Lifting the smog

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U experts lend a hand to help solve one of China’s most serious health threats: air pollution

On a humid day in urban China, a thick haze of smog can make people across the street virtually invisible.

The evidence of air pollution in China is jarring at best. At worst, it’s toxic—air pollution can lead to cancer, respiratory infections, nervous system problems, and birth defects. Worldwide, air pollution is to blame for about 7 million deaths every year, according to the World Health Organization.

China has seen a huge increase in pollution over the last several years, largely because of rapid economic and industrial development. Among the most hazardous air pollutants are the smallest particles, measuring 2.5 micrometers or smaller and labeled PM2.5 by experts in the field, because they can easily enter the body and cause harm after being inhaled.

For perspective, the level of PM2.5 pollution in major Chinese cities has been recorded at more than 10 times the level in the United States.

It’s a problem too large to ignore, even from halfway around the globe. So the University of Minnesota’s David Pui, Ph.D., a Distinguished McKnight University Professor in the College of Science and Engineering (CSE) Department of Mechanical Engineering, convened a group of his fellow faculty members and arranged a meeting in China in May to work with colleagues at the Institute of Earth Environment of the Chinese Academy of Sciences to address the health effects of this pollution.

“As global citizens, it is our obligation and responsibility to help China combat PM2.5 pollution and to transfer past experiences learned in the U.S. to China,” says Pui, holder of the Fingerson/TSI Chair in Mechanical Engineering and director of the U's Particle Technology Laboratory. Last year, Pui received the prestigious Einstein Professorship Award from the Chinese Academy of Sciences.

The U of M group, led by President Eric Kaler, Ph.D., and CSE Dean Steven Crouch, Ph.D., was composed of 15 total faculty members from the CSE; Medical School, including the Center for Lung Science and Health’s Marshall Hertz, M.D., and Christine Wendt, M.D.; and School of Public Health, including Jeffrey Mandel, M.D., M.P.H., and Gurumurthy Ramachandran, Ph.D. Another 45 scholars from Chinese institutions as well as 30 delegates representing 15 leading international filtration and pollution control companies participated in the workshop.

More industry, more cars, more health problems

Among the major sources of air pollution in China are coal-burning emissions from industry, vehicle emissions in urban areas, and indoor smoke in homes and restaurant kitchens.

“People in really polluted areas get more heart disease, more lung disease. We think that it’s a major contributor to COPD [chronic obstructive pulmonary disease] and lung cancer,” says Hertz, who is director of the Center for Lung Science and Health and the Judith H. and John M. Murphy Professor of Medicine. “[Pollution is] a huge stress on people who already have heart and lung diseases, and China has a lot of pollution from many sources. Of all the coal that is burned in the whole world, 50 percent is burned in China. Of all the cigarette smokers in the world, one-third are in China.”

The increase in disease is being largely attributed to these tiny PM2.5 particles.
“When you breathe them in, the big particles just land inside your nose, or they tickle your throat and you cough,” Hertz explains, “but the little teeny ones get all the way down into the little air sacs in your lungs—and even past there. Sometimes they can get absorbed into the bloodstream and can circulate in the body and cause sickness over a long period of time.”

**Solving a $277.5 billion problem**

Finding a remedy for this severe health threat will be no small feat. But the Chinese government is investing $277.5 billion over the next five years to help control and prevent further air pollution, and the University of Minnesota group is eager to help.

The workshop’s health effects group is exploring how it might measure improvements in health as the pollution is cleaned up. Wendt’s part of the project is looking for biomarkers that respond quickly to change so that the impact of the pollution reduction can be measured quickly, rather than several years from now, when it would be too late to act on findings about what's working and what isn't.

Mandel is hoping to use what he’s learned from his [study of higher mesothelioma rates on the Iron Range](http://www.ironrange.org/mesothelioma) to model a similar project for a city or region in China.

Since the May workshop in Xi’an, China, participants continue to meet and correspond, Pui says. Several joint research proposals have been or will soon be submitted to the Chinese Academy of Sciences and Natural Science Foundation of China for funding. Leaders are tentatively planning a second bilateral seminar in Minnesota for May 2015.

“PM pollution is a global problem requiring international participation to identify solutions,” Pui says. “This group represents the leading scholars and thinkers on PM2.5 pollution in China.”