

EDITORIALS



Air Pollution Still Kills

Rebecca E. Berger, M.D., Ramya Ramaswami, M.B., B.S., M.P.H.,
Caren G. Solomon, M.D., M.P.H., and Jeffrey M. Drazen, M.D.

In late October 1948, a dense smog descended over the town of Donora, Pennsylvania. The town was home to a zinc plant and a steel mill, both run by the United States Steel Corporation. Susan Gnora, a 62-year-old resident of Donora, started to gasp and cough as the smog descended.¹ She died the next day. Dr. William Rongaus, a physician and a member of the board of health, went door to door, treating patients for their respiratory symptoms and encouraging them to leave town if they could. Many thousands were ill, and at least 20 people died in one of the worst air-pollution disasters in U.S. history. The Donora tragedy transformed our perception of smog from a nuisance to a potential killer.

We started to improve air quality with the Clean Air Act of 1963. In 1970, Richard Nixon established the Environmental Protection Agency (EPA) by executive order, and the Clean Air Act was amended to institute National Ambient Air Quality Standards (NAAQS), which set exposure limits for six major air pollutants.² Among the pollutants regulated by the EPA is fine particulate matter — inhalable particles with an aerodynamic diameter of less than 2.5 μm ($\text{PM}_{2.5}$). Major contributors to $\text{PM}_{2.5}$ in the United States include various types of transportation and the coal-fired generation of electricity.^{3,4} Since the 1970s, hundreds of articles have been written establishing an association between $\text{PM}_{2.5}$ and poor health outcomes, including asthma, ischemic heart disease, and all-cause mortality in urban populations.^{5,6} In response to these findings, regulators have lowered NAAQS for the allowable amount of $\text{PM}_{2.5}$ in the air.⁷ Current NAAQS,

last updated in 2012, set an annual mean $\text{PM}_{2.5}$ level of 12 μg per cubic meter. This standard, which is to be reviewed every 5 years, aims to protect the population, especially those who are particularly sensitive to the adverse effects of air pollution, including children, elderly persons, and persons with cardiopulmonary disease.² As communities meet these stricter standards, fewer people will become sick and die as a result of air pollution. A 2011 report from the EPA projected that by 2020, amendments to the Clean Air Act would prevent more than 230,000 premature deaths, largely as a result of reductions in $\text{PM}_{2.5}$ levels.⁸ But are current standards sufficient to protect public health?

Di et al. now report in the *Journal* the results of a large study, including more than 60 million Medicare beneficiaries from the years 2000 through 2012, that addresses the association between annual average levels of $\text{PM}_{2.5}$ and ozone,⁹ as measured at the ZIP Code level, and mortality. For every increase of 10 μg per cubic meter in $\text{PM}_{2.5}$, there was an associated 7.3% increase in all-cause mortality (95% confidence interval [CI], 7.1 to 7.5), after adjustment for demographic characteristics, Medicaid eligibility, and area-level covariates. Below the current NAAQS for $\text{PM}_{2.5}$ of 12 μg per cubic meter, the data showed that each increase in $\text{PM}_{2.5}$ of 10 μg per cubic meter was associated with an even greater increase (13.6%) in mortality (95% CI, 13.1 to 14.1). There was no appreciable level below which the risk of death tapered off — and thus no “safe” level of $\text{PM}_{2.5}$. Owing to the large size of the cohort, Di et al. were able to perform robust sub-

group analyses and identified greater risks of death associated with air pollutants among blacks and Medicaid-eligible populations; moreover, these groups were more likely to be exposed to higher pollutant levels.

