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# 1

# Environmental Problems and Legal Responses

China's unprecedented economic growth since the late 1970s is rapidly depleting its natural resources and the environmental carrying capacities of air, water and land. 'Environmental pollution has become one of the main factors threatening human health, public security and social stability.'[1] 'There is a huge gap between the quality of the environment and people's demands and expectations.'[2] China addresses environmental problems with a range of legal instruments issued by national and local lawmaking bodies and administrative and judicial organs. In addition to the formal sources of law, state and party policies and plans often lead and shape the development of environmental law in China.

This chapter is divided into three sections. Section 1.1 exposes China's environmental crisis, the scale and impact of its air and water pollution and land contamination. Section 1.2 discusses the sources of environmental law in China: (i) the Constitution; (ii) specialized environmental statutes that regulate human conduct and the operation of legal persons and other organizations to prevent and control pollution; (iii) civil, criminal, administrative and procedural laws that are crucial in legal resolution of environmental problems; (iv) state regulations and administrative rules that implement national laws; (v) judicial interpretations that bind the courts and procuratorates in adjudication and procuratorial work, ensuring correct and consistent application of environmental law; (vi) local regulations that implement national laws, regulations and plans at a local level and (vii) international environmental treaties that China has ratified. Section 1.3 examines state and party policies and plans that have significant impact on the development of Chinese environmental law.

## 1.1 CHINA'S ENVIRONMENTAL CRISIS

The large-scale and high-speed economic growth seen in China since 1978 when the pragmatic leader Deng Xiaoping came to power has changed the lives of 1.3 billion Chinese and lifted 850 million out of poverty.[3] He initiated an 'open-door' policy to facilitate

[1] State Council, 12th Five-Year Plan (FYP) on Environmental Protection (2011), part I.
[2] State Council, 13th FYP on Ecological and Environmental Protection (2016), chapter 1.
[3] The poverty rate of the rural population in China fell from 97.5 per cent in 1978 to 3.1 per cent in 2017. See State Council, *Human Rights Development in China during Forty Years of Reform* (2018). www.pkulaw.cn, part II.



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China's economic reform and take-off after decades of chaotic political campaigns and class struggles during the Mao era. Within just forty years, China was transformed from a low-income developing country with a gross domestic product (GDP) of 367.9 billion yuan in 1978 to a powerhouse with a GDP of 82,712.2 billion yuan in 2017.[4] In 2011, China overtook Japan to become the world's second largest economy.[5] Such rapid economic ascendance has brought severe adverse impacts to the environment and to ecosystems, given the size and scale of China's population and economy. Environmental degradation caused by large-scale industrialization and urbanization has turned blue sky, clear water and green mountains into heavy smog, dark rivers, contaminated land and poisoned produce. Access to clean air and safe drinking water has become a luxury for China's citizens, rather than a basic staple.

By the early 1990s, seven areas had been identified as top priorities for action by state departments: (i) water pollution, especially contamination by organic waste; (ii) urban air pollution, as measured by particulates and sulphur dioxide ($SO_2$); (iii) pollution caused by industrial toxic and hazardous waste and municipal solid waste; (iv) water shortages, particularly in northern China; (v) soil erosion; (vi) low forest coverage and grassland deterioration and (vii) loss of species and habitats, especially wetlands.[6] Key elements of the environment, including air, water and land, continued to deteriorate, causing serious harm to human health and heavy losses to public and private property, and threatening and constraining China's long-term sustainable development.

### 1.1.1 Air Pollution

Coal is the primary source of air pollution in China. As the world's largest producer and consumer of coal, China burns as much coal as the rest of the world combined.[7] Its coal-fired power plants and industrial furnaces operate inefficiently and fail to control pollution effectively. Coal consumption contributes to 70 per cent of smoke and dust emissions and 90 per cent of $SO_2$ emissions in China.[8] Vehicles are another major source of air pollution. An expansion in car ownership, heavy traffic and low-grade petrol have made vehicles the leading source of air pollution in major cities. Particulate matters, major pollutants contributing to China's bad air and emitted by coal burning, industry and vehicles, are fine dust and soot, as well as aerosol particles less than 10 microns in diameter ($PM_{10}$) and less than 2.5 microns in diameter ($PM_{2.5}$).

