

October 9, 2008

Hon. Stephen L. Johnson
Administrator
United States Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Mail Code 1101A
Washington, DC 20460

Re: Petition for Rulemaking Under the Clean Air Act to Monitor and Reduce the Atmospheric Discoloration of the Night Sky

Dear Administrator Johnson:

Two-thirds of Americans cannot see the Milky Way from their backyard, and 99% of the population live in an area that scientists consider light polluted. The rate at which light pollution is increasing will leave almost no dark skies in the contiguous US by 2025.¹ This problem is not limited to big cities and industrial centers. Light pollution is affecting the night sky in our Federal Class 1 Areas, national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional national, recreational, scenic or historic value.²

Thus, as part of the Regional Haze plan, states should be asked to make a significant contribution to reducing man-made emissions that contribute to atmospheric discoloration of the night sky. I therefore petition the Administrator of the United States Environmental Protection Agency (“Administrator” or “EPA”), pursuant to the Administrative Procedure Act, 5 U.S.C. §§ 551-559, 701-706 (2000), (pursuant to 5 U.S.C. § 553(e), “[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule,”) the Clean Air Act, 42 U.S.C. §§ 7401-7671q (1990), (“the Act”), and the Act’s implementing regulations, to control and reduce the emissions of light fixtures that contribute to visibility impairments. In this petition we request that EPA promulgate regulations (1) requiring the monitoring of the night sky for atmospheric discoloration, and (2) develop regulations necessary to achieve the “natural visibility” conditions of the Clean Air Act in relation to atmospheric discoloration of the night sky by 2064 and the Prevention of Significant Deterioration for other regulated areas.

Given the predictions for 5%-10% annual growth of night sky brightness³, EPA must not delay in regulating these emissions. EPA is required to give prompt consideration to this petition. Due to the ongoing, and worsening visibility impairment, I hereby request a substantive response to this petition within one-hundred-eighty (180) calendar days. I will consider litigating to compel a response that is unreasonable delayed.

¹ <http://www.nature.nps.gov/air/lightscapes/>

² <http://www.nature.nps.gov/air/lightscapes/monitorData/index.cfm>

³ <http://www.lightpollution.it/dmsp/predictions.html>

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BACKGROUND

In this section, we set forth a brief description of the petitioner and their interest in protecting the night sky from atmospheric discoloration (aka Light Pollution). We identify the statutory regime under which the Administrator has the authority to regulate atmospheric discoloration and the available science showing that regulation is necessary.

I. PETITIONER

Robert Wagner is a private citizen at: 9005 N Chatham Avenue, Kansas City, MO 64154. An Eagle Scout and Assistant Scoutmaster for a troop in the Heart of America Council, I am also a co-author of the Boy Scout's of America Dark-Sky Camping paper. I believe the loss of a starry night sky to camp under will be a detriment to the Scouting program worldwide.

II. STATUTORY BACKGROUND

The Administrator has the responsibility and authority under the Clean Air Act to control man-made emissions that result in atmospheric discoloration of the night sky.

A. The Administrator Has the Responsibility to Protect Nighttime Visibility

In the District of Columbia Circuit case No. 99-1348, *American Corn Growers Association vs. EPA*; the EPA successfully argued for the Haze Rule which is covered by the Clean Air Act. This argument was upheld in *Section III. The "Natural Visibility" Goal and the "No Degradation" Requirement*⁴. It is nevertheless obvious that the EPA is responsible to protecting the nighttime visibility and establishing regulations to achieve its mission. To date the EPA has not claimed it was solely responsible for daytime visibility at the exclusion of the night. In its "Final Regulator Analysis: Control of Emissions from Nonroad Diesel Engines", page 108. Section 2.1.3.1.2 Visibility Impairment in Mandatory Federal Class I Areas; "More than 280 million visitors come to enjoy the scenic vistas and unique natural features including the night sky in these and other park and wilderness areas each year." The EPA mentions the night sky is an important feature of the scenic vista, which its mission is to protect.

