WASHINGTON — The Environmental Protection Agency issued a new health standard on Thursday for sulfur dioxide emissions, the first such revision in nearly 40 years.

The agency said the new standard, adopted under the Clean Air Act, would prevent 2,300 to 5,900 premature deaths and 54,000 asthma attacks a year. The agency estimates the cost to industry of adopting the new rule at $1.5 billion over the next 10 years, and the value of the health benefits at $13 billion to $33 billion a year.

Sulfur dioxide, or SO2, is a major element of the exhaust from coal-burning power plants and a component of acid rain. It has been linked to many health problems, including respiratory distress, asthma, emphysema and bronchitis.

The previous standard was based on a 24-hour measurement of sulfur dioxide concentrations; the E.P.A. is moving to a one-hour measuring period to protect against short-term exposure.

“We’re taking on an old problem in a new way, one designed to give all American communities the clean-air protections they deserve,” said Lisa P. Jackson, the E.P.A. administrator. “Moving to a one-hour standard and monitoring in the areas with the highest SO2 levels is the most efficient and effective way to protect against sulfur dioxide pollution in the air we breathe.”

The agency is also requiring that new monitors be set up by 2013 in the areas that are subject to the highest concentrations of sulfur dioxide.

States with metropolitan or industrial areas that do not meet the new standard will have to submit plans no later than August 2017 showing how they will come into compliance, generally
by requiring the sources of the emissions to install upgraded equipment to capture them. Compliance will be measured by the 470 monitoring stations already in operation; the new rule will require installation of about 40 monitoring sites.

The first standards for sulfur dioxide were set in 1971, establishing limits both for public health and for the environment. They have not been significantly altered since then, although a federal court ordered a revision in 1996 after the agency declined to set a new standard. Thursday’s action came in response to that court decree. The agency says it is working on a secondary standard to address the environmental effects of sulfur dioxide.

In 1990, the federal government imposed limits on nationwide emissions of sulfur dioxide from power plants and major sources, resulting in a reduction of nearly 50 percent in releases of the chemical. Emissions declined further in recent years when the E.P.A. ordered cuts in the sulfur content of diesel fuel.

Thursday’s action set a new air-quality standard for sulfur dioxide. The current standard calls for concentrations of no more than 140 parts per billion, averaged over 24 hours. The new rule reduces the ceiling to 75 parts per billion, measured hourly.

Frank O'Donnell of Clean Air Watch, an advocacy group, praised the action. “Although the final standard is a bit less strict than we and the American Lung Association had urged,” Mr. O'Donnell said in a statement, “it is well within the range recommended by E.P.A.’s independent science advisers.”

“This action will mean fewer kids and adults will have asthma attacks,” he said. “Fewer people will go to the hospital. And fewer people will die prematurely from air pollution.”