation. The 100 percent load operation was also configured with duct burners at ambient temperatures of 54, 90, and 104°F, since duct firing would only be practical under the 100 percent load condition. These load and temperature combinations created 13 different operating scenarios.

Q. IS IT YOUR OPINION THAT THE METHODOLOGY SELECTED AND APPLIED BY THE APPLICANT IS APPROPRIATE FOR DETERMINING THE PROJECT'S AMBIENT IMPACTS?

Yes. We have evaluated the modeling methodology including the model used, the development and application of the meteorological database, and the actual model application. My conclusion based on this evaluation is that the methodology is adequate to determine the impact of significant emissions from the Catoctin facility project. A detailed evaluation of the methodology, including an evaluation of the representativeness of the meteorological data, is contained in the ERD (DNR Exhibit __(DHB-2)), Section 4.3.4.1.

Q. WHAT WERE THE RESULTS OF THE MODELING FOR THE CATOCTIN PROJECT SOURCES?

A. As summarized in Table 4-14 of the Catoctin Power ERD (DNR Exhibit __(DHB-2)) maximum impacts for all pollutants of concern and for all relevant averaging periods are less than applicable significant impact levels (SILs).

Because the maximum impacts are less than the SILs for all pollutants, no additional steps need to be taken to demonstrate compliance with PSD increments and NAAQS for any regulated pollutant.

Q. BASED ON THE MODELING, IS ANY PRE-CONSTRUCTION MONITORING REQUIRED IN THIS CASE?

If the ambient impacts of a new source or modification are less than the monitoring *de minimis* levels specified in 40 CFR Part 52.21(i)(8), an exemption may be granted from PSD pre-construction air quality analyses. Because the impacts of the Catoctin facility project do not exceed the monitoring *de minimis* levels for CO, NO_2, SO_2, and PM10 (see Table 4-14 of the ERD), an exemption can be granted for these pollutants. PPRP and ARMA conclude, therefore, that the air quality analysis requirements of 40 CFR 52.21(m) have been satisfied for the Catoctin facility.

Q. CAN YOU SUMMARIZE YOUR OVERALL FINDINGS FOR THE NAAQS AND PSD INCREMENT IMPACT EVALUATIONS REQUIRED BY FEDERAL AND STATE REGULATIONS?

A. Based on the information provided in the Catoctin Power CPCN application, supplemented with independent analyses conducted by the State, I conclude on behalf of PPRP and ARMA that (1) criteria pollutant impacts for the Catoctin Power project will not adversely affect the NAAQS or PSD increments for NO_2, SO_2, PM10, and CO; and (2) no pre-construction monitoring is required in this case.

Other Impact Assessment:

Q. WERE ADDITIONAL IMPACT ASSESSMENTS CONDUCTED FOR THE CATOCTIN POWER PROJECT BEYOND THE NAAQS AND PSD INCREMENT ANALYES YOU JUST DESCRIBED?

A. Yes. The PSD regulations require additional analyses beyond the NAAQS and PSD increment assessment described previously. Specifically, the regulations require an assessment of any impairment to visibility, soils, and vegetation that would occur as a result of the new source and of general commercial, residential, industrial, and other growth associated with the new source. Furthermore, impacts on Class I areas must be analyzed to determine compliance with Class I increments and to assess the impacts of new emissions on air quality related values (AQRVs).

Impacts on Soils and Vegetation; Impacts of Growth

Q. DID YOU REVIEW THE ASSESSMENT CATOCTIN POWER PRESENTED DESCRIBING POTENTIAL IMPACTS ON SOILS AND VEGETATION, AND IMPACTS FROM GROWTH ASSOCIATED WITH THE CATOCTIN POWER PROJECT?

A. Yes I did.

Q. DO YOU AGREE WITH THE APPLICANT'S CONCLUSIONS REGARDING THESE ASSESSMENTS?

A. Yes; I have reviewed this analysis and agree with the conclusion that impacts from the Catoctin facility will not cause harmful effects on local soils and vegetation. We also agree with the conclusion that growth associated with the project will not have a significant effect on air quality.

Impacts from Cooling Tower Deposition, Icing, and Fogging

Q. DID YOU REVIEW THE ASSESSMENT CATOCTIN POWER PRESENTED DESCRIBING POTENTIAL IMPACTS ON FROM COOLING TOWER DEPOSITION, ICING, AND FOGGING?

