Battlefield and terrorist explosions pose new health risks

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High concentrations of nitrogen dioxide gas — inhaled for even very brief periods following fires, explosions of military munitions or detonations of terrorist devices — could cause serious lung damage, scientists reported today at the 233rd national meeting of the American Chemical Society.

Dr. Zengfa Gu, M.D., Ph.D., and colleagues at the Walter Reed Army Institute of Research, Silver Spring, Md., reached that conclusion based on experiments with laboratory rats that were exposed to the toxic gas. Gu explained that previous research showed that chronic exposure to low and moderate levels of nitrogen dioxide could damage the lungs. However, there was no clear information on the health risks of brief, high-level exposures lasting only a few minutes.

Nitrogen dioxide, a reddish-brown gas with a sharp, biting odor, is most familiar as an air pollutant. Released to the air from the exhaust pipes of automobiles and the burning of coal and other fossil fuels, it is an ingredient in photochemical smog. Nitrogen dioxide also is a common indoor air pollutant that is released from gas ranges and other indoor combustion sources. It can cause nose, eye and more serious health problems. Government industrial health regulations limit workplace exposures to 5 parts per million (ppm).

The gas, however, also forms when the heat from fires and explosives makes nitrogen and oxygen in the air combine to form nitrogen dioxide.

Gu said information about such brief exposures to nitrogen dioxide is important for the military because in battlefield situations, personnel easily can be exposed to high concentrations of nitrogen dioxide. Civilians also could be exposed as a result of terrorist bombings. Similar exposure could occur among civilians trapped in fires for several minutes before being rescued.

“This research is very important,” Gu said. “The results tell us that if [one encounters] an environment with high concentrations of inorganic fire gases, serious lung injury may be induced rapidly. So this research provides the scientific background for prevention of inhalation trauma and the treatment of inhalation injury.”

In their experiments, scientists exposed laboratory rats to varying concentrations of nitrogen dioxide — 100 ppm, 500 ppm, 1,000 ppm and 2,000 ppm — for 5 minutes. They monitored effects of nitrogen dioxide during the exposure and examined the lungs afterward for signs of damage.

“The experimental data showed that after exposure to high concentrations of nitrogen dioxide for only five minutes, the respiratory function was extremely changed,” Gu said. “Breathing rate and depth were sharply inhibited; lung edema was rapidly induced, [and] acute and delayed lung damage occurred.”

Gu said that the research represents the first real-time measurements of breathing changes due to the inhalation of nitrogen dioxide gas. No other laboratories have conducted the same research due to technical challenges, which involved designing a special exposure chamber and computer software to make accurate measurements on living animals.

Source: American Chemical Society