B. The Administrator Has the Authority to Regulate Nighttime Visibility Impairments

In the same court case mentioned above, the EPA argued that to fulfill its mission, the Administrator had the authority to create the Haze Rule and manage visibility impairments. It appears in reading the October 1979 *Protecting Visibility: An EPA*

⁴ <http://www.ll.georgetown.edu/FEDERAL/judicial/dc/opinions/99opinions/99-1348a.html>

Report to Congress and other documents available on the EPA website, that night sky brightness was linked haze problems and attributed primarily to particulate and aerosol issues. In Chapter 2, 2.5.1 under General Haze – Visual Range, Contrast, Color. The documents states “Aerosol haze can also degrade the view of the night sky. Light scattering and absorption diminish star brightness. Perception of stars is also reduced by an increase in the brightness of the night sky caused by scattering of available light. In or near urban areas, particle scattering of artificial light significantly increases night sky brightness. The combination of extinction of starlight and increased sky brightness markedly decreases the number of stars visible in the night sky at fine particle concentrations of 10 to 30 µg/m³ (Leonard et al., 1977).” In subsequent documents such as the 1982 Air Quality Criteria for Particulate Matter and Sulfur Oxides Volume III both in draft and final releases, this exact phrase is repeated. It is notable, however, that in the 1995 Air Quality Criteria for Particulate Matter II of III review draft this paragraph is included, but omitted from the final report. If the Administrator was limited to only day-time visibility impairments, this language would never have been included and repeated.

The term “day” is used many times in the Clean Air Act; the term daytime is not. “Day” always refers to a 24-hour day and current regulations support this⁵. Nighttime is part of the 24-hour day and visibility impairments unique to this time should be given the same weight as those occurring during the daytime.

With the authority to regulate nighttime visibility impairments clearly established in current rules and regulations, consideration must be given for identifying man-made emissions of light as a pollutant. (CAA, § 302(g)) The term "air pollutant" means any air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air. The EPA is presented with a broad definition due to the fact that the Clean Air Act is designed for any future impairment of visibility and needs to be broad to handle pollutants unknown at the time of its writing. While emissions of light in the early part of the 20th century would be considered minor problems in relation to particulate matter, today the situation is reversed in many areas as particulate matter levels improve and the night sky brightness worsens. Light emissions must be considered a new pollutant and managed under the “natural visibility” and “prevention of significant deterioration” sections of the Clean Air Act⁶.

III. FACTUAL BACKGROUND

Night Sky Brightness is not a new subject and considerable research exists to demonstrate the impairment and worsening conditions.

A. EPA

⁵ http://www.epa.gov/ttn/oarpg/t1/fact_sheets/pmfact.pdf 1997 new 24 hour PM2.5 standards

⁶ (CAA, § 169A(a)(1)) and (CAA, § 160)

Night sky visibility impairments appears to be first mentioned in the October 1979 *Protecting Visibility: An EPA Report to Congress*. “Aerosol haze can also degrade the view of the night sky. Light scattering and absorption diminish star brightness. Perception of stars is also reduced by an increase in the brightness of the night sky caused by scattering of available light. In or near urban areas, particle scattering of artificial light significantly increases night sky brightness. The combination of extinction of starlight and increased sky brightness markedly decreases the number of stars visible in the night sky at fine particle concentrations of 10 to 30 $\mu\text{g}/\text{m}^3$ (Leonard et al., 1977).” In subsequent documents such as the 1982 Air Quality Criteria for Particulate Matter and Sulfur Oxides Volume III both in draft and final releases, this exact phrase is repeated. It is notable, however, that in the 1995 Air Quality Criteria for Particulate Matter II of III review draft this paragraph is included, but omitted from the final report.