A. Yes I did.

Q. DO YOU AGREE WITH THE APPLICANT'S CONCLUSIONS REGARDING THESE ASSESSMENTS?

A. Yes. We confirmed the modeling results that Catoctin Power provided in the CPCN application and in the applicant's Response to DNR Data Request No. 5 by running the EPA model known as "SACTI" both with and without "plume abatement" (the system proposed by Catoctin Power to reduce emissions from the cooling tower). These results show that cooling tower visible effects are predicted to be minimal.

Class I Area Impacts

Q. WHAT, IF ANY, ANALYSES RELATED TO CLASS I AREAS ARE PSD APPLICANTS REQUIRED TO CONDUCT?

A. PSD applicants are required to show that emissions from a proposed project will not exceed applicable Class I increments. In addition to the increment evaluation, applicants must demonstrate that emissions will not have an adverse impact on "air quality related values" (AQRVs) of a Class I area under consideration. The AQRV evaluation is conducted separately from the Class I increment evaluation.

Q. PLEASE DEFINE "AIR QUALITY RELATED VALUES."

A. The PSD regulations do not contain a definition of AQRVs, and in fact, the assessment of impacts on AQRVs has historically been less prescriptive than the assessment of impacts on PSD increments. The Federal Land Manager (FLM) of the Class I area under consideration has an affirmative responsibility, under the PSD regulations, to ensure that AQRVs are not adversely affected. A working definition of AQRVs can be found in a report prepared by representatives of the U.S. Forest Service, the NPS, and the U.S. Fish and Wildlife Service – the Federal Land Managers' *Air Quality Related Values Workgroup (FLAG) Phase I Report*, December 2000 (NPS, 2000). The FLAG report's definition of an AQRV is, "A resource, as identified by the FLM for one or more Federal areas, that may be adversely affected by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area."

The FLAG report identifies three types of AQRV impacts that are common to all Class I areas: visibility, ozone, and deposition. These types of impacts are influenced by the concentrations in the Class I area of PM_{10}, SO_2, NO_x, and VOCs due to PSD sources.

Q. DID CATOCTIN POWER EVALUATE IMPACTS IN CLASS I AREAS?

A. Yes. Catoctin Power performed air quality modeling of NO_x, PM_{10}, and SO_2 emissions using the CALPUFF model to estimate concentration and deposition impacts in the Shenandoah, Dolly Sods, and Otter Creek Class I areas. CALPUFF is currently recommended in EPA's Guideline on Air Quality Models (GAQM) for applications involving long-range transport such as this evaluation.

Q. PLEASE SUMMARIZE THE METHODOLOGY FOLLOWED FOR THE CLASS I AREA CALPUFF MODELING.

A. The CALPUFF modeling was conducted by the applicant using three years of meteorological data (1990, 1992, 1996). CALPUFF uses three-dimensional meteorological data for modeling the dispersion and transport of plumes from a source. Catoctin Power used a 4-km grid spacing extending over approximately 300 km in the east-west direction and a vertical grid extending up to 3,000 m from the ground surface.

PPRP and ARMA have prepared a three-dimensional data set for use in evaluating impacts from various existing and proposed generating plants on a regional basis. This data set contains hourly meteorology for 1990.An additional analysis was conducted by PPRP and ARMA using this regional data set with CALPUFF. The meteorological data used by PPRP has a horizontal spacing of 40 km and has a vertical extent of 4,120 m from the ground surface.

Worst-case emissions from the two Catoctin Power combustion turbines and cooling tower were used for evaluation of Class I impacts. The National Park Service provides guidelines for particle size distribution for emissions from combustion turbines. These guidelines were used in modeling impacts from the Catoctin facility.

Q. WHAT WERE THE RESULTS OF THE CALPUFF MODELING FOR THE CLASS I AREAS?

A. Several types of potential impacts to Class I areas were evaluated, including Class I increments and three types of AQRV impacts described in the FLAG report: visibility, and ozone impacts.

