Air Quality Monitoring at the U.S. Embassy Hanoi

Thank you for your interest in air quality! This factsheet is divided into three parts: air quality monitoring, why outdoor air quality is important, and Frequently Asked Questions (FAQ).

About Air Quality Monitoring:

- The U.S. State Department, in collaboration with the U.S. Environmental Protection Agency (EPA), puts air quality monitors on some of its facilities to provide information to help protect the health of American personnel and citizens overseas.

- The U.S. Embassy is responsible for the operation of an instrument that measures particulate pollution with a size of 2.5 microns in diameter or smaller, commonly referred to as PM2.5.

- Please note that citywide analysis cannot be done with data from a single monitor. This data provides an accurate measure of the air quality for PM 2.5in the section of Hanoi close to the U.S. Embassy.

- The instrument is at the Embassy's Chancery building 7 Lang Ha Street in Ba Dinh District, Hanoi, and uses a beta attenuation measurement principle to provide hourly PM2.5 concentrations in micrograms per cubic meter.

(Image source: www.metone.com)

- The hourly PM2.5 concentrations are converted into the U.S. EPA's Air Quality Index (AQI) made available to the public on the www.airnow.gov website.

- The instrument is operated and maintained according to manufacturer specifications, as well as following the U.S. Environmental Protection Agency's Ambient Air Quality Surveillance requirements.

- The instrument was sited using the U.S. EPA's Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring, which includes important factors such as spacing from trees and other emission sources that can impact the readings.

- Multiple U.S. embassies and consulates around the world have air quality monitors. Each such monitor follows the same guidelines in terms of siting, installation, operations, maintenance, and assurance of data quality. These guidelines also apply to all air quality monitors in the United States that are used to determine compliance with U.S. air quality standards.

- The U.S. EPA has developed a formula to convert PM 2.5 readings into an air quality index (AQI) value that can help inform health-related decisions. Meanings of AQI numerical values can be seen in the chart below. Please note that the U.S. EPA's AQI includes air pollution in the form of both gases and particles, but U.S. embassies use particle pollution as an overall indicator for air quality. For more information on AQI and how it is calculated, please click **here**.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	**0 to 50**	**Air quality is considered satisfactory, and air pollution poses little or no risk**
Moderate	**51 to 100**	**Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.**
Unhealthy for Sensitive Groups	**101 to 150**	**Members of sensitive groups may experience health effects. The general public is not likely to be affected.**

Unhealthy	**151 to 200**	**Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.**
Very Unhealthy	**201 to 300**	**Health warnings of emergency conditions. The entire population is more likely to be affected.**
Hazardous	**301 to 500**	**Health alert: everyone may experience more serious health effects**

Why is Outdoor Air Quality Important?

- According to the 2013 Global Burden of Disease study, the science is clear: breathing polluted air increases the risk of debilitating and deadly diseases such as heart disease, stroke, lung cancer, and chronic bronchitis. Air pollution is now the world's fourth-leading fatal health risk, causing one in ten deaths in 2013. At the same time, air pollution from industries, construction sites, agricultural practices, vehicles, and the combustion of dirty energy sources continues to grow. *Source: http://www.healthdata.org/infographic/global-burden-air-pollution*

- According to the WHO, worldwide, outdoor air pollution contributes to approximately 3 million deaths per year. The main sources of outdoor pollution are:
  - Combustion of fossil fuels
  - Industrial processes
  - Agricultural processes
  - Waste incineration

- The major outdoor air pollutants are:
  - Particulate matter
  - Ozone
  - Nitrogen oxides
  - Carbon monoxide
  - Sulfur dioxide

  Source: http://www.who.int/ceh/capacity/Outdoor_air_pollution.pdf

- Of these pollutants, particulate matter, especially particulates less than 2.5 microns in diameter, has the most profound health impacts, followed by ozone.

- The health effects of air pollution also have profound economic impacts. A 2016 World Bank study found that the global welfare losses due to air pollution's premature mortality impact totaled approximately $5.11 trillion. In Vietnam, these losses totaled an estimated $23.8 billion in 2013, or about 5.2% of the country's GDP.
  Source: http://documents.worldbank.org/curated/en/781521473177013155/pdf/108141-REVISED-Cost-of-PollutionWebCORRECTEDfile.pdf

- Several nations, including the United States, have been able to improve the quality of outdoor air while maintaining economic growth. This was the result of multiple, complementary efforts, including:
  - National and local level laws and regulations aimed at air quality and sources of pollution, including vehicles, industry, agriculture and power generation
  - Strict enforcement of those laws

  Involvement by community organizations and individuals

  Source: https://www.epa.gov/laws-regulations/summary-clean-air-act

- In the United States, the Clean Air Act was enacted in 1970. Between 1970 and 2014, U.S. national emissions of the six common pollutants monitored under the Clean Air Act dropped an average of 69 percent while gross domestic product grew by 238 percent.