In 1983 in a report (000R83105 Impact Assessment Work Group I, Final Report January 1983, 5-16, page 490) it is mentioned “When urban light and haze combine at night, the contrast between the night sky and the stars is reduced, markedly limiting the number of stars visible in the night sky (Leonard et al. 1977)” Another report (450582001 Review of the National Ambient Air Quality Standards for Particulate Matter: Assessment of Scientific and Technical Information, OAQPS Staff Paper, January 1982) mentions this same paragraph.

In 1984 in a report (450R84503 – Developing Long-Term Strategies for Regional Haze Findings and Recommendations of the Visibility Task Force), the task force mentions Effect of Increased Visibility – Improved view of night sky as a visibility related aesthetic value. Indeed, they reference the decrease in star brightness by fine particles (Leonard et al., 1977).

The January 1995 (EPA-SAB-EC-95-007) report: *EPA Beyond The Horizon: Using Foresight To Protect The Environmental Future* mentions: Ecological Effects, Their Assessment and Management “Increasing light pollution is found to be seriously disruptive to many species’ physiology and behavior.”

The March 31, 1995 (EPA-SAB_EPEC-95-003) letter to the Administrator regarding SAB Environmental Futures Project – EPEC Futures Report, “Ecosystem Management: Imperative for A Dynamic World” it is mentioned in section 4.2 Stressors: “the Committee identified light pollution, electro-magnetic fields (EMF), and noise pollution as significant potential future stressors.” And Section 7.1.2 Driver/Stressor Linkages mentions: “The spread of human development, in combination with increased per capita consumption, would increase habitat fragmentation, noise and light pollution, introduction of exotic species, and water pollution.” Section 7.1.3 Ecological Endpoints mentions: “Species which would be negatively affected under this scenario include those that live in xeric or high elevation environments, species with large home ranges (because of fragmentation of the natural landscape), nocturnal species (because of increased light pollution), and species highly sensitive to noise pollution.” Section 7.1.4 Risk Management mentions: “Manage Exposure: Control toxics in surface waters, nutrients,

thermal pollution, EMF, light pollution, and noise pollution.” Section 7.1.5 mentions: “Nocturnal animals would be stressed by continuous nighttime light pollution from ubiquitous human settlements.” APPENDIX B. ECOLOGICAL ISSUES FOR THE FUTURE mentions: “Using the conceptual model for futures analysis to evaluate two energy scenarios, the Committee identified light pollution, noise pollution, and electromagnetic fields as having possible adverse ecological effects in the future.

a) Light pollution: If energy becomes inexpensive and widely available globally associated with advances in fusion and/or hydrogen technologies, it is likely that this energy will be used to light up the planet. Many animals and plants use light cues to initiate their reproductive activities. Nocturnal animals have evolved life strategies which partition niches based on nighttime activities. Excessive light could significantly disrupt plant and animal physiology and behavior, potentially causing significant effects.”

In 2003 a report (454R04012) Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel’s ongoing peer review of the Agency’s Fourth External Review Draft of Air Quality Criteria for Particulate Matter (June 2003) and peer review of the Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information (OAQPS Staff Paper - First Draft)(August 2003) and a related draft technical report, Particulate Matter Health Risk Assessment for Selected Urban Areas (Draft Report)(August 2003)) mentions “B-18 “As indicated earlier, the 3 local visibility standards summarized in the CD are all based on daytime-only observations. In addition to minimizing effects of fog, mist (heavily hydrated hygroscopic aerosol) and other natural influences that may cause or interact with pollutants to impair visibility, there are other logical reasons to consider a daytime-only averaging time for a secondary visibility standard. Nighttime visibility is less important in urban areas. Unlike wilderness areas, there are few campers sleeping out under the stars and urban light pollution substantially diminishes urban views of distant objects. Its dark, there’s not much to see except lights, and most of us are indoors with our eyes closed and asleep.”

In the May 2004 "Final Regulator Analysis: Control of Emissions from Nonroad Diesel Engines", page 108. Section 2.1.3.1.2 Visibility Impairment in Mandatory Federal Class I Areas; "More than 280 million visitors come to enjoy the scenic vistas and unique natural features including the night sky in these and other park and wilderness areas each year."

