

NOISY NEIGHBORS
Sound Pollution in the High Country

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Esse quam videri

Foreword

This study, "Noisy Neighbors" Sound Pollution in the High Country, is based on available information and research gathered by the author with the help of research assistants Shelly Parsons and Butch Reeves, members of the Blue Ridge Environmental Defense League and leaders of its chapter Watauga Citizens for Local Control in Boone North Carolina. The purpose of the study is to educate the members of the group, the general public and local officials in Watauga County about the impacts of environmental noise from a nearby dirt racetrack for automobiles. The emphasis is on the High Country, the region of North Carolina west of the Blue Ridge, a mountain region situated at an elevation of about 3,300 feet amsl at geographic coordinates 36.21769° N, -81.68586° E. The county seat of Boone, population 18,130, is the home of Appalachian State University. During the last year, the residents of the communities of Hidden Hills, Locust Hills, Seven Oaks and East Ridge have been affected by noise caused by an auto race track.

This study centers on the public health impacts of noise on a residential area. Data gathering completed by local residents in 2015 indicated a serious problem. Further study is always welcome in any scientific inquiry, but this report presents a case for immediate action by local officials to reduce or eliminate the loud, disruptive noise which has affected its residents and caused Watauga Citizens for Local Control to take action. We would not recommend that action be postponed pending further study. The precautionary principal, to anticipate and take steps to prevent harm before it occurs, is good medicine and applies in this case. The ethics of medical practice and public policy support action.

All scientific work is incomplete-whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us freedom to lower the knowledge we already have, or to postpone the action that it appears to demand at a given time. The lessons of the past in general health and safety practices are easy to read. They are characterized by empirical decisions, by eternally persistent reappraisal of public health standards against available knowledge of causation, by consistently giving the public the benefit of the doubt, and by ever striving for improved environmental quality with the accompanying reduction in disease morbidity and mortality. The day of precise quantitative measurement of health and welfare effects has not yet arrived. Until such measurement is possible, action must be based upon limited knowledge, guided by the principal of the enhancement of the quality of human life. Such action is based on a philosophy of preventive medicine.¹

Delay would not serve the needs of the community; in fact, the harm to the residents is already having an impact. Watauga Citizens for Local Control is the messenger. The Town of Boone must act to protect its residents' health and well-being. The economic considerations of a special interest group cannot take precedence over the right to be secure in one's home.

¹ "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety," US Environmental Protection Agency, Office of Noise Abatement and Control (March 1974), Hill EB, Foreword, EPA-550/9-74-004, accessed 1/18/16 at <http://www.nonoise.org/library/levels74/levels74.htm>

Executive Summary

The neighborhoods surrounding the Mountain View Speedway have endured extremely loud and irritating noise from the track almost every week end, April through October of 2015. Sound level readings taken at many residents' properties have been very high, in the mid-90 decibel level. Jack Butler, a local resident stated, "The roar of the track is like having a jackhammer or lawnmower operating on my deck." Other activities relating to the track take place on additional days, giving residents little reprieve from the bombardment of noise pollution. Some who are not directly affected have questioned whether noise is pollution. It is.

In the United States, public policy to address noise pollution began in the early 1970s. The Noise Control Act of 1972 charged the federal government with protecting public health and welfare from noise pollution by establishing standards for noise emissions and by authorizing federal agencies to establish rules. If the federal government recognizes noise as a form of pollution, so should local governing bodies.

The scientific community has documented many effects of noise on people and their activities. Some effects are directly related to the noise, others are related indirectly as a result of stress induced by noise. The United States EPA has recognized clear evidence that noise of sufficient intensity and duration can temporarily or permanently damage hearing, affect performance of a complicated task, interfere with speech and other auditory communication, disturb sleep, and be a source of annoyance. More than five million children in the United States, ages six to nineteen, suffer from noise-induced hearing impairment. Stress induced by noise can affect the ability of the body to fight existing ailments. In sum, stress caused by noise pollution causes negative health issues in addition to hearing loss.

Numerous studies have documented heart-related, respiratory, neurological, and other physiological effects of noise. Stress, high blood pressure, anger and frustration, lower resistance to disease and infection, circulatory problems, ulcers, asthma, colitis, headaches, gastrointestinal disorders, and many other physiological and psychological problems have been linked directly to noise. A fetus exposed to noise may experience a change in heart rate, or it may suffer the impact of its mother's noise-related stress.