The impact assessment modeling that the applicant conducted, and our independent modeling, indicate that: (1) the Catoctin facility will have a minimal impact on the Class I increment in the SNP, Dolly Sods and Otter Creek protected areas; (2) visibility degradation is predicted to not exceed the FLAG criterion of 5 percent degradation of natural conditions; (3) maximum deposition rates for both sulfur and nitrogen are substantially lower than the deposition analysis threshold (DAT) levels of 0.01 kg/ha/yr for both sulfur and nitrogen; and (4) although impacts to ozone cannot be modeled directly, because Catoctin Power's impacts on visibility and deposition rates in SNP have been shown to be minimal, we conclude, that potential concerns regarding ozone impacts are not exacerbated by emissions from the Catoctin Power project.

Q. DO YOU CONCUR WITH THE APPLICANT'S FINDINGS ON CLASS I AREA IMPACTS?

A. Yes. PPRP and ARMA believe that it can be reasonably concluded that the Catoctin facility's impacts on primary pollutant concentrations, visibility, deposition, and ozone in the Shenandoah National Park Class I area are likely to be minimal. Even though an assessment of impacts on AQRVs is less prescriptive than the assessment of impacts on the NAAQS and PSD Class II increments, the analyses reported here support the conclusion of minimal impacts. It should be noted that these analyses do not take into account the anticipated beneficial impact of the NO_x reductions that will be required as offsets for the Catoctin facility NO_x emissions.

Q. DID THE FEDERAL LAND MANAGERS (FLMs) REVIEW THE CLASS I IMPACT ASSESSMENTS IN THIS CASE?

A. Yes. The FLM for Dolly Sods and Otter Creek indicated that the analysis was conducted in an acceptable manner, and that the conclusion regarding insignificant impacts in Class I areas is correct. The review did find one minor shortcoming in the Class I area impact modeling, related to the specification of background ozone concentrations. Catoctin Power's modeling utilized a single ozone concentration for determining transformation rates, while the FLM recommended that the use of hourly measured ozone concentrations would be preferable. PPRP and ARMA conducted additional modeling with CALPUFF for the worst-case year, 1996, using hourly measured ozone concentrations as input for determining transformation rates. The results of this additional modeling indicated that estimated impacts increased by approximately 1 percent. Even with this increase, predicted impacts in Class I areas remain below applicable significance thresholds and the conclusions regarding Class I areas do not change.

The FLM for Shenandoah also reviewed the evaluation and indicated that the modeling was acceptable.

Impacts from Nitrogen Deposition

Q. DID YOU CONDUCT ADDITIONAL IMPACT ANALYSES TO DETERMINE POTENTIAL IMPACTS OF ATMOSPHERIC DEPOSITION OF NITROGEN ON THE CHESAPEAKE BAY WATERSHED?

A. Yes. The effects of nitrogen due to airborne emissions of NOx on nutrient loading, and consequently on water quality, in the

Chesapeake Bay is an issue of ongoing interest and concern to PPRP. Because of this interest and concern, we conducted deposition modeling to calculate nitrogen loading in the vicinity of the proposed site.

Q. CAN YOU BRIEFLY DESCRIBE THE MODELING TECHNIQUES AND ASSUMPTIONS THAT WERE USED TO EVALAUTE NITROGEN DEPOSITION IMPACTS OF THE CATOCTIN POWER PROJECT?

A. We generally used the same modeling approach for this nitrogen deposition modeling as we use for the Class I area deposition analysis described previously. A receptor grid was generated to encompass the Chesapeake Bay watershed area, and the CALPUFF modeling system was run on this grid with a full year (1990) of meteorological data to determine wet and dry deposition fluxes of nitrogen species, and total nitrogen deposition to the watershed and to the Bay.

Q. WHAT WERE THE RESULTS OF THE CALPUFF NITROGEN DEPOSITION MODELING?

A. The average nitrogen deposition flux rate predicted by CALPUFF in the Chesapeake Bay watershed area – approximately 21 million hectares - was used to calculate the total tons of nitrogen deposited in the watershed over a year due to Catoctin Power combustion sources. The SPARROW methodology, developed by USGS, was used to estimate the total nitrogen delivered to the Chesapeake Bay. The result of this calculation is approximately 1.95 tons of nitrogen per year, of which 0.35 tons of nitrogen is predicted to be delivered to the Chesapeake Bay waters.