More recently in the January 3, 2008 Letter from the Clean Air Scientific Advisory Committee (CASAC) to the Administrator regarding Particulate Matter Review Panel’s Consultation on EPA’s Draft *Integrated Review Plan for the National Ambient Air Quality Standards for Particulate Matter*, Dr. William Malm mentions “Page 33, line 19: Shouldn’t night sky issues be addressed? Light pollution is directly related to haze levels and the ability to see celestial landscapes.”

In the April 18, 2008 (EPA-SAB-08-007) letter to the Administrator regarding SAB Advisory on EPA's Draft Report on the Environment 2007: Science Report it is mentioned "**In the final Report, indicators should be included in the ecological condition chapter to represent physico-chemical components of ecosystems** (e.g., soils, water, chemicals, snow pack, and physical habitats). Some physico-chemical indicators are already included in the Report (e.g., mean temperature and precipitation, sea surface temperature, sea level, stream flows, and nitrogen and phosphorus discharge into rivers and streams). It is also noted that an indicator of light pollution is not currently included in the Report. Because artificial light may adversely affect some species that depend upon darkness as a physical attribute of habitat, it is specifically recommended that in future Reports, EPA consider including an indicator of light pollution."

B. THE NATIONAL OCEANIC and ATMOSPHERIC ADMINISTRATION

The National Oceanic and Atmospheric Administration has produced numerous works regarding Light Pollution and modeling Light Pollution. This includes: *Modeling Light Pollution From Population Data and Implications for National Park Service Lands*⁷ Steve Albers, and various turtle recovery plans. Nighttime images of the Earth at night have been obtained from the Defense Meteorological Satellite Program (DMSP) of the US Air Force and were used to produce numerous papers⁸ showing the Artificial Night Sky Brightness⁹ around the world in conjunction with other scientists. Current efforts exist to continue monitoring the brightness of the night sky¹⁰. Growth research has been able to provide predictions for the near extinction of our unpolluted night skies by 2025¹¹ given a conservative 6% annual growth rate.

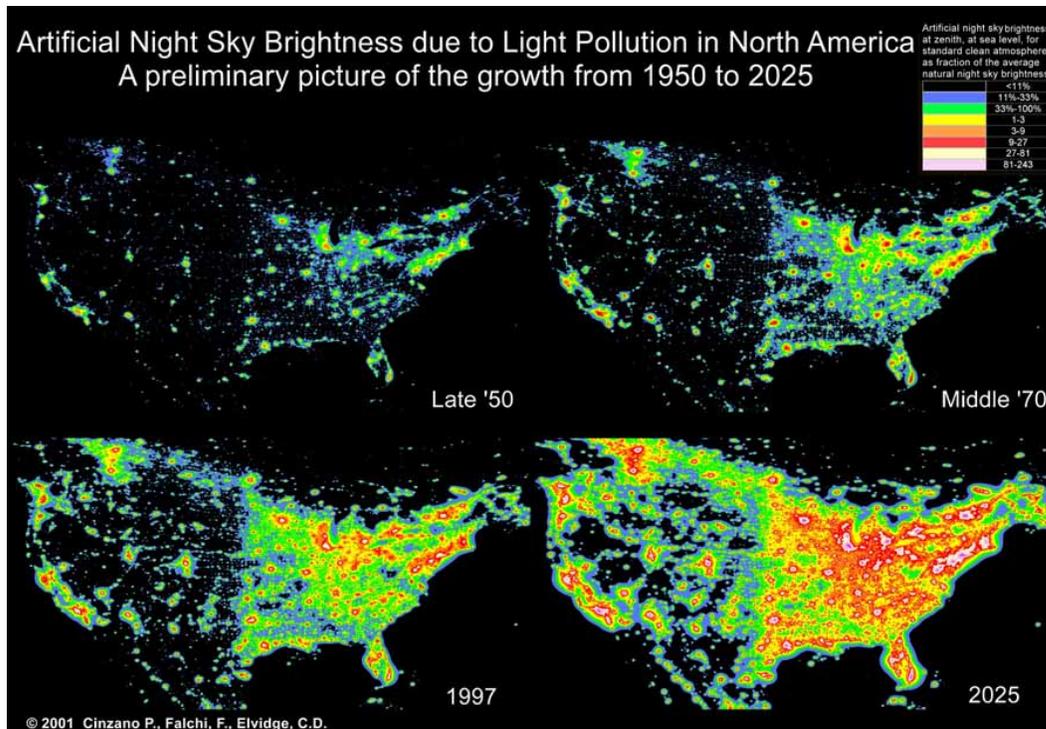
⁷ <http://laps.noaa.gov/albers/lp/gwpaper/lppaper.htm>

