(快速浏览只需看红色或下划线部分)

二次污染

A primary pollutant is an air pollutant emitted directly from a source. A secondary pollutant is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere. Examples of a secondary pollutant include ozone, which is formed when hydrocarbons (HC) and nitrogen oxides (NOx) combine in the presence of sunlight; nitrogen dioxide (NO_2), which is formed as nitric oxide (NO) combines with oxygen in the air; and acid rain, which is formed when sulfur dioxide or nitrogen oxides react with water.[15] All of these harsh chemicals are usually highly reactive and oxidizing. Photochemical smog is therefore considered to be a problem of modern industrialization. It is present in all modern cities, but it is more common in cities with sunny, warm, dry climates and a large number of motor vehicles.[16] Because it travels with the wind, it can affect sparsely populated areas as well.

健康影响

It can inflame breathing passages, decrease the lungs' working capacity, cause shortness of breath, pain when inhaling deeply, wheezing, and coughing. It can cause eye and nose irritation and it dries out the protective membranes of the nose and throat and interferes with the body's ability to fight infection, increasing susceptibility to illness. Hospital admissions and respiratory deaths often increase during periods when ozone levels are high.[22][23]

Levels of unhealthy exposure[edit]
The U.S. EPA has developed an Air Quality Index to help explain air pollution levels to the general public. 8 hour average ozone concentrations of 85 to 104 ppbv are described as "Unhealthy for Sensitive Groups", 105 ppbv to 124 ppbv as "unhealthy" and 125 ppb to 404 ppb as "very unhealthy".[21] The "very unhealthy" range for some other pollutants are: 355 $\mu g\ m^{-3}$ - 424 $\mu g\ m^{-3}$ for PM10; 15.5 ppm - 30.4ppm for CO and 0.65 ppm - 1.24 ppm for NO_2.[24]

Smog and the risk of certain birth defects[edit]
A study examining 806 women who had babies with birth defects between 1997 and 2006, and 849 women who had healthy babies, found that smog in the San Joaquin Valley area of California was linked to two types of neural tube defects: spina bifida (a condition involving, among other manifestations, certain malformations of the spinal column), and anencephaly (the underdevelopment or absence of part or all of the brain, which if not fatal usually results in profound impairment).[27]

Smog and low birth weight[edit]
According to a study published in The Lancet, even a very small (5 µg) change in PM2.5 exposure was associated with an increase (18%) in risk of a low birth weight at delivery, and this relationship held even below the current accepted safe levels.[28]

环境影响

Smog can form in almost any climate where industries or cities release large amounts of air pollution, such as smoke or gases. However, it is worse during periods of warmer, sunnier weather when the upper air is warm enough to inhibit vertical circulation. It is especially prevalent in geologic basins encircled by hills or mountains. It often stays for an extended period of time over densely populated cities or urban areas, and can build up to dangerous levels.

United Kingdom
Severe episodes of smog continued in the 19th and 20th centuries, mainly in the winter, and were nicknamed "pea-soupers," from the phrase "as thick as pea soup." The Great Smog of 1952 darkened the streets of London and killed approximately 4,000 people in the short time of 4 days (a further 8,000[53] died from its effects in the following weeks and months). Initially a flu epidemic was blamed for the loss of life.

In 1956 the Clean Air Act started legally enforcing smokeless zones in the capital. There were areas where no soft coal was allowed to be burned in homes or in businesses, only coke, which produces no smoke. Because of the smokeless zones, reduced levels of sooty particulates eliminated the intense and persistent London smog.

Los Angeles and the San Joaquin Valley[edit]
Because of their locations in low basins surrounded by mountains, Los Angeles and the San Joaquin Valley are notorious for their smog. The millions of vehicles in these regions combined with the additional effects of the San Francisco Bay and Los Angeles/Long Beach port complexes frequently contribute to further air pollution.

Los Angeles in particular is strongly predisposed to accumulation of smog, because of peculiarities of its geography and weather patterns. Los Angeles is situated in a flat basin with ocean on one side and mountain ranges on three sides. A nearby cold ocean current depresses surface air temperatures in the area, resulting in an inversion layer; a phenomenon where air temperature increases, instead of decreasing, with altitude, suppressing thermals and restricting vertical convection. All taken together, this results in a relatively thin, enclosed layer of air above the city that can't easily escape out of the basin and tends to accumulate pollution.

Though Los Angeles was one of the best known cities suffering from transportation smog for much of the 20th century, so much so that it was sometimes said that Los Angeles was a synonym for smog,[63] strict regulations by government agencies overseeing this problem, including tight restrictions on allowed emissions levels for all new cars sold in California and mandatory regular emission tests of older vehicles, resulted in significant improvements in air quality. For example, air concentrations of volatile organic compounds declined by a factor of 50 between 1962 and 2012.[64] Concentrations of air pollutants such as nitrous oxides and ozone declined by 70% to 80% over the same period of time.[65](治理成效)

污染指数

The severity of smog is often measured using automated optical instruments such as Nephelometers, as haze is associated with visibility and traffic control in ports. Haze however can also be an indication of poor air quality though this is often better reflected using accurate purpose built air indexes such as the American Air Quality Index, the Malaysian API (Air Pollution Index) and the Singaporean Pollutant Standards Index.

AQI Category, Pollutants and Health Breakpoints

AQI Category (Range)	PM_{10} (24hr)	$PM_{2.5}$ (24hr)	NO_2 (24hr)	O_3 (8hr)	CO (8hr)	SO_2 (24hr)	NH_3 (24hr)	Pb (24hr)
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

批注： 1.如果要做对健康的影响，根据上述标红部分，我们可以试图找到雾霾时期医院就诊上升率，呼吸疾病人数增加量，雾霾对孕妇生育健康宝宝的影响，做一个人口预测模型。

2.如果考虑环境因素，根据上述洛杉矶市的地形和报道，对洛杉矶市的地形建模，再跑一遍我们的扩散模型，如果可以得到新地形扩散速度慢于理想地行的结论，就可以揭示雾霾运动和地形的关系

3.经济发展和交通部分我觉得很难和雾霾活动建立联系，资料也不太好找，所以建议做对人口健康和自然环境的影响分析。