Q. DO DEPOSITION IMPACTS TRIGGER ANY REGULATORY REQUIREMENTS?

A. No, deposition impacts do not trigger any regulatory requirements; however, these levels should be considered in the context of nutrient loading goals for the Chesapeake Bay as a whole.

Impacts from Use of Wastewater Treatment Plant Effluent

Q. DID YOU EVALUATE THE POSSIBLE IMPACTS OF CATOCTIN POWER'S PROPOSAL TO USE TREATED EFFLUENT AS A SOURCE OF COOLING WATER FOR THE CATOCTIN PROJECT?

A. Yes. The applicant's preferred source of cooling water is treated effluent from the Ballenger Creek Wastewater Treatment Plant (WWTP). As such, there is a potential for any toxic compounds in the effluent to be released to the atmosphere in the cooling tower drift as toxic air pollutants (TAPs).

Q. ARE TOXIC AIR POLLUTANTS FROM COOLING TOWERS AT POWER PLANTS REGULATED BY THE MDE AIR AND RADIATION MANAGEMENT ADMINISTRATION (ARMA)?

A. No. As a utility power plant project, the Catoctin Power project is not subject to MDE's TAP regulations (in COMAR 26.11.15. -16), as explained in Section 4.9 of PPRP's ERD (DNR Exhibit__(DHB-2). However, PPRP elected to evaluate potential air quality impacts of the use of treated effluent for cooling purposes.

Q. CAN YOU PLEASE DESCRIBE THE COOLING TOWER AIR TOXICS EVALUATION THAT WAS CONDUCTED FOR THIS PROJECT?

A. ERM evaluated water quality data for the Ballenger Creek WWTP presented by the Applicant to determine potential TAP emission rates from the cooling tower. Data for toxic metals were available for the evaluation.

For this analysis, the concentrations of TAPs released to air in water droplets (referred to as "drift") were assumed to be equivalent to concentrations in the effluent. The short-term emission rate (in grams per second, g/s) for each TAP from the cooling tower was determined as the product of the circulating water flow rate (gal/min), the drift rate (percent), and the concentration of toxic pollutant in water (mg/l).

Once TAP emissions from the cooling tower were determined, we modeled the emissions using EPA's AERMOD model. The receptor grid for this analysis was the same that was used for the PSD modeling analysis described previously. Although the project is not subject to MDE's TAP program, we used the MDE's TAP program guidance to conduct this TAP evaluation.

Under MDE's TAP program, the model-predicted concentrations of TAPs are compared to "TAP screening levels." The screening levels are generally Threshold Limit Values (TLVs) obtained from American Council of Governmental and Industrial Hygienists (ACGIH) with an applied safety factor of 100. The TLV can be a time weighted average (TWA) or a short-term exposure limit (STEL).

Q. WHAT ARE THE RESULTS OF YOUR EVALUATION OF AIR TOXICS THAT COULD BE RELEASED FROM THE COOLING TOWER, SHOULD CATOCTIN POWER ELECT TO USE TREATED EFFLUENT FROM THE BALLENGER CREEK WASTEWATER TREATMENT PLANT?

A. Using guidance from MDE on conducting TAP evaluations, we found that the model-predicted concentrations of all TAPs from the cooling tower are well below the screening levels for those pollutants. The results of the toxic impact analysis conducted by PPRP are summarized in Table 4-31 of the ERD (DNR Exhibit__(DHB-2)).

Impacts from Accidental Releases of Aqueous Ammonia

Q. IS IT YOUR UNDERSTANDING THAT CATOCTIN POWER WILL USE AQUEOUS AMMONIA IN ITS AIR POLLUTION CONTROL SYSTEM, THE "SELECTIVE CATALYTIC REDUCTION" (OR "SCR") SYSTEM, TO REDUCE NOX EMISSIONS FROM THE PROJECT?

A. Yes. Ammonia is an important chemical in SCR pollution control systems to reduce NOx emissions from combustion sources.

Q. IS THE USE OF AQUEOUS AMMONIA SUCH AS THAT PROPOSED BY CATOCTIN POWER FOR THE CATOCTIN PROJECT REGULATED BY THE U.S. EPA UNDER ITS ACCIDENTAL RELEASE PREVENTION PROGRAM?

