United States Department of the Interior

NATIONAL PARK SERVICE
Rocky Mountain National Park
Estes Park, Colorado 80517

IN REPLY REFER TO:

(N36)
May 9, 2006

Dennis E. Ellis
Executive Director
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Dear Mr. Ellis:

The Memorandum of Understanding (MOU) "For Interagency Collaboration to Address Air Quality Issues Affecting Rocky Mountain National Park" recently signed by our agencies and the Environmental Protection Agency (EPA), recognizes that reversing current trends and restoring ecosystem health at the park will require collaboration. As outlined in the MOU, establishing a science-based resource management goal that is protective of park resources is a critical step that will help advance our shared interest in moving toward that goal. The MOU states that the National Park Service (NPS) will: "Define resource management goals related to nitrogen deposition (e.g., critical loads, sustainable conditions, and desired future conditions) that would be protective of the park's sensitive resources." The purpose of this letter is to report to you on progress towards establishing these resource management goals.

Our agencies recognize that establishing a science-based management goal for nitrogen deposition will provide us with an assessment tool that will enable us to integrate information about the effects of nitrogen deposition on ecosystems, land management objectives, and management of air pollution. This is especially important in light of the NPS's responsibilities to protect national park resources as mandated by several legislative acts of Congress. Specifically, the NPS has an affirmative responsibility under the Clean Air Act to protect and enhance air quality related values (e.g., sensitive ecosystem components) and to fulfill our obligation under the Organic and Wilderness Acts to conserve national park resources unimpaired for future generations. In addition, the 1915 enabling legislation for Rocky Mountain National Park (RMNP) states that it was set aside "for the preservation of the natural conditions and scenic beauties" contained therein.

As you know, the NPS has worked for many years with the scientific community to identify ecosystem effects from atmospheric nitrogen deposition loadings (expressed in kilograms of nitrogen per hectare per year – kg N/ha/yr). Current loadings of 3.1 kgN/ha/yr (for a five-year average of 2000-2004 wet deposition data) have been monitored at the Loch Vale watershed on the east side of the Park. Total nitrogen deposition (wet and dry) is estimated at 4.0 kgN/ha/yr over the past five years. These levels of deposition are 15-20 times greater than the estimated

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natural background level of around 0.2 kg N/ha/yr nitrogen deposition. Measured levels of nitrogen deposition have also been increasing at about 2.5% per year over the past two decades as documented by the park's on-site monitoring program.

A wealth of peer-reviewed scientific research articles have documented ecosystem effects from nitrogen deposition that have already occurred on the east side of the Continental Divide in RMNP. The effects of atmospheric deposition in the park have been summarized in presentations, technical background documents, literature reviews, and fact sheets and this information has been made available to the public on the Colorado Department of Public Health and Environment (CDPHE) web site at (www.cdphe.state.co.us/ap/rmnp.html). Briefly, these unnatural effects include:

(1) Changes in both the type and abundance of aquatic plant species (diatoms). This indicates a shift from naturally occurring plant species in undisturbed, oligotrophic (low-nutrient) lakes towards nutrient-tolerant plant species indicative of disturbed systems and eutrophication;

(2) Chronically elevated levels of nitrate in surface waters. Accumulation of nitrate in east side park waters indicates advanced stages of nitrogen saturation– nitrate levels are "stage 2+" on a widely used, nitrogen saturation scale of zero to three. Nitrogen saturation effects are negligible at stage "zero" and declines in ecosystem health (such as increased mortality of trees and fish) are more likely as stage 3 is reached;

(3) Elevated levels of nitrogen in spruce tree chemistry. This indicates an imbalance of essential nutrients and an increased risk of declining forest resistance to disease, insect infestation, drought, and cold temperatures;

(4) Long-term accumulation of nitrogen in forest soils. Soil nitrogen at current elevated levels has increased soil microbial activity, which further increases nitrogen production. As such, accumulating nitrogen from atmospheric deposition is fueling a cycle of increasing nitrogen concentrations in park soils and surface waters.

In addition, the following has been documented at high elevation sites in Niwot Ridge, just outside park boundaries:

(5) Nitrogen induced shifts in alpine tundra plant communities from wildflowers toward more sedges and grasses.