- A 2011 U.S. EPA study looked at the demonstrated and projected benefits and costs of the Clean Air Act between 1990 and 2020 and found that benefits outweigh costs by a factor of more than thirty to one. The study estimates that, by the year 2020, the Clean Air Act will prevent over 230,000 early deaths per year, as well as over 20 million lost days of school and work.
  Source: https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act

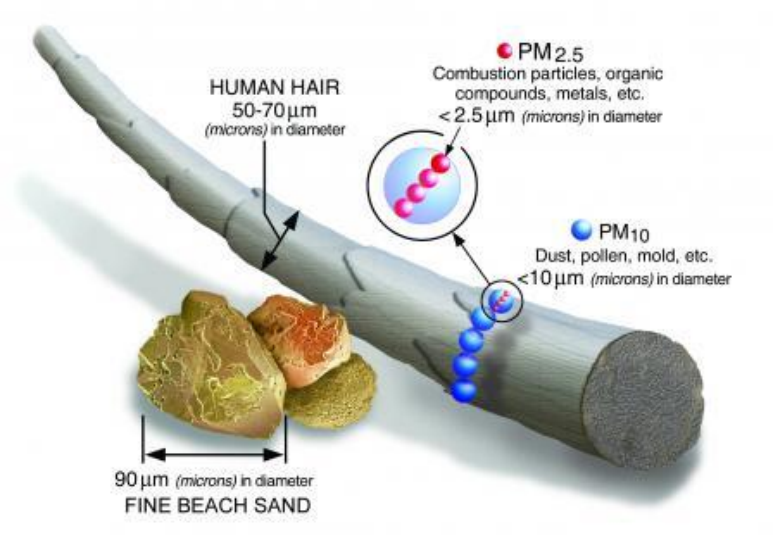
FAQs:

- **When did the United States start monitoring air quality in Hanoi and Ho Chi Minh City?**
  - **Answer:** We set up an air quality monitor on the roof of the U.S. Embassy in Hanoi on April 2015 and a separate monitor on the roof of the U.S. Consulate in Ho Chi Minh City in February 2016.

- **Question: Why are the readings different when we compare the U.S. Embassy's air quality monitor and the ones operated by the Government of Vietnam in Hanoi?**
  - **Answer:** There are several factors that could lead to a difference between the U.S. Embassy's monitor and Government of Vietnam's monitor readings. First, air quality differs throughout the city, and, for example, there is a 7.2 kilometer distance between the Embassy's monitor and the monitor operated by the Center for Environmental Monitoring. Second, the methods of calculating AQI and the

pollutants measured may be different. The U.S. Embassy monitor uses PM2.5 readings and calculates AQI based on the U.S. EPA's Air Now NowCast formula. Third, there may be differences in siting, operations, and maintenance procedures. All of these factors make a comparison difficult.

- **Question: Why does the U.S. monitor and AQI focus on PM 2.5?**
  - **Answer:** According to the WHO, particle size is the most important factor in determining where particles are deposited in the lung. Compared with large particles, fine particles can remain suspended in the atmosphere for longer periods and be transported over longer distances. Some studies suggest that fine particles have stronger respiratory effects in children than large particles. Particles greater than 10 micrometers rarely make it past the upper airways, whereas fine particles smaller than 2 micrometers can make it as far as the alveoli, and can penetrate the walls of the lungs, entering the bloodstream. *Source: http://www.who.int/ceh/capacity/Outdoor_air_pollution.pdf*
  - PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. Particle pollution includes:
    - **PM_{10}** : inhalable particles, with diameters that are generally 10 micrometers and smaller; and
    - **$PM_{2.5}$** : fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.
  - How small is 2.5 micrometers? Think about a single hair from your head. The average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle.



Source: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

- **Question: What are the major sources of air pollution in Hanoi?**
    - **Answer:** The U.S. government does not monitor air pollution sources in Hanoi or in Vietnam; however, typical sources of air pollution in many countries include: transportation, electricity production, industry, waste and agricultural burning, and construction.