⁸ <http://www.lightpollution.it/cinzano/papers.html>

⁹ <http://www.ngdc.noaa.gov/dmsp/publications.html>

¹⁰ http://www.ngdc.noaa.gov/dmsp/pubs/Nightsat_IJRS_2007.pdf

¹¹ <http://www.yosemite.org/naturenotes/NALightPollution.htm>



C. NATIONAL PARK SERVICE

The NPS put together the Night Sky Team in 1999 to address increasing alarm over the loss of night sky quality throughout the network of national parks¹². They have been able to put together Night Sky Assessments¹³ for a variety of parks. Their monitoring includes several Federal Class 1 Areas including: Arches National Park, Canyonlands National Park, Yellowstone National Park, Lassen Volcanic National Park, Yosemite National Park, Sequoia National Park and others. All of the data collected indicates varying degrees of night sky brightness due to man-made emissions.

D. U.S. FISH & WILDLIFE SERVICE

The FWS has integrated light pollution remediation into its sea turtle recovery plan. Research indicates that newly hatched turtle are drawn to inland artificial lights. Other reports on the effects of Light Pollution include migratory birds¹⁴, to the Ashy Storm-Petrel Federal Register Notice on May 15, 2008¹⁵. The FY2008 Cooperative Endangered Species Conservation Fund show that in Nebraska, \$385,911 was allocated

¹² <http://www.nature.nps.gov/air/lightscapes/team.cfm>

¹³ <http://www.nature.nps.gov/air/lightscapes/monitorData/index.cfm>

¹⁴ <http://www.fws.gov/migratorybirds/issues/tower.html>

¹⁵ <http://www.fws.gov/policy/library/E8-10790.html>

to acquire and restore 80 acres for protecting known populations of Salt Creek Tiger Beetle from light pollution and water quality impacts¹⁶.

E. OTHER REPORTS

Other notable reports on the effects upon wildlife include: *A Silent Cry for Dark Skies*, Connie Walker (National Optical Astronomy Observatory)¹⁷, *Ecological Consequences of Artificial Night Lighting*, Edited by Catherine Rich and Travis Longcore¹⁸.

A map of the night sky brightness at zenith produced by NOAA was also used to create maps of 149 Federal Class 1 Areas. Estimates show over half of the areas had problems, while a quarter have a night sky brightness that would indicate they have lost the ability to see half of the visible stars¹⁹.

A Simple Computer Model For The Growth Of Light Pollution, Robert Pike, Toronto Centre, Royal Astronomical Society of Canada²⁰, indicates that conservative growth rate of 10% per year in Ontario with rates as high as 20% are not uncommon in the outlying suburbs of Toronto. Riegel (1973)²¹ states that outdoor lighting levels in the U.S. are growing at about 20% per year, many times faster than the population.

Historically, as more efficient methods for producing light have been developed, our lighting needs have increased²². Simply developing more efficient light sources can only be expected to exasperate the problem.