[4] State Council, *Human Rights Development* (2018), part III.
[5] Justin McCurry and Julia Kollewe, 'China overtakes Japan as world's second-largest economy', *The Guardian*, 14 February 2011; 'China's economy is now the world's second largest', BBC News, 14 February 2011.
[6] NEPA and State Planning Commission, China's Environmental Protection Action Plan for 1991 to 2000 (1994), at 118–21. The NEPA was elevated in 1998 and renamed the State Environmental Protection Administration (SEPA), which was further upgraded to the Ministry of Environmental Protection (MEP) in 2008. It was then restructured and renamed the Ministry of Ecology and Environment (MEE) in 2018. The State Planning Commission (1952–98) became the State Development Planning Commission (1998–2003), and then the National Development and Reform Commission (NDRC) in March 2003. The NDRC is the most powerful of China's ministries and is in charge of socio-economic development.
[7] Adam Vaughan, 'China burns half of coal consumption worldwide, figures show', *The Guardian*, 30 January 2013. China's coal consumption peaked in 2013 at 4.24 billion t. Government efforts to improve the country's energy structure and tackle pollution resulted in a fall in coal use from 2014 to 2016. Coal consumption rose slightly in 2017 and again in 2018, but has not returned to 2013 levels. See Feng Hao and Tom Baxter, 'China's coal consumption on the rise', *China Dialogue*, 1 March 2019.
[8] State Council, *Environmental Protection in China* (1996). www.pkulaw.cn, part III.

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**TABLE 1.1 WHO AIR QUALITY GUIDELINES (AQG) ON ANNUAL MEAN CONCENTRATION LEVELS OF $PM_{10}$ AND $PM_{2.5}$**

| | WHO interim targets (stage I) ($\mu g/m^3$) | WHO interim targets (stage II) ($\mu g/m^3$) | WHO interim targets (stage III) ($\mu g/m^3$) | WHO goal ($\mu g/m^3$) |
|---|---|---|---|---|
| $PM_{10}$ | 70 | 50 | 30 | 20 |
| $PM_{2.5}$ | 35 | 25 | 15 | 10 |

*Sources:* WHO, *Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide: Global update 2005: Summary of Risk Assessment* (World Health Organization, 2006), at 11.

In order to protect public health, the World Health Organization (WHO) has made recommendations on air quality targets, as seen in Table 1.1.

For years after the promulgation of the WHO AQG (2006), however, China continued to implement its Ambient Air Quality Standards (GB3095-1996, amended 2000), which applies limits on major air pollutants, including $SO_2$, $NO_2$ and $PM_{10}$, for three different types of zone:

(i) Grade I: nature reserves, scenic areas and other special protection areas;
(ii) Grade II: residential areas, mixed commercial and residential areas, cultural areas, ordinary industrial zones and rural regions and
(iii) Grade III: special industrial zones.

The national ambient air quality standard for $PM_{10}$ was 40 $\mu g/m^3$ for Grade I areas, 100 $\mu g/m^3$ for Grade II and 150 $\mu g/m^3$ for Grade III.[9] They were much higher than the maximum recommended by the WHO. In 2006, of 559 cities monitored, 33.5 per cent had an annual mean $PM_{10}$ concentration level of more than 100 $\mu g/m^3$ and 7 per cent had excessively high $PM_{10}$ levels of more than 150 $\mu g/m^3$.[10] Worse still, $PM_{2.5}$ was not monitored. Air quality continued to deteriorate, especially in the economically most-advanced regions, including the Pearl River Delta, Yangtze River Delta and the Beijing–Tianjin–Hebei region. By 2010, megacities, including Guangzhou, Shenzhen, Shanghai, Nanjing, Suzhou and Tianjin, had smoggy days on 30 per cent to 50 per cent of all days of the year. In 2010, 17.2 per cent of the cities monitored failed to achieve Grade II air quality.[11]

Faced by both domestic and international pressure and demand for clean air, China finally adopted the new Ambient Air Quality Standards (AAQS) (GB3095-2012) to include $PM_{2.5}$ and revised concentration levels for other pollutants, including $PM_{10}$.[12] It replaced the three categories of zones with two:

(i) Grade I: nature reserves, scenic zones and special protection areas;
(ii) Grade II: residential, mixed commercial and residential, industrial and rural areas.