These effects noted above and documented in multiple scientific studies, together provide a body of evidence that nitrogen deposition has resulted in significant harmful effects on park ecosystems on the east side of the Continental Divide. To begin the process of restoring healthy ecosystems to the Park, it is necessary to establish the resource protection goals for the Park, and base them on the best science currently available. Recently published research findings specific to RMNP indicate that ecosystem health began to decline at high elevation areas on the east side of the park at 1.5 kg N/ha/yr wet deposition. Significant ecosystem response to the atmospheric contribution of nitrogen began to occur at this wet deposition rate, which was first reached

sometime between 1950 and 1964. Additional information about the documented effects in the park at this level of deposition, expressed as a "critical load", can be found in the paper recently published by Dr. Jill Baron, USGS, in the journal *Ecological Applications*, April, 2006, titled "Hindcasting Nitrogen Deposition to Determine an Ecological Critical Load." Critical load is defined as "a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge". This concept has been used successfully for many years in Europe and Canada to focus cost-effective cooperative conservation efforts on reducing atmospheric deposition of pollutants harmful to ecosystems.

Therefore, 1.5 kg N/ha/yr wet deposition is the critical load defining the threshold for ecological change due to eutrophication (nitrogen fertilization) at RMNP. The nutrient-induced changes in aquatic biota signal a shift in ecosystem health in the Park from a natural state to increasingly degraded conditions, indicated by the physical, chemical and biological effects discussed above. Collectively, if not individually, these changes constitute significant harmful effects on park ecosystems east of the Continental Divide.

This critical load value is about half the current level of wet nitrogen deposition at the Loch Vale subalpine monitoring site on the east side of RMNP. It is also similar to deposition loadings currently measured or estimated at Colorado sites on the west side of the Continental Divide. This coincides with the relatively healthy, unimpacted ecosystem conditions monitored on the west side of the Park. We believe, based on the available body of science for east side ecosystems of the Park, a critical load of 1.5 kgN/ha/yr (as measured in wet deposition at Loch Vale) is the benchmark that should be used at this time to link ecosystem protection goals of RMNP with air, and possibly water, management programs and policies administered by the State. This goal does not represent a regulatory standard nor is it enforceable by the NPS. Rather, it provides a guidepost to illuminate our ongoing discussions about potential management options and objectives.

Inaction to address deposition issues, considering the trend of increasing deposition rates in the park, represents additional short- to long-term risks to park resources. Studies on the progression of deposition effects in the eastern United States show that with continued elevated nitrogen deposition, even at current deposition rates, degradation in RMNP is likely to proceed towards significant effects of episodic and chronic acidification and the associated lethal effects on aquatic biota (such as fish) and terrestrial biota (such as forests). This is because nitrogen deposition can accumulate in soils over time. Although critical loads can also be estimated by scientists for the loading at which fish and forest mortality may occur; these outcomes do not represent resource management goals as outlined in the MOU, so will not be discussed further here.

We look forward to working together to develop approaches that will help us address these nitrogen deposition issues affecting RMNP. The next step, as outlined in the MOU, is for "all parties (will) work to develop a nitrogen deposition goal and/or a proposed air or water quality standard for making progress toward any resource management goal(s) established by the Park." Because many of the same atmospheric pollutants that contribute to nitrogen deposition also play a role in ozone pollution and visibility degradation, air pollution impacts that also affect RMNP,

existing and future Colorado state programs addressing ozone and visibility may provide some benefits in reducing nitrogen species emitted from contributing sources. We believe the effects of such programs will need to be assessed to determine any additional need for reductions that will reverse the trend of increasing deposition, to levels that are protective of ecosystem health. Thank you for your interest in this matter.

Sincerely,

/signed/
Vaughn Baker
Superintendent

cc:
Robert Roberts
Regional Administrator
Environmental Protection Agency, Region 8
999 18th Street
Denver, Colorado 80202

Howard Roitman
Director of Environmental Programs
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246

Mike Snyder
Director, Intermountain Region
National Park Service
P.O. Box 25287
Lakewood, Colorado 80225-0287

Douglas A. Lempke
Administrator, Air Quality Control Commission
Colorado Department of Public Health and Environment
OED-OLRA-A5
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Robert E. Brady Jr.
Air Quality Control Commission
Colorado Department of Public Health and Environment
OED-OLRA-A5
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Paul Frohardt
Administrator, Water Quality Control Commission
Colorado Department of Public Health and Environment
OED-OPPI-A5
4300 Cherry Creek Drive South
Denver, CO 80246-1530