The true social costs of noise pollution also must include monetary losses from sickness, absenteeism, loss of productivity and earning capacity. Residents are at risk for tremendous financial loss when they sell their homes.

Atmospheric factors can strongly influence sounds from distances beyond a few hundred feet. The normally humid environment in the southeastern US allows sound to travel further with less reduction in noise level. The topography of an area also greatly affects the way sound travels.

Neighbors of the racetrack are suffering from the effects of this unchecked noise. As homeowners are forced indoors to escape the roaring noise of cars without mufflers or insufficient mufflers, they have discovered that going inside, closing all windows and doors does not eliminate the noise from the track. Local resident Jette Terpner said, "I must leave my home to escape the noise from this track. My home should be my sanctuary from the stresses of the world. Now, living here with the racetrack as a neighbor has become the cause of my stress."

The Town of Boone needs to step up and challenge the operation of this racetrack, because noise pollution has human costs as well as monetary costs to communities. Residents cannot be expected to leave their homes every Saturday night to avoid the noise. Racing fans can choose to attend a race, but local residents are left with no choice in the matter. These are our homes, our property. Please help protect the only sanctuary we have from the pressures of life. Stop the noise!

Butch Reeves

Sound Pollution in the High Country

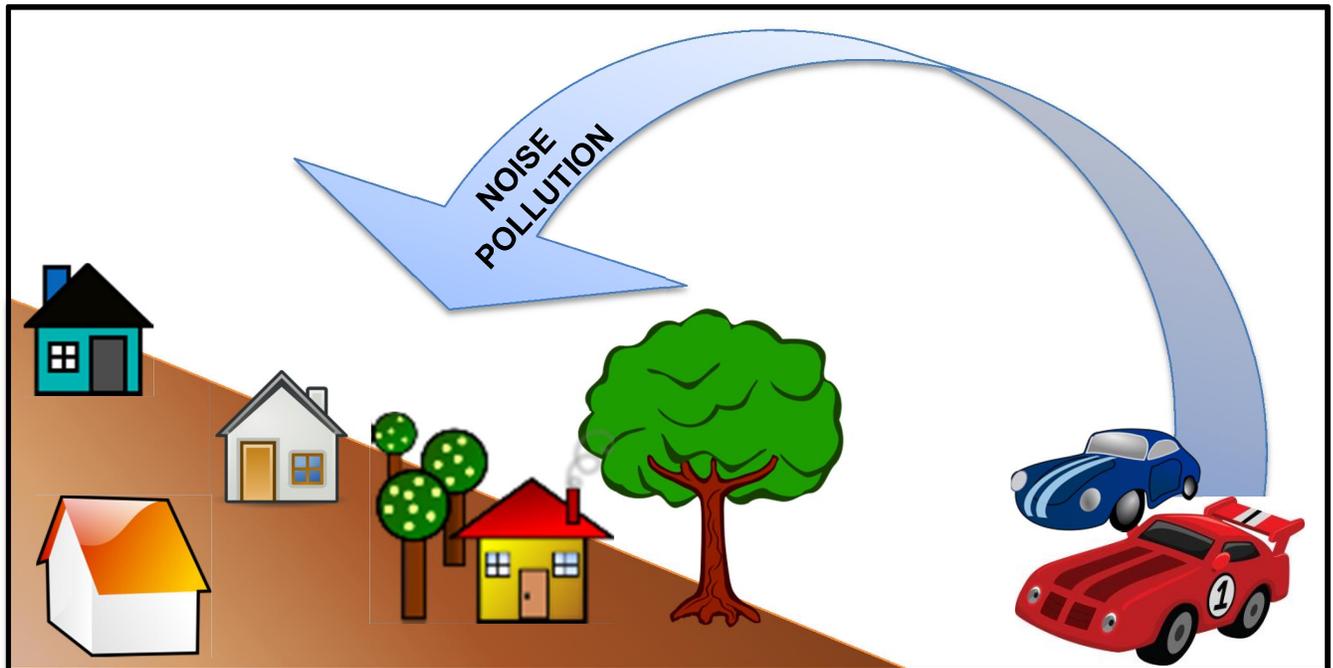
Physical Phenomena

Sound is a form of energy which consists of physical vibrations through a medium. *Science Dictionary* defines sound as: "mechanical vibrations and waves in gases, liquids and solid elastic media. Specifically the sensation felt when the eardrum is acted upon by air vibrations." Some vibrations can be heard by the human ear, others of very low or high frequency cannot. The range of human hearing is from 20 Hz to 20 kHz. (Hertz, abbreviated Hz, is a unit of measure. One Hz is one cycle per second.) The kinetic energy which is sound can travel long or short distances and greater or lesser speed depending on the medium through which it moves. For example, sound travels at 768 mph in dry air and at 3,300 mph in water. High energy sound waves can be painful, and has been employed to torment political prisoners. Clearly, loud noise can interfere with speech and disturb sleep.