No. Aqueous ammonia at a concentration of 19 percent, such as that proposed for use by Catoctin in its SCR system, is not considered an extremely hazardous substance under EPA's Accidental Release Prevention program (40 CFR Part 68), and so is not subject to Risk Management Program (RMP) evaluations and requirements. The threshold for consideration of aqueous ammonia under the RMP program is a concentration of 20 percent. PPRP has nonetheless evaluated the potential off-site consequences of an accidental release of aqueous ammonia from the Catoctin Power project using methods that would normally be required in an RMP evaluation, as outlined by EPA in its Offsite Consequence Analysis Guidance (OCAG) document.

Q. WHAT METHODS DID YOU USE TO EVALUATE IMPACTS OF AN ACCIDENTAL RELEASE OF THE CHEMICAL?

A. Using RMP guidance, we conducted an "off-site consequence analysis" (OCA) for two possible catastrophic releases of aqueous ammonia from the project. One scenario assumed that the ammonia storage tank at the Catoctin site ruptures when full, and the entire 20,000 gallons of aqueous ammonia empties into the tank's containment system. The containment dike will be designed to capture the entire contents of the tank. The second scenario assumed that an ammonia delivery truck overturns and spills the entire contents of the truck (~6,000 gallons) onto the ground.

Q. WHAT IS THE GOAL OF AN OFF-SITE CONSEQUENCE ANALYSIS?

A. The goal of an OCA is to determine the maximum distance to the "toxic endpoint" of a chemical due to an accidental release. The toxic endpoint is defined as the concentration of the chemical to which nearly all individuals can be exposed for up to one hour without experiencing or developing irreversible or other serious health effects. Models are used to predict the concentrations at increasing distances from the spill. EPA defines the toxic endpoint concentration for ammonia as 0.14 milligrams per liter (mg/L), equivalent to 200 parts per million, ppm. This concentration is from Appendix A of 40 CFR part 68.

Q. WHAT MODELS DID YOU USE TO EVALUATE A POTENTIAL AMMONIA SPILLS?

A. Two available models were used to determine the distance to the toxic endpoint: EPA's release calculation software, *RMP*Comp*, and a publicly available dispersion model, ALOHA. Both models are designed to provide a conservative estimate of the consequence distance (i.e., a distance that is likely to be greater than the actual distance). Of these two models, ALOHA generally provides a smaller, "lower-bound" estimate of the consequence distance than *RMP*Comp*, by taking site-specific conditions into account. In addition to running the software and modeling tools, PPRP also conducted additional release calculations to verify the modeling software outputs by using guidance provided in EPA's Off-site Consequence Analysis Guidance Document (OCAG).

Q. DOES THE OFF-SITE CONSEQUENCE MODELING REPRESENT ACTUAL CONDITIONS THAT MAY OCCUR, SHOULD A SPILL OF AQUEOUS AMMONIA ACTUALLY TAKE PLACE?

A. The entire accidental release modeling approach is, by design, conservative. For example, off-site consequence analyses are typically based on a series of worst-case assumptions to ensure that the maximum distance is estimated, in order to facilitate planning for an accidental release if necessary.

Specifically for this evaluation of the Catoctin Power projects, there are two key assumptions used in the evaluation of an accidental aqueous ammonia release that will overestimate the impacts of a release: 1) it is assumed that the entire volume of the spill is released instantly into the environment; and 2) it is also assumed that the entire volume is released from a single point. These assumptions cause the models to predict distances to the toxic endpoint farther from the location of the spill than would occur in the event of an actual spill.

Q. CAN YOU PLEASE SUMMARIZE THE FINDINGS OF THE CATOCTIN OFF-SITE CONSEQUENCE ANALYSES?

A. The first scenario assumed the instantaneous release of the entire contents of the Catoctin storage tank into its containment dike. OCA modeling with the conservative assumptions discussed previously indicate that the distance to the toxic endpoint would range from 0.1 miles (567 ft) based on the ALOHA model to 0.3 miles (1,584 ft) based on *RMP*Comp*. These distances remain within the Catoctin property boundary.

The second scenario involved the catastrophic spill of ammonia from a tanker truck outside of any designated containment area. Distances to the toxic endpoint predicted for this scenario ranged from 0.3 miles (~1,750 ft) based on ALOHA modeling and 0.6 miles (~3,200 ft) based on *RMP*Comp*.