9 Ambient Air Quality Standards (GB3095-1996, amended 2000).
10 SEPA, *2006 China Environment Gazette* (2007). www.mee.gov.cn/hjzl/sthjzk/, at 43.
11 Zhou Shengxian, *Report on Environmental Protection Work* (2011). www.pkulaw.cn. On 25 October 2011, Zhou Shengxian, the then minister of environmental protection, presented the report to the 23rd session of the 11th NPCSC.
12 The Ambient Air Quality Standards (GB3095-2012) were issued by the MEP and the State Administration for Quality Supervision, Inspection and Quarantine (SAQSIQ) on 29 February 2012. It came into force on 1 January 2016.

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**TABLE 1.2 ANNUAL MEAN CONCENTRATION LEVELS OF $PM_{10}$ AND $PM_{2.5}$ (μG/M³) IN BEIJING**

| | AAQS (2012) target | | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| | Grade I | Grade II | | | | |
| $PM_{10}$ (μg/m³) | 40 | 70 | 92 | 84 | 78 | 68 |
| $PM_{2.5}$ (μg/m³) | 15 | 35 | 73 | 58 | 51 | 42 |

*Sources:* AAQS (GB3095-2012); MEP, *2016 China Environment Gazette*. www.mee.gov.cn/hjzl/sthjzk/; MEE, *2017 to 2019 China Ecology and Environment Gazette*. www.mee.gov.cn/hjzl/sthjzk/.

The 2012 AAQS was implemented across China in stages, finally covering the whole country on 1 January 2016. As a result of tightened quality standards for major and newly monitored and controlled pollutants, an overwhelming majority of cities failed to meet the requirements of the AAQS. Of 338 cities monitored, 75.1 per cent failed to achieve the required standard in 2016,[13] 70.7 per cent failed in 2017[14] and 64.2 per cent failed in 2018.[15] The new AAQS was first implemented in 2012 in the Yangtze River Delta, Pearl River Delta and the Beijing–Tianjin–Hebei region, areas in which significant efforts had already been made to abate air pollution from all sources. Despite this, many cities, including the capital Beijing, were still in violation in 2019, notwithstanding steady improvement over the years.

$PM_{10}$ and $PM_{2.5}$ are suspended particulates – these include sulphates, nitrates, metals and organic chemicals – that are largely emitted by vehicles, manufacturing, power plants and farming. Most Chinese cities have dangerously high levels of $PM_{10}$ and $PM_{2.5}$ that exceed the WHO guidelines several times, and lead to health conditions, including asthma, lung cancer, heart disease, stroke and chronic obstructive pulmonary disorder. Another major air pollutant in China is $SO_2$, which is emitted by burning coal and diesel. It can cause respiratory and cardiovascular diseases, as well as acid rain. China became the world's largest emitter of $SO_2$ in 2005.[16] As per Table 1.3, acid rain affected around 50 per cent of cities monitored in 2005, at the end of the 10th Five-Year Plan on National Economic and Social Development (for the period 2000–5) (10th FYP), and in 2010, at the end of the 11th Five-Year Plan on National Economic and Social Development (for the period 2006–10) (11th FYP). Cities affected by acid rain dropped to 40 per cent in 2015, at the end of the 12th FYP on National Economic and Social Development (for the period 2011–15) (12th FYP). During the 13th FYP on National Economic and Social Development