Sound is measured in terms of decibels, abbreviated dB. A decibel is a logarithmic unit; that is, a ten decibel increase indicates a sound energy level ten times higher. Environmental measurements of sound and human perception of it indicate that:

The sound level increases by 3 dB (or decibels) when the actual sound energy present is doubled. Conversely, half the sound energy must be eliminated to reduce the level 3 dB. A six decibel change indicates four times as much sound, and a 10 decibel change 10 times the sound. It means that 90% of a given sound energy must be eliminated before most people will judge a sound half as loud.²

Figure 1. How Noise Pollution Impacts Mountain Areas



² *Evaluation of Environmental Sound in the Community*, Stewart ND, Ph.D. FASA FASTM (July 23, 2011), page 2, downloaded 1/16/15 from <http://www.sacnc.com>

Experts in the science of noise pollution have determined that disruptive sound levels can travel far from the source and over natural and artificial barriers such as trees and walls. This phenomenon is illustrated in Figure 1.

“The atmospheric effects become most important at distances beyond about 1000 feet from the source....The normally humid environment in the southeastern US allows sound to travel further with less reduction in level. Downwind and under many night-time conditions (cooler air near the surface), sound waves that start upward will bend downward. Thus, the noise reduction benefits of barriers can be negated by these atmospheric effects.”³

Thus, although sound generally decreases with distance, under some circumstances noise pollution can have higher impacts at greater distances. The map attached at Appendix A shows the elevated location of the most-affected residential areas overlooking the Speedway: Hidden Hills, Locust Hills, Seven Oaks and East Ridge.

Noise Pollution

Noise is a form of pollution. The plain definition of noise is: “sound, especially when it is unwanted, unpleasant or loud”⁴ But when noise in the environment becomes a public health problem, it is more than unpleasant, it is rightly considered a pollutant, like nitrogen oxides, sulfur dioxide, carbon monoxide and ozone. In fact, the nation’s major environmental protection laws include noise as a pollutant.

Just as individuals react to sound in different ways, a community’s reaction to noise includes a range of responses. Residents who take steps to complain about a noisy neighbor represent but a small fraction of the people who are actually bothered. Experts have quantified community response.

The researchers found that if 1% complained, 17% were highly annoyed, and if 10% complained, 43% were highly annoyed. A few complaints may show a high community-annoyance level.⁵

The federal Noise Control Act of 1972 made it the nation’s policy to reduce the harm caused by excessive levels of noise to the general public.⁶ The law states:

The Congress declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare. To that end, it is the purpose of this Act to establish a means for effective coordination of Federal research and activities in noise control, to authorize the establishment of

³ *Evaluation of Environmental Sound in the Community*, Stewart ND, Ph.D. FASA FASTM (July 23, 2011), page 3, downloaded 1/16/15 from <http://www.sacnc.com>

⁴ Cambridge Advanced Learner's Dictionary

⁵ *Id.* page 10

⁶ Noise Control Act of 1972, 42 U.S.C. 4901, Public Law 92-574, Oct. 27, 1972; 86 Stat. 1234; 42 USC 4901 et seq.; Amended by PL 94-301, May 31, 1976; PL 95-609, Nov. 8, 1978; PL 100-418, Aug. 23, 1988

Federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products.

The term "health and welfare" in the above statement is defined as the "complete physical, mental and social well-being and not merely the absence of disease and infirmity"; in other words, the absence of mental anguish and annoyance.⁷

The Noise Control Act designated roles for the three levels of government— federal, state and local. Emission controls are a federal responsibility. Local and state governments are delegated control over the use of the various noise sources and the levels permitted in the environment from them, including automobiles, lawn mowers, leaf blowers, amplified sound systems and other common sources.

The federal Clean Air Act Title IV includes a section on the reduction of noise as a pollutant.⁸ The United States Environmental Protection Agency defines noise pollution as follows:

Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life. The fact that you can't see, taste or smell it may help explain why it has not received as much attention as other types of pollution, such as air pollution, or water pollution. The air around us is constantly filled with sounds, yet most of us would probably not say we are surrounded by noise. Though for some, the persistent and escalating sources of sound can often be considered an annoyance. This "annoyance" can have major consequences, primarily to one's overall health.⁹

Under the Clean Air Act, the EPA established the Office of Noise Abatement and Control to study the impacts of noise on public health and welfare. In 1981 the Administration closed this office and transferred this responsibility from the federal agency to state and local governments where it remains.