These consequence distances associated with the tank truck release are considerably larger than the distances identified for the storage tank rupture, since the liquid from the truck spill is assumed to spread to a depth of 1 centimeter (less than ½ inch) in accordance with RMP guidance. At this depth, the contents of the tanker truck would cover an area greater than 24,000 square feet. The evaporation rate calculated from such a large surface area is much greater than the evaporation rate from the area of the containment dike surrounding the tank, hence the consequence distance is also much greater. It is likely, due to small changes in ground elevation that could limit the spread and the porous nature of some surfaces, that an actual spill would spread over a smaller area with a smaller resulting release rate and smaller consequence distance.

Q. WHAT IS THE SIGNIFICANCE OF THESE FINDINGS?

A. The area immediately surrounding the Catoctin facility is relatively sparsely populated (see Figure 3-9 of the Catoctin Power ERD). Three elementary schools, two middle schools, and one high school are located within a few miles of the project site. It appears (see Section 3.5.5) that the schools are not located on the likely routes for heavy truck traffic to the site, and if a truck spill occurred on-site, the modeling results show that none of the schools would be affected. The results of the analysis, and consideration of some of the conservative assumptions involved in the analysis, suggest that consequences of a spill would be relatively limited.

Cumulative Impacts

Q. HAVE YOU CONDUCTED ANY ANALYSES RELATED TO THE POTENTIAL FOR CUMULATIVE IMPACTS OF MULTIPLE POWER GENERATION PROJECTS IN CLOSE PROXIMITY TO THE CATOCTIN POWER PROJECT?

A. Yes, separate from the state and federal PSD permitting requirements, we examined the potential for cumulative impacts due to additional possible power generation projects close to the Catoctin site. In order to carry out this examination of cumulative impacts, we conducted air quality evaluations that looked at two types of potential air quality impacts that may result from emissions from power plants:

1. Concentrations of pollutants relative to NAAQS and PSD increments, and
2. Concentrations and visibility impacts in PSD Class I Areas.

The evaluations focused on the potential for impacts of power generation projects that could be exacerbated by the construction of multiple projects in close proximity and that might not be fully evaluated by the analyses required for each plant.

Q. WHAT WERE THE CONCLUSIONS OF THE CUMULATIVE IMPACT ANALYSIS RELATED TO AIR QUALITY?

A. First, the air quality impacts of non-reactive criteria pollutants tend to be local for the most part, and significant interactions between projects do not occur even when the projects are in close proximity. Second, concerns over the impacts on Class I areas are limited to situations where fuel oil is proposed as a back-up fuel. Since the Catoctin Power project does not propose to utilize fuel oil as a backup fuel, no additional concerns are raised by the consideration of cumulative impacts. The results of this analysis are described further in Section 6.1 of the ERD (DNR Exhibit __(DHB-2).

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes it does.

APPENDIX A

STATEMENT OF QUALIFICATIONS
for Mark E. Garrison

Experience and Employment

Mark E. Garrison has over twenty years of experience as a meteorologist and air quality dispersion modeler in the environmental consulting field and for industry and the U.S. EPA. For the past nine years, Mr. Garrison has been employed by Environmental Resources Management, Inc. (ERM), and has provided management and technical support to Maryland Power Plant Research Program (PPRP) for evaluating air quality issues associated with electric power generation. ERM has been serving as the Atmospheric Sciences Integrator for PPRP since January 1995.

Prior to his employment with ERM, Mr. Garrison worked as an air quality meteorologist for the U. S. EPA Region III (eight years), for the Pennsylvania Power and Light Company (five years), and for another consulting firm (five years).

Mr. Garrison has extensive experience in the application of air quality models to assess the impacts of releases of criteria and toxic air pollutants. He has detailed knowledge of the technical, regulatory, and policy issues related to dispersion modeling of new and existing sources, and special expertise in modeling sources in complex terrain and in the application of advanced models (e.g., CALPUFF, ISCPRIME, AERMOD). He was the principal author and programmer of the Integrated Gaussian Model (IGM), an air quality model approved as an equivalent model by the U.S EPA. His experience includes modeling for Prevention of Significant Deterioration (PSD) and nonattainment New Source Review (NSR) permitting, with special emphasis on electric utility power plants.
Mr. Garrison has served as an invited scientific peer reviewer for two new EPA models: AERMOD and CALPUFF, and is the author of numerous papers presented at technical conferences on a wide variety of modeling topics.