[13] MEP, *2016 China Environment Gazette*, at 7.
[14] MEE, *2017 China Ecology and Environment Gazette*, at 7.
[15] MEE, *2018 China Ecology and Environment Gazette*, at 7.
[16] At a press conference in 2006, the SEPA said China emitted 25.49 million t of $SO_2$ in 2005, making it the world's largest emitter. See Xia Mingqun, 'State Environmental Protection Administration: China's sulfur dioxide emissions ranked first in the world in 2005', *Sina Finance*, 4 August 2006. http://finance.sina.com.cn/g/20060804/09052792219.shtml

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**TABLE 1.3 CHINESE CITIES AFFECTED BY ACID RAIN**

| | 2005 | 2010 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Total cities monitored | 696 | 494 | 480 | 474 | 463 | 471 |
| Per cent of cities affected (%) | 51.3 | 50.4 | 40.4 | 38.8 | 36.1 | 37.6 |

*Sources:* SEPA, *2005 China Environment Gazette*; MEP, *2010 China Environment Gazette*; MEP, *2015 China Environment Gazette*; MEP, *2016 China Environment Gazette*; MEE, *2018 China Ecology and Environment Gazette.*

(for the period 2016–20) (13th FYP), the proportion of cities affected has remained below 40 per cent.

Acid rain directly affects ecosystems. Acid deposition of rain, snow, fog and dew damages forests and agricultural crops, while deposition on lakes and rivers harms aquatic flora and fauna. Acid rain also corrodes metals and building materials and impacts on human health. A conservative estimate of the economic costs of crop and forestry losses was more than 4 billion US dollars a year, perhaps as much as 5 billion US dollars a year.[17]

### 1.1.2 The Water Crisis: Water Pollution and Water Shortage

China's water crisis is an even more acute challenge.[18] Serious water pollution and shortage not only threaten public health, but also restrict China's ability to sustain its industrial and agricultural output. China is home to 20 per cent of the world's population, but only 7 per cent of its fresh water.[19] Pollution by untreated industrial effluent and household sewage has intensified the water shortage. In contrast to the large-scale and swift industrialization and urbanization seen in China since 1978, pollution treatment infrastructure remains a weakness. By the mid-1990s, only 20 per cent of municipal wastewater received treatment before discharge and less than 50 per cent of solid waste was disposed of safely.[20] By the end of 2004, the municipal wastewater treatment rate had reached 46 per cent and the rate for safe disposal of municipal solid waste (MSW) was 52 per cent.[21] The 11th FYP on Environmental Protection (2007) accepted that the discharge of major pollutants far exceeded China's environmental carrying capacity and had caused serious pollution. In 2005, more than a quarter of surface water had quality below Grade V, the lowest grade, and was not safe for use. More than 60 per cent of surface water did not meet quality standards for Grade III and was thus unsafe for use as drinking water, even with treatment.[22] In China, the quality of surface water is divided into five grades, each of

[17] World Bank, *Clear Water, Blue Skies: China's Environment in the New Century* (Washington, DC, World Bank Group, 1997), at 21–2, 26–8; see also Thorjorn Larssen et al., 'Acid rain in China', *Environmental Science and Technology*, 40:2 (2006), 418–25.
[18] Ma Jun, *China's Water Crisis* (Beijing: China Environmental Sciences Publishing House, 1999).
[19] World Affairs Council of Pittsburgh, 18 April 2014, 'China's struggle to access water'. Blog. https://worldpittsburgh.wordpress.com/2014/04/18/chinas-struggle-to-access-water/
[20] State Council, *Environmental Protection in China* (1996), part III.
[21] State Council, *Environmental Protection in China 1996–2005* (2006). www.pkulaw.cn, part IV.
[22] State Council, 11th FYP on Environmental Protection (2007), part I.

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which is suitable for different uses, under the Surface Water Quality Standards (GB3838-2002):

> Grade I: water flowing through state nature reserves;
> Grade II: drinking-water-source reserve (DWSR) (I); conservation areas for rare aquatic species; areas for fish spawning;
> Grade III: DWSR (II); conservation areas for common aquatic species; areas for swimming;
> Grade IV: industrial water use; recreational use other than skin-contact activities;
> Grade V: agricultural water use; for use in view-only water features in parks or gardens.