The findings of Di et al. stress the need for tighter regulation of air-pollutant levels, including the imposition of stricter limits on levels of $PM_{2.5}$. Despite compelling data, the Trump administration is moving headlong in the opposite direction. In March, Trump signed an executive order that lifted a moratorium on new leases for coal mined on public and tribal lands and began a process to dismantle guidelines intended to reduce emissions from coal-fired electricity plants.¹⁰ Earlier this month, he announced his intention to withdraw the United States from the Paris climate agreement. Although these actions were primarily intended to undo efforts made by the Obama administration to address climate change, the potentially dire consequences also include increasing people's exposure to particulate matter. In addition, EPA Administrator Scott Pruitt has not ruled out the possibility of revoking a waiver included in the 1970 Clean Air Act that allows California to set limits on automotive tailpipe emissions that are more stringent than national standards¹¹; 15 states have adopted California's standards. Revoking this waiver could have the effect of exposing more than 100 million Americans to higher levels of automobile emissions. Trump's proposed budget includes crippling cuts to the EPA, including cuts in funding for both federal and state enforcement of regulations. The increased air pollution that would result from loosening current restrictions would have devastating effects on public health.

In explaining his withdrawal from the Paris climate agreement, Trump stated, "I was elected to represent the citizens of Pittsburgh, not Paris." Ironically, Pittsburgh is less than 30 miles from the Donora Smog Museum, where a sign reads,

"Clean Air Started Here." With the report by Di et al. adding to the large body of evidence indicating the risks of air pollution, even at current standards, we must redouble our commitment to clean air. If such protections lapse, Americans will suffer and we are doomed to repeat history. Do we really want to breathe air that kills us?

Disclosure forms provided by the authors are available with the full text of this editorial at NEJM.org.

1. Templeton D. Cleaner air is legacy left by Donora's killer 1948 smog. *Pittsburgh Post-Gazette*. October 29, 1998 (<http://old.post-gazette.com/magazine/19981029smog1.asp>).
2. National Ambient Air Quality Standards — criteria air pollutants: NAAQS table. Washington, DC: Environmental Protection Agency (<https://www.epa.gov/criteria-air-pollutants/naaqs-table>).
3. Laden F, Neas LM, Dockery DW, Schwartz J. Association of fine particulate matter from different sources with daily mortality in six U.S. cities. *Environ Health Perspect* 2000;108:941-7.
4. Thurston GD, Burnett RT, Turner MC, et al. Ischemic heart disease mortality and long-term exposure to source-related components of U.S. fine particle air pollution. *Environ Health Perspect* 2016;124:785-94.
5. Atkinson RW, Kang S, Anderson HR, Mills IC, Walton HA. Epidemiological time series studies of $PM_{2.5}$ and daily mortality and hospital admissions: a systematic review and meta-analysis. *Thorax* 2014;69:660-5.
6. Hoek G, Krishnan RM, Beelen R, et al. Long-term air pollution exposure and cardio-respiratory mortality: a review. *Environ Health* 2013;12:43.
7. National Ambient Air Quality Standards — table of historical particulate matter (PM). Washington, DC: Environmental Protection Agency (<https://www.epa.gov/pm-pollution/table-historical-particulate-matter-pm-national-ambient-air-quality-standards-naaqs>).
8. Benefits and costs of the Clean Air Act 1990-2020, the second prospective study. Washington, DC: Environmental Protection Agency Office of Air and Radiation, 2011.
9. Di Q, Wang Y, Zanobetti A, et al. Air pollution and mortality in the Medicare population. *N Engl J Med* 2017;376:2513-22.
10. Presidential Executive Order on promoting energy independence and economic growth. Press release of The White House, Washington, DC: March 28, 2017.
11. Hearing on nomination of Attorney General Scott Pruitt to be Administrator of the U.S. Environmental Protection Agency — questions for the record for the Honorable E. Scott Pruitt: hearing before the Senate Environment and Public Works Committee, January 18, 2017 (https://www.epw.senate.gov/public/_cache/files/1291a5e0-b3aa-403d-8ce3-64cb2ef86851/spw-011817.pdf).

DOI: 10.1056/NEJMe1706865

Copyright © 2017 Massachusetts Medical Society.