**Testimony of**

**Tee Guidotti, MD, MPH, DABT**

**Representing the**

**American Thoracic Society**

**Hearing on**

**The Proposed National Ambient Air Quality Standards**

**for Particulate Matter**

**Subcommittee on Energy and Power**

**Committee on Energy and Commerce**

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Mr. Chairman, Members of the Committee, thank you for the opportunity to testify today. My name is Tee Lamont Guidotti. I am a medical doctor and environmental health scientist with training in epidemiology and training and qualifications in toxicology. I held many positions over the years, including professor and Chair of the Department of Environmental and Occupational Health in the School of Public Health and Health Services and Director of the Division of Occupational Medicine and Toxicology of the Department of Medicine, School of Medicine and Health Sciences at George Washington University. I also held cross-appointments in epidemiology, health policy and pulmonary medicine. I have engaged in research on air

quality and health and have followed the issue of fine particulate matter since before fine particulates were identified as a special hazard. I am now an international consultant based on Washington DC. I am here today representing the American Thoracic Society.

Founded in 1905, the American Thoracic Society is an international medical society with more than 15,000 members. The American Thoracic Society is the world's leading medical association dedicated to advancing clinical and scientific understanding of pulmonary diseases, critical illnesses and sleep-related breathing disorders.

The American Thoracic Society supports EPA adopting a much stronger standard for fine particulate matter ($PM_{2.5}$), first on the grounds that revision of the standard will be protective of human health, and second on the grounds that the scientific evidence accumulated by EPA is sufficient and compelling to justify a move to a more protective standard at this time. The American Thoracic Society is recommending an annual standard of 11 $\mu g/m^3$ combined with a 24-hour standard of 25 $\mu g/m^3$. That recommendation has been supported by a wide range of medical societies and public health groups, including the American Medical Association, the American Academy of Pediatrics, the American Lung Association, the American Heart Association and the American Public Health Association.

There is a broad consensus in the scientific community that particulate matter air pollution is harmful to human health. Based on the available evidence, the American Heart Association recently concluded that exposure to ambient fine particulate matter air pollution ($PM_{2.5}$) is a “modifiable

factor that contributes to cardiovascular morbidity and mortality".[1] The World Health Organization attributes 28,000 premature deaths in North America and 800,000 worldwide to ambient particulate matter each year,[2-3] although more recent studies suggest that the true public health burden might be even greater.[4]

The American Thoracic Society further believes that the scientific evidence that supports the proposed revision and upon which EPA relies is sound, comprehensive, and validated. This body of evidence is the product of decades of intensive research conducted with stringent oversight, double- and triple-checking results, reanalysis to confirm every important finding, and laboratory validation of observations in human populations. The demonstration of the health effects of $PM_{2.5}$ is itself a scientific triumph nearly on a level with the analysis of the human genome.

This was hard science, difficult to do because health outcomes are tangled up and related to one another and because several air pollutants and weather conditions move up or down closely together. It takes years of observation, careful analysis, and replication at many different sites to isolate and characterize the individual effects of $PM_{2.5}$ and to separate it from, say, ozone or "synoptic" weather patterns characterized by heat and humidity. This science was tough to do and it was ultimately well done by the many investigators in the United States who figured out the problem and by thousands of investigators around the world who have studied the problem in diverse settings to establish its generalizability. In the end the evidence is overwhelming.

In the scientific review of the 2009 Integrated Science Assessment for Particulate Matter, the external panel of independent scientists that make up the Clean Air Scientific Advisory Committee and the EPA scientists concluded that a "causal relationship" exists between ambient fine particulate matter and both mortality and cardiovascular effects and that "a likely causal" relationship exists between ambient fine particulate matter and respiratory effects.[5-6]

These conclusions were reached following a rigorous review. EPA convened ten multi-day public workshops, CASAC meetings, and teleconferences beginning in 2007 in a transparent process that allowed scientific peer review by CASAC and public comment at every step. The CASAC alone submitted over 650 pages of comments reviewing each of the EPA documents multiple times. The science has been thoroughly vetted. The CASAC reached a unanimous conclusion that a range of 13-11 $\mu g/m^3$ for the annual standard was scientifically justified. [13]

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In epidemiology, there is a guide to whether an association is likely to be causal or non-causal, by which is meant that the true cause may be indirect, acting on both the risk factor and the outcome, or that the association is spurious, the result of bias or error. This guide consists of nine basic tests, or "criteria" for accepting as causal a statistical association demonstrated by studies in human populations. These nine criteria are: [5]

1. Strength of association (interpreted here as strength against a background of other environmental drivers)
2. Consistency
3. Specificity
4. Temporal relationship (temporality)
5. Biological gradient (an exposure-response relationship)
6. Biological plausibility
7. Coherence
8. Experiment evidence
9. Analogy (are there similar observed associations)

For fine particulate air pollution, all nine criteria have been abundantly and exhaustively satisfied. There have even been quasi-experimental situations in human populations (in which air pollution dropped and then rose again) which have demonstrated a dip and then a return in mortality, an unusual and very compelling validation. [5]

Furthermore, epidemiology is not the only way of knowing that $PM_{2.5}$ has an effect on the human body. Studies of the effect of fine particulate matter in tissues, in animal experiments, and in human volunteer research has clearly

shown that even low levels of $PM_{2.5}$ are associated with abnormalities of the heart conduction system, coagulation of blood, and airways.