By 2010, the municipal wastewater treatment rate had increased to 77 per cent, and the rate for safe disposal of MSW had reached 72.4 per cent.[23] Water quality had improved slightly by the end of 2010 when more than half of surface water reached Grade III and above, compared to 38 per cent in 2005.[24] The toxic water that had lost all function, sub-Grade V, dropped to 20.8 per cent, a slight improvement compared to 26 per cent in 2005.[25] By the end of the 12th FYP period in 2015, roughly two-thirds of surface water had achieved water quality of Grade III and above and the proportion of water that fell into the worst sub-Grade V category had dropped to 9.7 per cent.[26] This slow improvement continued during the 13th FYP period (2016–20).[27]

Groundwater quality is even more alarming. In 2010, 57 per cent of the groundwater monitored was rated as 'poor' or 'very poor'.[28] Under China's Standard for Groundwater Quality, there are five categories of groundwater, each with different uses:[29]

> Grade I (very good): low levels of chemicals detected, suitable for any use;
> Grade II (good): relatively low levels of chemicals detected, suitable for any use;
> Grade III (average): medium levels of chemicals detected, suitable for use as source of centralized drinking water supply and other industrial and agricultural use;
> Grade IV (poor): relatively high levels of chemicals detected, suitable for agricultural and certain industrial use, may be used as drinking water subject to proper treatment;
> Grade V (very poor): high levels of chemicals detected, not suitable for drinking water supply, may be used for other purposes.

23 Zhou Shengxian, *Report on Environmental Protection Work*.
24 State Council, 12th FYP on Environmental Protection (2011), part I.
25 Zhou Shengxian, *Report on Environmental Protection Work*, part I.
26 State Council, 13th FYP on Environmental Protection (2016), part I. Note that the annual report by the MEP recorded a slightly different set of data: 64.5 per cent for Grades I to III, 26.7 per cent for Grades IV and V, and 8.8 per cent for sub-Grade V. See MEP, *2015 China Environment Gazette*, at 5.
27 MEP, *2016 China Environment Gazette*; MEE, *2017 China Ecology and Environment Gazette*; MEE, *2018 China Ecology and Environment Gazette*.
28 Zhou Shengxian, *Report on Environmental Protection Work*; see also MEP, *2010 China Environment Gazette*.
29 Standard for Groundwater Quality (GB/T 14848-2017), s. 4.1. The Standard for Groundwater Quality (GB/T 14848-2017, replacing GB/T 14848-1993) was issued by the SAQSIQ and State Standardization Commission on 14 October 2017. It came into force on 1 May 2018.

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**TABLE 1.4 SURFACE WATER QUALITY AS A PERCENTAGE OF MONITORED RIVERS AND LAKES**

| | Grades I–III (%) | Grades IV–V (%) | Sub-grade V (%) |
|---|---|---|---|
| 2005 | 38 | 36 | 26 |
| 2010 | 51.9 | 27.3 | 20.8 |
| 2015 | 66 | 24.3 | 9.7 |
| 2016 | 67.8 | 23.7 | 8.6[a] |
| 2017 | 67.9 | 23.8 | 8.3 |
| 2018 | 71 | 22.3 | 6.7 |
| 2019 | 74.9 | 21.7 | 3.4 |

*Sources:* MEP, *2005 China Environment Gazette* to *2016 China Environment Gazette*; MEE, *2017 China Ecology and Environment Gazette* to *2019 China Ecology and Environment Gazette.*
[a] Due to rounding, percentages in this table may not total 100 per cent.

In 2010, the MEP started to publish – in its annual gazette – more detailed data on groundwater quality. Table 1.5 shows China has experienced further deterioration of groundwater quality since 2010, with the 'poor' and 'very poor' categories going up from 57 per cent in 2010 to 86.2 per cent in 2018.

