China's Fight for Clean Air and Human Health

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In March 2018, the 13th National People's Congress of China strategically designed three major national tasks: mitigation of social and financial risk, precise poverty relief, and pollution control. Two top national pollution control priorities are reducing air pollution and preventing cancer and other diseases. Among the goals set by the Chinese Congress, both government and ordinary citizens echo the importance of protecting the blue skies.

Economic growth is essential for improving the quality of life. However, unsustainable development in China in recent decades results in detrimental effects, such as severe air pollution, which is directly and indirectly linked to adverse human diseases, including respiratory and cardiovascular diseases and cancer. [1] According to the China Pulmonary Health Study, 8.6% of the population in China has a chronic obstructive pulmonary disease (COPD) based on a study of 50 991 people. These results suggested that nearly 100 million people may suffer from COPD in the country. [2] Air pollution caused 8% of all deaths worldwide in 2015. [3] A study in 2015 showed that $PM_{2.5}$ causes approximately 3.3 million premature deaths each year, primarily in Asia, and the number of deaths will double by 2050. [4] In China, the recent cancer statistics data show that the number of new cancer cases continued to increase from 2000 to 2011. [5] In 2015, the age-standardized cancer incidence ranged from 191 to 213 per 100 000 people. [5] Among all types of cancer, lung cancer is the leading cause of mortality for both males and females in China. In 2013, the International Agency for Research on Cancer (IARC), a branch of the World Health Organization (WHO), classified air-borne particulate matter as a carcinogen (i.e., cancer- causing agent) linked to lung cancer and increased bladder cancer risk. [6] Owing to China's large population of ~1.3 billion, China adds a signi*fi*cant portion of the global cases of cancer and premature death due to air pollution.

Faced with the grand challenges of air pollution and human health issues, the government,

industry, researchers and other stakeholders have implemented a series of measures in recent years, such as banning coal and biomass burning, and promoting renewable energy applications. Monitoring data show that the $PM_{2.5}$ concentrations in many regions have continuously declined in recent years.

The number of days that exceeded the national standard for $PM_{2.5}$ concentration in 338 cities was reduced by 17.5%, 14.7%, and 12.4% in 2015, 2016, and 2017, respectively. [7] Compared with the previous years, the annual average $PM_{2.5}$ concentration in 338 cities decreased by 6%, and 10.6% in 2016 and 2017, respectively (Figure 1). However, $PM_{2.5}$ pollution levels in most, if not all, Chinese cities are still higher than the national standard of 35 $\mu g/m^3$, and much higher than the WHO standard of 10 $\mu g/m^3$. Thus, the fight against air pollution is a still long-lasting battle and a top priority of the government's agenda. Several national initiatives were launched three years ago. The Ministry of Science and Technology (MOST) initiated numerous related research projects on various aspects of $PM_{2.5}$ research with a total of $433 million in funding. The National Science Foundation of China (NSFC) also initiated two large projects, "Causes and counter measures for complex air pollution in China" and "Toxicology and health effects of atmospheric fine particulate matters", that each received $30 million in funding for eight years. These interdisciplinary collaborative projects have already involved hundreds of key investigators with back- grounds in epidemiology, biology, toxicology, material chemistry, analytical chemistry and atmospheric chemistry.

As an extension of previous efforts, the National People's Congress proposed a stage-by-stage strategy. The pollution relief strategy will shift from controlling the total emission amount to accurately controlling released toxic compounds and elucidating the related health effects. The future national science and technology policy will focus on improving human health and the

welfare by overcoming various environmental pollution issues.

In current government structure, pollution emission organizations and environmental enforcement agencies are not very clearly defined, and effective environmental control measures cannot be achieved because of bureaucrat procedures. To correct this problem, a new governing body, the "Ministry of Ecology and Environment", was established recently. This new ministry integrates the necessary authorities and responsibilities from six previous ministries, and have effective power to achieve eco-environmental protection at a national scale. At the same time, specific plans are also being made to further drive scientific innovation and strengthen fundamental and applied research; establish high-caliber national laboratories; support research projects with joint efforts from universities, research institutes, and corporations; and reinforce translational research and practical applications. Rapid improvements in environmental protection, particularly in air quality, are desirable and critical for sustainable development in China. Based on the past record, these new national initiatives can be expected to improve both the air quality and health of Chinese people in the coming years. Because China is currently one of the major global polluters, the success of these Chinese initiatives will positively contribute to global environmental protection and human health improvement.

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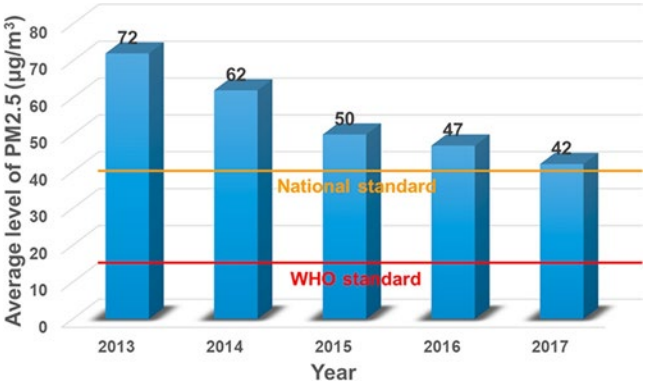

Figure 1. Nationwide average $PM_{2.5}$ levels in China from 2013 to 2017. [7]