Air Pollution Control Technology

Introduction to Air Pollution

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Chapter Description

- Aims
  - To introduce the current status on air pollution locally and regionally

- Expected Outcomes
  - Students could briefly explain the types of air pollutants
  - Students are able to discuss general impacts of air pollution towards human and environment

- References
  - de Nevers, N. (2000). Air Pollution Control Engineering. 2nd Edition. McGraw-Hill. USA.

Types of Pollutants

- There are six common of air pollutants:
    - Carbon Monoxide (CO)
    - Sulfur Dioxide (SO_2)
    - Nitrogen Dioxide (NO_2)
    - Lead (Pb)
    - Small particulate (PM10)
    - Ground level ozone (O_3)

Air Quality Legislations

- EPA
- Clean Air Act 1970
- AAQNS

Table: Recommended Malaysia Air Quality Guideline (RMAQG)

Pollutant	Average Time Exposure	Malaysia Guideline (ppm)
Carbon monoxide	1 hour	30
Sulfur dioxide	1 hour	0.13
Ozone	1 hour	0.1
Nitrogen dioxide	1 hour	0.17

Source: JAS, Malaysia

Air Pollution Scale

- Ambient air pollution exists at all scales, from extremely local to global
    - Local – 5km of the earth's surface
    - Urban – 5 to 50km
    - Regional – 50 to 500km
    - Continental – 500 to 1000km
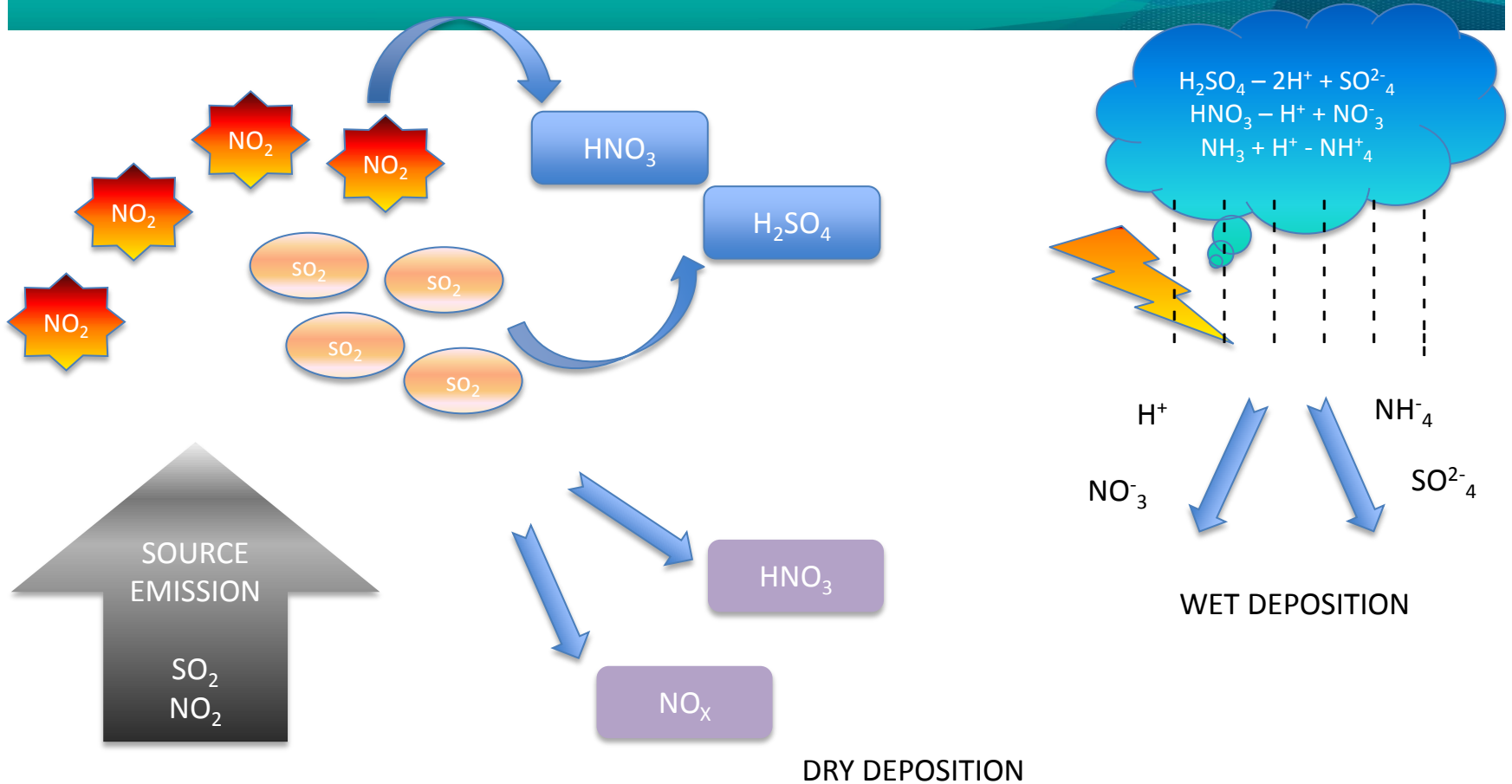   - Global – worldwide