China's water resources face serious risks of being contaminated by secret or hidden discharge of untreated wastewater and illegally dumped hazardous waste (HW), as well as by environmental emergencies caused by chemical explosions or spills. China has approximately 44,600 chemical factories, of which 72 per cent are located along the Yangtze, Yellow and Pearl rivers and Lake Tai, while 12.2 per cent are within 1 km of a DWSR or other eco-sensitive region.[30] Damage caused by water pollution includes a reduction in the land available for farming following irrigation with wastewater, human health problems caused by unsafe drinking water that has been contaminated with pesticides, fertilizers and toxic discharges, and declines in fish catches.[31]

The other aspect of China's water crisis is a water shortage, which is directly linked to pollution. Serious pollution means that water cannot be used as drinking water, or as an industrial or agricultural input. Pollution of surface waters drives an over-reliance on groundwater. Aquifers in northern China have been depleted faster than they can be replenished. Levels have dropped by 50 m to 90 m in the Hai River Basin, and in cities such as Tianjin and Beijing serious subsidence has occurred.[32] Inefficient use of water intensifies the problem. Some estimates suggest that up to 60 per cent of water used for irrigation is lost to evaporation from canals and fields and to poor maintenance of an outdated supply

[30] Zhou Shengxian, *Report on Environmental Protection Work.*
[31] Xiaoying Ma and Leonard Ortolano, *Environmental Regulation in China*: *Institutions, Enforcement, and Compliance* (Lanham, MD: Rowman & Littlefield, 2000), 3.
[32] World Bank, *China: Agenda for Water Sector Strategy for North China* (*Summary Report)*, (Washington, DC: World Bank Group, 2002), at 32–4.

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**TABLE 1.5 GROUNDWATER QUALITY**

| | Number of monitoring wells | Grade I (very good) (%) | Grade II (good) (%) | Grade III (average) (%) | Grade IV (poor) (%) | Grade V (very poor) (%) |
|---|---|---|---|---|---|---|
| 2010 | 4,110 | 10.2 | 27.6 | 5 | 40.4 | 16.8 |
| | | | | | 57.2 | |
| 2015 | 5,118 | 9.1 | 25 | 4.6 | 42.5 | 18.8 |
| | | | | | 61.3 | |
| 2016 | 6,124 | 10.1 | 25.4 | 4.4 | 45.4 | 14.7 |
| | | | | | 60.1 | |
| 2017 | 5,100 | 8.8 | 23.1 | 1.5 | 51.8 | 14.8 |
| | | | | | 66.6 | |
| 2018 | 10,168 | 1.9 | 9.0 | 2.9 | 70.7 | 15.5 |
| | | | | | 86.2 | |
| 2019* | 10,168 | 14.4 (Grades I to III) | | | 66.9 | 18.8 |
| | | | | | 85.7 | |

*Sources:* MEP, *2010 China Environment Gazette* to *2016 China Environment Gazette* ; MEE, *2017 China Ecology and Environment Gazette* to *2019 China Ecology and Environment Gazette.*
* Due to rounding, percentage is not 100.

infrastructure. China's extremely unbalanced distribution of water resources further intensifies the water shortage: 80 per cent of water supply is found in the south, primarily in the Yangtze River basin. The north, home to approximately half China's population and 66 per cent of its agriculture, is an immense and parched region that threatens to become the world's biggest desert. From 1982 to 2000, the Yellow River ran dry for as much as two-thirds of each year.[33] To address the challenge of water scarcity in the north, China has undertaken the South-to-North Water Diversion Project, one of the most ambitious engineering projects in history. It consists of a network of canals, rivers and lakes to transport water from the flood-prone Yangtze River to feed dry areas in the north. This long-distance water transfer project may well be the inconvenient solution to the problems of inadequate surface water supply and over-exploitation of groundwater resources.

### 1.1.3 Soil Contamination

Until the beginning of this century, soil contamination was believed to be restricted to rural China and caused by excessive use of fertilizers and pesticides (dichlorodiphenyltrichloroethane (DDT) and hexachlorocyclohexane (HCH)) in agricultural

33 Eric Zusman, 'The river runs dry: examining water shortages in the Yellow River Basin' in *Economic, Social and Legal Issues in China's Transition to a Market Economy* (University of California, Los Angeles: Asia Institute, 2000).