There are good reasons why $PM_{2.5}$ is so potent in the human body, despite the very small size of the particles and the very small mass of all the particles that reach the lung. This is largely because the size range of $PM_{2.5}$, being so tiny, insinuates itself in places where larger particles cannot go and presents the body, in the aggregate, with a geometrically much larger surface are than large particles. We know this now.

The conclusion that ambient fine particulate matter is an important and preventable cause of death and hospitalization has been endorsed by a number of scientific organizations including the World Health Organization, the National Research Council, the American Medical Association, the American Lung Association, the American Heart Association, the American Academy of Pediatrics, the American College of Cardiology, and the American Association of Cardiovascular and Pulmonary Rehabilitation, among others and the Clean Air Scientific Advisory Committee.

I now draw your attention to some key scientific findings of these health effects.

**Long-term health effects**

A number of large studies have looked at the long-term health effects of ambient particles. The first of these studies was the Harvard Six Cities study which followed 8111 men and women living in 6 U.S. cities for 14-16 years. The researchers found that over a 16 year period, adults who lived in the

most polluted of the 6 cities had a 26% higher rate of death as compared to those in the least polluted city.[7] Several other studies have found similar results including the American Cancer Society Cancer Prevention Study II,[8-10] the California Seventh-day Adventists cohort study,[11] and a recent national study of 66,000 participants from the Women's Health Initiative (WHI) Observational Study.[12] These studies provide evidence linking long-term exposure to ambient particulate matter and all-cause mortality, cardiovascular mortality, and non-fatal cardiovascular events.

The impact of particulate air pollution on life expectancy is substantial. Scientists recently looked at changes in life expectancy in 200 counties in the U.S. and calculated that reductions in fine particle air pollution between 1980 and 2000 increased the average lifespan in these counties by approximately 5 months.[14] Importantly, the greatest increase in life expectancy was seen in those counties showing the greatest reduction in fine particle air pollution during this time.

**Short-term health effects**

Hundreds of studies in the U.S. and around the world have confirmed that elevations in particulate matter are associated with an increased risk of premature death, cardiovascular death, hospitalization for respiratory and cardiovascular diseases, and respiratory symptoms within days.[5] These associations have been found for $PM_{2.5}$ (fine particles smaller than 2.5 micrometers in diameter), $PM_{10}$ (particles smaller than 10 micrometers in diameter), and $PM_{10-2.5}$ (coarse particles ranging in diameter from 2.5 to 10 micrometers).

These scientific studies have linked particulate matter exposure to a variety of problems, including:

- aggravated asthma in children;[15]
- increased emergency department visits and hospital admissions;[16-17]
- higher risk of hospitalization for congestive heart failure,[18]
- stroke,[19] and myocardial infarction (heart attacks);[20]
- increased risk of premature death;[21] and
- more frequent dangerous irregularities of the heartbeat[22]; and
- more frequent deaths, second heart attacks, and hospital admissions for people who have already experienced one heart attack.[23]

Particulate pollution can cause health problems for anyone, but certain people are especially susceptible. Children and teenagers, the elderly, and people who already have cardiovascular disease, chronic lung disease or diabetes are among the groups most at risk. Even healthy adults who work or exercise outdoors may face higher risk.[5] As best we can now tell, people pass into and out of conditions where they are more susceptible to the effects of fine particulates. Even younger and healthier people may be transiently susceptible.

Air pollution acts by serving as the last straw or by stacking the odds against a person when they are most vulnerable to their health problems. We know that the majority of people who are affected by fine particulate air pollution are older and may already be ill, the effect of $PM_{2.5}$ are not limited to them: fine particular air pollution also takes smaller numbers of young people and even, in some studies (mostly of more severe pollution), fetal deaths. The

effects are seen disproportionally in individuals with low socioeconomic status or lower educational levels because of where they live and their health status.

Many of these studies have been done in cities that are in compliance of the U.S. National Ambient Air Quality Standards. Thus, the harmful effects of particulate matter can be seen even at pollution levels well below the current regulatory standards.

Congress built into the Clean Air Act an orderly process for the regular review of the scientific evidence related to the health effects of air pollution. This review includes multiple rounds of peer review, including by the congressionally mandated panel of independent scientists – the Clean Air Scientific Advisory Committee (CASAC). The American Thoracic Society strongly supports the authority of the EPA to periodically review and update the air quality standards as mandated by the Clean Air Act, including for $PM_{10}$ and coarse particle pollution. The evidence of the harm from particulate matter pollution underscores how important it is for the EPA to review and adjust health standards on an ongoing basis — and for Congress to continue to allow them to do so.

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