The following summarizes selected relevant projects that Mr. Garrison has played a key role in recently.

- Performed a full-scale analysis using the CALMET/CALPUFF modeling system to assess Nitrogen deposition to the Chesapeake Bay resulting from NO_x emissions from sources located up to 1,000 kilometers from the Bay. Conducted evaluations of the performance of CALPUFF and developed proposed improvements.

- Conducted and directed a model intercomparison study between the newly released ISC-PRIME model and existing downwash algorithms in ISCST3 to determine regulatory implications.

- Conducted and directed a model intercomparison study between existing complex terrain models and test versions of EPA's new AERMOD model to evaluate AERMOD's performance. Recommended changes in AERMOD formulation were implemented by EPA.

- Led the PSD and nonattainment NSR impact assessment studies as part of the CPCN licensing proceedings on PPRP's behalf for the following projects:

  – Kelson Ridge Combined Cycle Generation Project
  – ODEC-Rock Springs Simple Cycle Generation Project
  – Bentech/Oaks Sanitary Landfill Electrical Generation Project
  – Town of Berlin Power Plant Replacement Project
  – Trigen/University of Maryland Power Plant Upgrade Project
  – Trigen/Sweetheart Cup Power Plant Upgrade Project
  – Brown Station Road Landfill Gas Turbine Installation Project
  – Mirant Mid-Atlantic Chalk Point Expansion Project
  – Mirant Mid-Atlantic Dickerson Expansion Project

- Performed and managed a dispersion modeling study in support of a utility company's system planning that examined the air quality impacts of an existing coal-fired power plant in complex terrain, and the effect of different stack configuration and control alternatives.

- Conducted an evaluation of the effect on nitrogen deposition loading in Maryland of the proposed Chesapeake Commonwealth power plant in Virginia.

- Conducted and directed a multi-source SO_2 NAAQS modeling study for a refinery in Philadelphia.

- Conducted and directed PSD impact assessments for two fiberglass manufacturing facilities.

Education

Mark E. Garrison received a B.S. degree in Environmental Engineering Technology from Temple University in June 1977, followed by a M.S. degree in Environmental Science from Drexel University in January 1981.

Professional Affiliations

Member of the Air and Waste Management Association and the American Meteorological Society.

Selected Publications – Mark E. Garrison

Garrison, M. and J. Sherwell. 1997. *An Evaluation of the AMS/EPA Regulatory Model (AERMOD) Complex Terrain Algorithms.* Paper presented at the AWMA 90th Annual Meeting & Exhibition, June 8-13, 1997, Toronto, Canada.

Sherwell, J. and M. Garrison. 1997. *An Investigation Into Using the CALMET/CALPUFF Modeling System for Assessing Atmospheric Nitrogen Deposition in the Chesapeake Bay.* Paper presented at the AWMA 90th Annual Meeting & Exhibition, June 8-13, 1997, Toronto, Canada.

Garrison, M., P. Mayes, and J. Sherwell. 1998. *Evaluation of CALPUFF Nitrogen Deposition Modeling in the Chesapeake Bay Watershed Area Using NADP Data.* Paper presented at the AWMA 91st Annual Meeting & Exhibition, June 14-18, 1998, San Diego, CA.

Brower, R. P., L. A. Corio, M. Garrison, and J. Sherwell. 1998. *Evaluation of the Phase II AMS/EPA Regulatory Model Improvement Committee Model (AERMOD).* Paper presented at the AWMA 91st Annual Meeting & Exhibition, June 14-18, 1998, San Diego, CA.

Brown, D., M. Kahal, K. Palmer, J. Ross, and M. Garrison. 1998. *Assessing the Impact of Electricity Restructuring on the Environment in Maryland*. In Proceedings 91st Annual Meeting of the Air and Waste Management Association, 98-MP21.02, Air and Waste Management Association, Pittsburgh, PA.