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fields in the 1950s, 1960s and 1970s, and a lack of household waste disposal facilities.[34] Farmland contamination was further aggravated in the 1980s and 1990s by increased industrial and mining operations that released heavy metals, including lead, mercury and cadmium. China's initial response to soil contamination was narrowly focused. The first Soil Environmental Quality Standard (1995)[35] applied solely to agricultural land and covered only eight heavy metals (cadmium, mercury, arsenic, copper, lead, chromium, zinc and nickel) and two organic compounds (DDT and HCH). Toxic contaminants in the soil have been absorbed by crops and have entered the food chain. Media exposure of lead poisoning and cadmium-tainted rice has drawn public attention to food safety in China and beyond.[36] Lead is especially harmful to children's behavioural and cognitive development, while cadmium affects liver function and bone health, and nitrogen from fertilizers can cause blood disorders in infants that result in brain damage or death.[37] Clearly, soil pollution poisons more than China's farmland.[38]

Urbanization since the 1990s has been characterized by industrial relocation from city centres to the outskirts, construction of roads and subways, and property development. This has exposed the hidden risks of contamination at sites previously used by industry.[39] The toxic site at SongJiaZhuang in Beijing, at which three subway construction workers were poisoned in April 2004, revealed the serious historical contamination left by industrial operators, including a pesticide factory and subsequently Beijing Hongshi Paint Co.[40] In July 2006, six road construction workers fainted as they dug into soil at a site at Guoxiang, near the southern ring road in Suzhou, which had been contaminated by a chemical factory that had since relocated. In February 2007, a construction worker at the Heshan property development site in Hanyang district in Wuhan was poisoned and rushed to hospital for

[34] State Council, *Environmental Protection in China 1996–2005* (2006). www.pkulaw.cn; see also the 9th FYP on Environmental Protection (1996–2000), 10th FYP on Environmental Protection (2001–5) and 11th FYP on Environmental Protection (2006–10); Yang Meng, 'The damaging truth about Chinese fertiliser and pesticide use', *China Dialogue*, 7 September 2012; Dominique Patton, 'China farm pollution worsens, despite moves to curb excessive fertilisers, pesticides', *Reuters*, 14 April 2015.

[35] Soil Environmental Quality Standard (GB15618-1995). It was recently replaced by the Soil Environmental Quality Risk Control Standard for Soil Contamination of Agricultural Land (GB15618-2018).

[36] Xinhua, 'Pollutants, pesticides threaten farm land', *China Daily*, 12 June 2012; Sharon LaFraniere, 'Lead poisoning in China: the hidden scourge', *New York Times*, 15 June 2011; Liu Hongqiao, 'The polluted legacy of China's largest rice-growing province', *China Dialogue*, 30 May 2014; Chen Huamian et al., 'Heavy metal pollution in soils in China: status and countermeasures', *Royal Swedish Academy of Science*, 28 (1999), 130–4, at 132; Gong Jing, 'Toxic rice tainted by cadmium', *New Century Weekly*, 14 February 2011.

[37] Dustin D. Drenguis, 'Reap what you sow: soil pollution remediation reform in China', *Pacific Rim Law and Policy Journal*, 23 (2014), 171–201.

[38] Li Jing, 'Soil pollution poisons more than farmland', *China Daily*, 10 March 2011.

[39] Zhao Yuhong, 'Land contamination in urban China: developing a national cleanup legal regime', *Hong Kong Law Journal*, 39 (2009), 627–48; Jian Xie and Fasheng Li, *Overview of the Current Situation on Brownfield Remediation and Redevelopment in China* (Washington, DC: World Bank Group, 2010). China has been trying to transform its economy from one dependent on its secondary industrial sector to one focused on tertiary service provision. In the course of this transformation, industry has relocated from city centres and residential areas, often leaving behind contaminated land. The relocation of hundreds of Beijing's old industrial facilities to the city outskirts left behind 8 million $m^2$ of brownfield sites in need of redevelopment.