Effect of Air Pollution

- Acid rain
- Ozone depletion
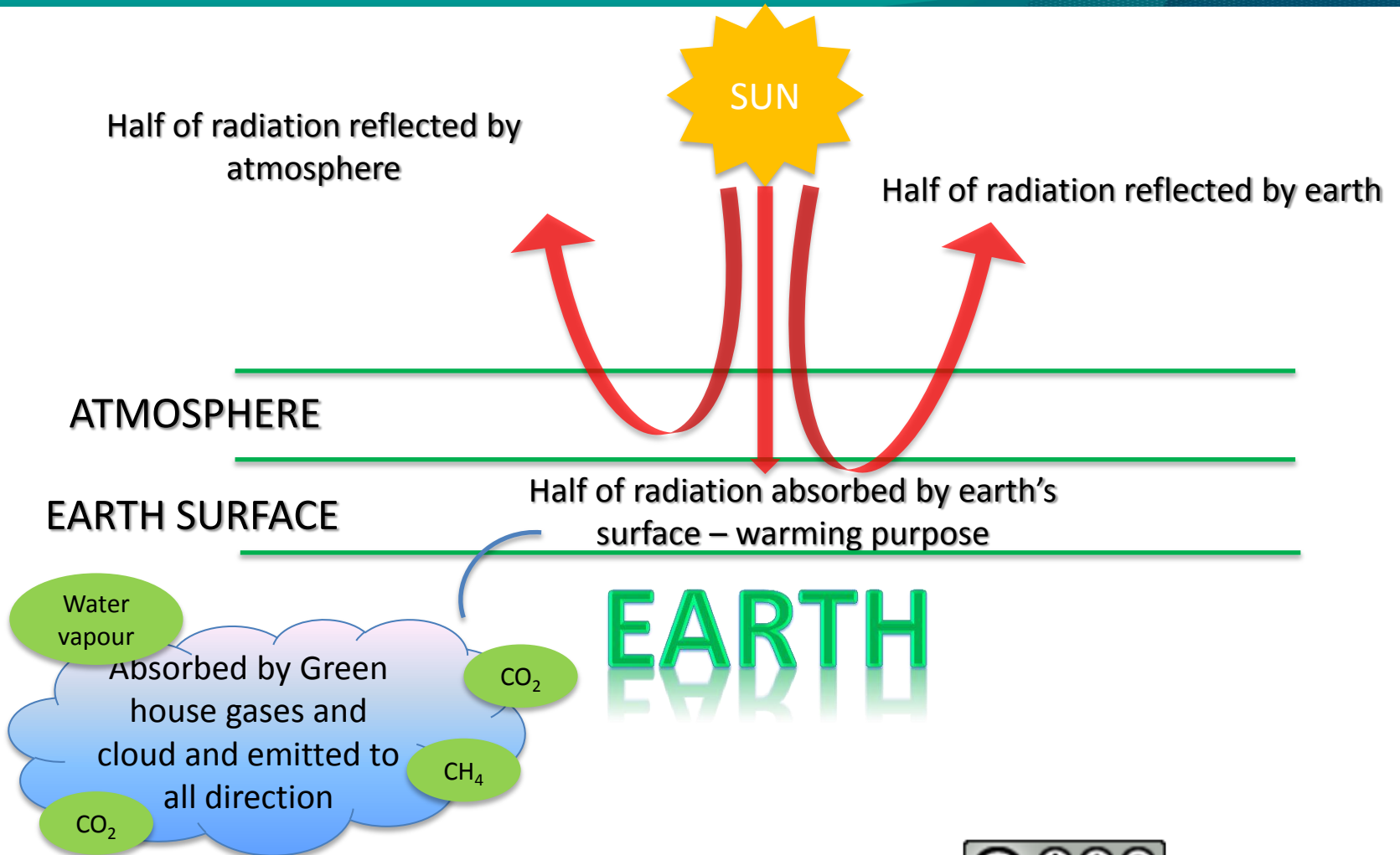- Global warming
- Green house gases

Acid rain

NO$_2$

NO$_2$

NO$_2$

NO$_2$

HNO$_3$

H$_2$SO$_4$

SO$_2$

SO$_2$

SO$_2$

SO$_2$

$$H_2SO_4 - 2H^+ + SO^{2-}_4$$
$$HNO_3 - H^+ + NO^-_3$$
$$NH_3 + H^+ - NH^+_4$$

H$^+$

NH$^-_4$

NO$^-_3$

SO$^{2-}_4$

WET DEPOSITION

SOURCE
EMISSION

SO$_2$
NO$_2$

HNO$_3$

NO$_X$

DRY DEPOSITION

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Ozone Depletion

- Ozone (O_3) is a naturally occurring form of oxygen, which forms a layer in the upper levels of the earth's atmosphere (the stratosphere).

- The O_3 screens out a high proportion of the UV in sunlight and prevents it reaching the lower levels of the atmosphere (the troposphere). Without this protection, the surface of the earth would be exposed to elevated levels of UV solar radiation, which would be harmful to almost all forms of life.

- Increased levels of UV light have been linked to the recent growth in skin cancers (SEPA, 1999b). UV radiation can also depress the human immune system, and harm aquatic systems and crops.

- Scientists now believe that over the past ten years (i.e. since the late 1980s) average global O_3 concentrations have decreased by 3%

- CFCs, HCFCs, carbon tetrachloride, 1,1,1 trichloroethane, halons and methyl bromide reacted with the O_3 layer causing it to deplete.

Green house Effect and Global Warming

SUN

Half of radiation reflected by atmosphere

Half of radiation reflected by earth

ATMOSPHERE

EARTH SURFACE

Half of radiation absorbed by earth's surface – warming purpose

EARTH

Water vapour

Absorbed by Green house gases and cloud and emitted to all direction

CO_2

CH_4

CO_2

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Conclusion of The Chapter

- ## Conclusion #1
  - Air pollutants mostly generated by burning of coal, gas and oil, emission from coal mining, solid and sewage disposal.

- ## Conclusion #2
  - Some of the air pollutants concentration are small in atmosphere, but play an important role in climate change (global warming and greenhouse gases) depend on each radiated properties, molecular weight as well as their lifetime in atmosphere

- ## Conclusion #3
  - Control the emission of air pollutants prior to greenhouse gases could prevent serious damage to the climate

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