Goldstein, D., J. Ross, and M. Garrison. 1998. *Environmental and Basis of Need Review Report for the Town of Berlin Power Plant Expansion Project.* Prepared by Environmental Resources Management, Annapolis, MD for the Maryland Power Plant Research Program, Annapolis, MD.

Goldstein, D., M. Garrison, J. Ross, and M. Kahal. 1998. *Environmental and Basis of Need Review Report for the Town of Berlin Power Plant Expansion Project*. Prepared by Environmental Resources Management, Annapolis, MD; Exeter Associates, Inc., Silver Spring, MD; and Versar, Inc., Columbia, MD for the Maryland Power Plant Research Program, Annapolis, MD.

Sherwell, J., M. Garrison, S. Gill, and J. Ross. 1999. *Further Applications of the CALMET/CALPUFF Modeling System to the Estimation of Nitrogen Deposition in the Chesapeake Bay Watershed.* Paper presented at the AWMA 92nd Annual Meeting & Exhibition, June 20-24, 1999, St. Louis, MO.

Gill, S., M. Garrison, and J. Sherwell. 1999. *A Review of the New ISC-PRIME Model and Implications for Power Plant Licensing in Maryland.* Paper presented at the AWMA 92nd Annual Meeting & Exhibition, June 20-24, 1999, St. Louis, MO.

Sherwell, J., M. Garrison, S. Joshi. 2001. *Experience with Using the AERMOD and ISCPRIME in New Power Plant Licensing in Maryland.* In Proceedings 94th Annual Meeting of the Air and Waste Management Association, Air and Waste Management Association, Pittsburgh, PA.

Sherwell, J., M. Garrison, S. Joshi. 2001. *Use of CALMET/CALPUFF to Evaluate Long-term Deposition Trends*. In Proceedings 94th Annual Meeting of the Air and Waste Management Association, Air and Waste Management Association, Pittsburgh, PA.

Garrison, M. and J. Sherwell. 2002. *Visibility Impact Modeling: How Well Does CALPUFF Perform?* Presentation at the 5th Electric Utilities Environmental Conference (EUEC), Tucson, AZ. 25 January 2002.

Avendt, L, M. Garrison, J. Ross, D. Brown. 2002. *Air Impacts of Distributed Generation Power Sources in Maryland.* In Proceedings 95th Annual

Meeting of the Air and Waste Management Association, 02-42920. Air and Waste Management Association, Pittsburgh, PA.

Yegnan, A., M. Garrison, S. Joshi. 2003. *Estimation and Analysis of Long-term Trends in Nitrogen Deposition Using CALPUFF*. In Proceedings 96th Annual Meeting of the Air and Waste Management Association, 03-70408 Air and Waste Management Association, Pittsburgh, PA.

Avendt, L., D. Brown, M. Garrison, J. Ross. 2003. *Air Impacts of Distributed Generation Power Sources in Maryland*. In Proceedings 96th Annual Meeting of the Air and Waste Management Association, 03-69844 Air and Waste Management Association, Pittsburgh, PA.

Garrison, M., J. Sherwell, A. Yegnan. 2004. *A Source Apportionment of Nitrogen Deposition in the Maryland Coastal Bays*. For presentation 20-22 September 2004 NADP Conference, Halifax, Nova Scotia, Canada.

Garrison, M., J. Sherwell, A. Baines, A. Yegnan. 2004. *Modeling Mercury Deposition in Maryland Using CALPUFF*. For presentation 20-22 September 2004 NADP Conference, Halifax, Nova Scotia, Canada.

Garrison, M., J. Sherwell, P. Wishinski. 2004. *CALPUFF/MM5 Modeling Results*. For presentation at the MANE-VU Modeling and Data Analysis/Monitoring Meeting, Hall of States, Washington, D.C., Septermber 30, 2004.

L. Avendt, M. Garrison, J. Ross, A. Yegnan, *Air Impacts of Distributed Generation Power Sources in Maryland*, Reported prepared by ERM for Maryland Department of Natural Resources Power Plant Research Program, PPRP-131, August 2004.

Sherwell, J., M. Garrison, A. Yegnan. 2004. *Evaluation of Wet Deposition Predicted by the CALPUFF Model Using NADP/NTN Historical Data*. For presentation at 20-24 October 2003 NADP Conference, Washington, D.C.