Smog and "Chinese Haze"

Smog
- Derive from merging of "smoke" and "fog"
- Yellowish or blackish fog, but consists particles and ground level ozone.
- Generally is a kind of mixture of various gas, dust, water vapor.
- It is harmful to humans, animals, plants, and will cause many diseases such as lung cancer.
- Has long history. Smog issue was recorded as early as in 12th century. It was considered as a serious environment problem as early as in 17th century.

Types of Smog
- **London Types sulfurous smog**
  - Happened in 1952, caused by continuing expansion of the use of coal and fossil fuels in 19th and 20th century.
  - High level sulfur dioxide mixed with soot and fly ash from coal use in home and from industrial emissions. Many citizens' respiratory function was damaged. About 4000 deaths were observed.
  - Not only happened in European. On October 28, 1948, similar smog event occurred in Donora, Pennsylvania, United States. Similar smog could formed by sulfur dioxide (SO_2) and carbon monoxide (CO) and metal dust from the smokestacks of the local zinc smelter. Over the next five days, twenty residents died and 7000 people, were hospitalized with difficulty breathing after being exposed to the cloud.
  - This kind of smog event is still observed in China, India, the Middle East, and Eastern Europe.
- **Los Angeles Type Photochemical Smog**
  - Happened at the same period of London's smog.
  - This is an oxidizing gas cloud filled with nitrogen dioxide (NO), hydrocarbons, and their photochemical product, ozone.
  - Primary Pollutants: carbon monoxide and carbonaceous soot, nitrogen oxides, sulfur dioxide, and VOCs (photochemical contributors)
  - Secondary pollutants: ozone, PANs, sulfate aerosols, nitrate aerosols, organic aerosols, etc. (photochemical products)
  - Photochemical Smog is proportional to light concentration, thus prefers appearing at summer, afternoon; but for London type smog, high emissions of the primary pollutants (sulfur dioxide and soot) combined with low boundary layer inversions leading to high concentrations near the surface, thus appeared at winter, morning.

Chinese Haze
- Since China now exhibits a mixture of high level of Ozone, soot, SO_2 and organic particles, both London type sulfurous smog and Los Angeles Type photochemical smog are observed, which makes this problem more complex.
- The mixture of pollutants lead to special urban smog, usually known as "Chinese haze".
- Value of $PM_{2.5}$ in Beijing is a famous and worldwide topic. PM is a major inducement of photochemical smog.
- Huge emissions of SO_2 from burning fuels and coals

- Huge emissions of NO_x (major NO_2 and NO) from mobile sources (traffic-related pollution) and minor emissions from burning fuels.
- The climate is another inducement. Beijing is usually a city with dry air, but intensive sunlight.
- Additional pollution source: Residents may directly burn crude "coal chunks", and straws. Advanced purification technology is not widely generalized.

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