CONCLUSION

EPA has the responsibility and authority to protect our national treasures from visibility impairments including atmospheric discoloration of the night sky. This includes the prevention of significant deterioration and a return to natural visibility conditions for specific areas. Ignoring the brightening of the night sky has resulted in twilight conditions for many of these areas through the night with more expected to degrade to this level. Such a result is neither natural nor exemplary of its mission and duties under the Clean Air Act. Any short-term gains in night sky brightness observed through the reduction of particulate matter will be erased as the quantity and intensity of outdoor lighting continues to increase²³.

¹⁶ <http://www.fws.gov/pdfs/Sect6FY2008AwardSummariesFINAL.pdf>

¹⁷ <http://www.astrosociety.org/education/publications/tnl/74/uitc74.pdf>

¹⁸ <http://www.urbanwildlands.org/ecanlbook.html>

¹⁹ <http://mcrol.trianglealumni.org/class1.html>

²⁰ <http://herpolhode.com/rob/rpike.pdf>

²¹ Riegel, K.W. 1973, *Science*, 179, 1285.

²² <http://www.sciencemag.org/cgi/content/abstract/179/4080/1285?ck=nck>

²³ <http://cowles.econ.yale.edu/P/cp/p09b/p0957.pdf> Page 34, Table 1.9 Budget Studies on Lighting

²³ See Attachment 1

It is necessary for the EPA to start monitoring the night sky for atmospheric discoloration and manage light emissions that contribute to its degradation. Quick action by the EPA can ensure that light fixtures installed are complementary to the goals of the Clean Air Act and our national investment in upcoming energy efficient technologies is not wasted. Additionally, a related comment on the Proposed Missouri State Implementation Plan – State of Missouri Regional Haze Plan raise questions about whether the plan will be successful in achieving “natural visibility” conditions and “prevention of significant deterioration” for the state’s two Federal Class I Areas and national parks²⁴.

²⁴ and <http://www.dnr.mo.gov/env/apcp/docs/02-07-2008recommendforadoption.pdf> - Missouri Regional Haze Plan: Comment #2, Page #2



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

28 JAN 2008

Robert Wagner
9005 N. Chatham Avenue
Kansas City, MO 64154

Dear Mr. Wagner:

Thank you for your correspondence regarding whether the Regional Haze Program, Sections 169A and 169B of the Clean Air Act, addresses decreased visibility of the night sky due to artificial light. Specifically, you asked whether the Environmental Protection Agency (EPA) will include night sky visibility in its reasonable progress goals, and whether manmade light can be regulated as visibility impairment.

The Clean Air Act sets as the national goal of the visibility program "the prevention of any future, and the remedying of any existing impairment of visibility in mandatory class I federal areas which impairment results from manmade air pollution." The EPA's implementing Regional Haze regulations require the States to submit plans containing "reasonable progress goals" providing for progress towards achieving this goal. These regulations also establish the deciview as the metric for measuring and tracking changes in visibility impairment. The deciview, in turn, is a function of visual range, which is only valid during daylight hours. Therefore, the reasonable progress goals are based upon daytime visual impairment only and do not consider light as contributing to visibility impairment. The Regional Haze regulations do not accordingly include night sky visibility in the reasonable progress goals.

As to whether manmade light could be regulated under the Clean Air Act's visibility program, Sections 169A and 169B do not clearly authorize the EPA to regulate visibility impairment due to manmade light, as reflected by the existing Regional Haze regulations. In addition, there may also be some question as to whether light would be considered an "air pollutant" under Section 302(g) of the Clean Air Act for purposes of the visibility program.

If you have any additional questions, you may contact Robert Fenemore of my staff, at (913) 551-7745. In addition, as you may know, the National Park Service has established a Night Sky Team to address increasing alarm over the loss of night sky quality through the network of national parks. For more information about their work in this important area, please contact Chad Moore, Night Sky Team Program Manager, at (435) 834-4904.

Sincerely,

A handwritten signature in black ink, appearing to read "J. A. Tapp".

Joshua A. Tapp
Branch Chief
Air Planning and Development Branch