The medical definition of noise pollution specifically refers to the internal combustion engines of automobiles and others: "Noise pollution: environmental pollution consisting of annoying or harmful noise (as of automobiles or jet airplanes)" called also sound pollution.¹⁰ Noise pollution is a recognized health hazard by the US Surgeon General, who further distinguishes noise pollution in the home from its workplace counterpart:

⁷ "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety," US Environmental Protection Agency, Office of Noise Abatement and Control (March 1974), page 7, EPA-550/9-74-004, accessed 1/18/16 at <http://www.nonoise.org/library/levels74/levels74.htm>

⁸ The Clean Air Act Amendments of 1990 added subchapter IV-A to Title IV dedicated to the control of acid deposition caused by the burning of fossil fuel and emissions of sulfur dioxide. United States Code, Title 42 § Chapter 85, The Public Health and Welfare, Air Pollution Prevention and Control, Acid Deposition

⁹ "Title IV - Noise Pollution," US EPA website at <http://www.epa.gov/clean-air-act-overview/title-iv-noise-pollution>

¹⁰ Medline plus Health information, World Health Organization

In relation to environmental pollution, noise is normally associated with annoying sound waves in communities, but noise is also a threat to public health. As asserted by Dr. William H. Stewart, former U.S. Surgeon General, "Calling noise a nuisance is like calling smog an inconvenience. Noise must be considered a hazard to the health of people everywhere."

Environmental noise is any combination of sounds that disturbs desired actions and the health of individuals or groups in a particular geography. Community noise (also called environmental noise, residential noise, or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail, and air traffic; industries; construction and public works; and the neighborhood. The main indoor noise sources are ventilation systems, office machines, home appliances, and neighbors.¹¹

The US EPA's Office of Noise Abatement and Control found that "levels of 55 decibels outdoors and 45 decibels indoors are identified as preventing activity interference and annoyance. These levels of noise are considered those which will permit spoken conversation and other activities such as sleeping, working and recreation, which are part of the daily human condition."¹²

The US EPA places a large measure of responsibility on local governments to protect their residents from the negative effects of noise pollution. This is a logical method of protecting public health because municipal officials are in the best position to know their environment, their residents and the nature of the problems they face from excessive noise.

Medical Impacts

Sound has no odor, no taste and is invisible. Nevertheless, excessive noise is a pollutant. Disturbing levels of sound become a medical issue when the noise interferes with normal activities and the quality of life. Being unable to sleep or to have a normal conversation for extended periods or at recurring intervals creates stress. These conditions lead to acute, chronic and long-term problems. And the negative impacts of noise pollution on human health can be serious.

Chronic environmental noise causes a wide variety of adverse health effects, including sleep disturbance, annoyance, noise-induced hearing loss (NIHL), cardiovascular disease, endocrine effects, and increased incidence of diabetes (Passchier-Vermeer and Passchier 2000; Sørensen et al. 2013).¹³