[40] Zhao Yuhong, 'Land contamination in urban China'; 'Hidden toxic sites', *Caijing*, 4 June 2012; 'Toxic site clean-up at SongJiaZhuang section of subway line no. 10', *Jianghua Times*, 7 December 2009; Liu Wei, 'Beijing: after the subway workers fell ill', *Outlook Weekly*, 9 (2009), 49–50; Liu Yang, 'Soil at the site of Beijing Hongshi Coatings factory removed for incineration', *Beijing Daily*, 16 August 2007; Pan Hongtao, 'Relocation of chemical enterprises and the building of residential housing', *China Environment News*, 25 December 2008.

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emergency treatment. More workers then fell ill at the site, which had been contaminated by the relocated Wuhan Pesticide Factory.[41] These seemingly isolated cases are only the tip of the iceberg of land contamination in urban China. In contrast to these cases of acute poisoning of construction workers by sudden exposure to exceptionally high levels of toxins accumulated in soil, there are more cases that cause harm quietly in a chronic manner to humans, property and the environment. People with long-term exposure by direct skin contact, through drinking contaminated water or eating contaminated food, are at high risk of being harmed by land contamination. In December 2015, nearly 500 students of the Changzhou Foreign Language School fell ill after moving to a new campus in September of the same year. They suffered headaches, skin rashes and, from December 2015 and into early 2016, some were diagnosed with lymphoma and leukaemia. Less than 100 m to the north of the school campus, the Changlong toxic site was being treated by an environmental remediation firm – organized by the local government – for contamination. The site had been occupied since the late 1970s by three chemical factories, Changlong, Changyu and Huada.[42]

The National Soil Pollution Survey, conducted from 2005 to 2013, confirmed the extremely bleak picture for land contamination in rural and urban China, and the serious threat posed to the health and safety of humans and the environment. The survey, jointly led and coordinated by the MEP (now MEE) and the Ministry of Land Resources (MLR, now part of the Ministry of Natural Resources, MNR), covered roughly 6.3 million $km^2$, and included all China's farmland, and part of its forestland, grassland, unutilized land and land for development. In 2014, the MEP and MLR issued a brief report, the *National Soil Pollution Survey Report*, that started with an unusually pessimistic tone for a government report:

> The overall national soil environmental quality does not allow us to be optimistic. Soil pollution in some regions is quite severe. Soil environmental quality of farmland is of great concern. Soil pollution at sites historically used by industrial and mining operators is particularly problematic.[43]

From the limited data released,[44] we gain a very general understanding of the nature, type, distribution, causes, extent and degree of soil pollution in China. Overall, 16.1 per cent of

[41] Luo Jingyun and Zhou Hui, 'Lack of information disclosure on toxic sites, investigation of chaotic treatment sector', *21st Century Economic Report*, 29 September 2012; Zhang Yanchun et al., 'Wuhan Heshan "toxic site" cleaned up at high cost', *People's Daily*, 4 January 2013, 1; Zhou Hui, 'Wuhan toxic site in city centre sold for 1.44 billion yuan', *21st Century Economic Report*, 23 December 2014; Michael I Jeffery and Xiaobo Zhao, 'Developing a national contaminated land liability scheme in China: the Comprehensive Environmental Response, Compensation, and Liability Act Revisited', *Journal of Energy and Natural Resources Law*, 30 (2012), 423–65.

[42] Li Jing, 'Hundreds of pupils at school near toxic site in East China fall ill, some with cancer, state TV reports', *South China Morning Post*, 17 April 2016; 'School campus 100 meters from the toxic site: Changzhou school chemical pollution incident', *Xinhua News*, 19 April 2016.

[43] MEP and MLR, *National Soil Pollution Survey Report* , 17 April 2014, part I. www.mee.gov.cn/gkml/sthjbgw/qt/201404/t20140417_270670.htm

[44] The government refused to release the full report or raw survey data to the public, presumably in order to avoid public concern over the seriousness of rural and urban soil contamination in China. Public requests for disclosure of the survey data were rejected on the basis that it was a state secret. Li Jing, 'Report on mainland China's soil pollution a "state secret" ', *South China Morning Post*, 26 February 2013; see also discussion on

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