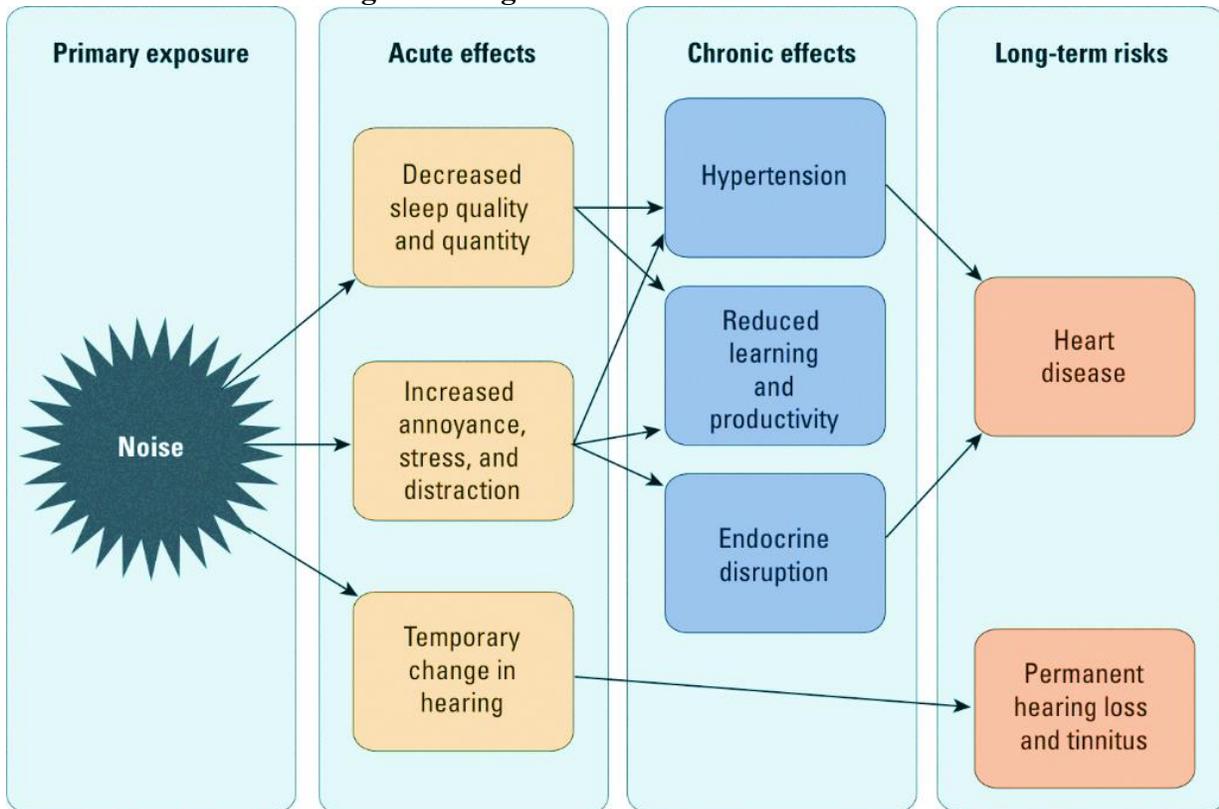
¹¹ Mauricio Leandro, "Encyclopedia of Consumption and Waste: The Social Science of Garbage," Edited by Carl A. Zimring & William L. Rathje, DOI: <http://dx.doi.org/10.4135/9781452218526.n233>

¹² "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety," US Environmental Protection Agency, Office of Noise Abatement and Control (March 1974), page 7, EPA-550/9-74-004, accessed 1/18/16 at <http://www.nonoise.org/library/levels74/levels74.htm>

¹³ "Environmental Noise Pollution in the United States: Developing an Effective Public Health Response," Monica S. Hammer, Tracy K. Swinburn, and Richard L. Neitzel, *Environmental Health Perspectives*, Vol. 122, No. 2, February 2014, pp. 115-119

The World Health Organization describes high levels of noise as a “serious annoyance” in residential areas when the average sound levels exceed 55 decibels during the day and 45 decibels at night. The agency recommends that 60 decibels be the maximum level to prevent sleep disturbance at night. An independent expert states, “For a speaker and listener outdoors, around 6 feet apart, the beginning of speech interference by many common steady noises is at around 60 dBA.”¹⁴ Persistent levels of sound at the serious annoyance level create the conditions illustrated in Figure 2.

Figure 2. Negative Health Effects of Noise¹⁵



This cascade of health problems created by excessive noise appears to be related to anxiety and tension, leading to medical problems.

Traffic noise causes considerable disturbance and annoyance in exposed subjects. Besides the psychosocial effects of community noise, there is concern about the impact of noise on public health, particularly regarding cardiovascular outcomes. Non-auditory health effects of noise have been studied in humans for a couple of decades using

¹⁴ *Evaluation of Environmental Sound in the Community*, Stewart ND, Ph.D. FASA FASTM (July 23, 2011), page 9, downloaded 1/16/15 from <http://www.sacnc.com>

¹⁵ “Environmental Noise Pollution in the United States: Developing an Effective Public Health Response,” Monica S. Hammer, Tracy K. Swinburn, and Richard L. Neitzel, *Environmental Health Perspectives*, Vol. 122, No. 2, February 2014, pp. 115-119

laboratory and empirical methods. Biological reaction models have been derived which are based on the general stress concept.¹⁶

Excessive noise is a serious public health problem which calls for preventive measures.



¹⁶ Journal of Public Health | Vol. 33, No. 2, pp. 1606-169 | doi:10.1093/pubmed/fdr032

APPENDIX A: Communities Impacted by Noise Pollution Within 1500, 3000 and 4500 Feet of the Speedway