- **Question: Do coal burning power plants produce air pollution?**
    - **Answer:** Burning coal produces emissions that adversely affect the environment and human health. These include: sulfur dioxide (SO2), which contributes to acid rain and respiratory illnesses; nitrogen oxides (NOx), which contribute to smog and respiratory illnesses; particulates, which contribute to smog, haze, and respiratory illnesses and lung disease; carbon dioxide (CO2), which is the primary greenhouse gas emission produced from the burning of fossil fuels; mercury and other heavy metals, which have been linked to both neurological and developmental damage in humans and other animals; and fly ash and bottom ash, which are residues created when coal is burned at power plants. Specialized equipment is available to reduce SO2, NOx, particulate matter, fly ash, and, in some cases, mercury, from coal power plant emissions. Research is underway to address emissions of CO2 from coal combustion.
      Source: http://www.eia.gov/energyexplained/?page=coal_environment

- **Question: Is outdoor air pollution more harmful to children?**
    - **Answer:** According to the WHO, power plants, factories and vehicles spew out harmful gases and small particles that can penetrate deep into children's lungs. Children may be more vulnerable to the effects of air pollution than adults. Children's lung development is not complete at birth. Lung development proceeds through proliferation of pulmonary alveoli and capillaries until the age of 2 years. Thereafter, the lungs grow through alveolar expansion until 5–8 years of age. Lungs do not complete their growth until full adult stature is reached in adolescence.
    - According to UNICEF, pollution can also enter the bloodstream and cross the blood-brain barrier, and may damage children's developing brains.
    - In strong sunlight, oxides of nitrogen from vehicle exhaust fumes form ozone at ground level, which can trigger asthma attacks. Industrial growth and rapid urbanization aggravate the problem, with the pressure felt most acutely in the megacities of the developing world. Use of cleaner fuels and technologies, refined motor engines, and public transport are crucial in ensuring that children breathe clean air.
      Sources: http://www.who.int/ceh/capacity/Outdoor_air_pollution.pdf
      https://www.unicef.org/publications/files/UNICEF_Clear_the_Air_for_Children_30_Oct_2016.pdf

- **Question: What is the U.S. Clean Air Act, and What Does it Do?**
    - **Answer:** The U.S. Clean Air Act, passed by the U.S. Congress in 1970 and significantly revised in 1977 and 1990, requires the U.S. EPA to develop, issue, and enforce detailed air quality regulations. The U.S. EPA sets National Ambient Air Quality Standards, or concentrations permitted in the outdoor air, for six common air pollutants (nitrogen dioxide, sulfur dioxide, lead, ground-level ozone, carbon monoxide, and particulate matter). The Clean Air Act identifies two types of National Ambient Air Quality Standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as children, people with asthma or other heart and lung diseases, and older adults. Secondary standards are set at a level that protects the environment against adverse impacts of air pollution such as decreased visibility and damage to animals, crops, vegetation, and buildings.
    - The standards for each of the criteria pollutants are different. The level of each standard is set based on an extensive review of scientific research on human health effects and environmental impacts. The standards are also reviewed at regular intervals and revised if appropriate based on any new scientific information. Information on the levels of the current National Ambient Air Quality Standards may be found here: https://www.epa.gov/criteria-air-pollutants/naaqs-table. Information on the process of reviewing the standards may be found here: https://www.epa.gov/criteria-air-pollutants/process-reviewing-national-ambient-air-quality-standards.
    - While the U.S. EPA sets air quality standards, U.S. states are required to meet those standards, and to submit to EPA enforceable plans showing how they will achieve and maintain air quality.

- **Question: How can we make our air cleaner?**
    - **Answer:** According to the WHO and the UN Environment Programme (UNEP), there are many examples of successful policies in transport, urban planning, power generation and industry that reduce air pollution:
        - **for industry:** clean technologies that reduce industrial smokestack emissions; improved management of urban and agricultural waste, including capture of methane gas emitted from waste sites as an alternative to incineration (for use as biogas); improving energy efficiency;
        - **for transport:** setting stricter vehicle emissions standards and shifting to cleaner heavy duty diesel vehicles and low-emissions vehicles and fuels; shifting to fuels with reduced sulfur content;
        - **for public transport:** prioritizing rapid urban transit, walking and cycling networks in cities as well as rail interurban freight and passenger travel;
        - **for urban planning:** improving the energy efficiency of buildings and making cities more compact, and thus energy efficient;

- **for power generation:** increased use of low-emissions fuels and renewable combustion-free power sources (like solar, wind or hydropower); co-generation of heat and power; distributed energy generation (e.g. mini-grids and rooftop solar power generation); use of technologies to remove harmful pollutants from coal-fired power plant emissions ("scrubbers");
- **for municipal and agricultural waste management:** strategies for waste reduction, waste separation, recycling and reuse or waste reprocessing; as well as improved methods of biological waste management such as anaerobic waste digestion to produce biogas, are feasible, low cost alternatives to the open incineration of solid waste. Where incineration is unavoidable, then combustion technologies with strict emission controls are critical.

Sources: http://www.who.int/mediacentre/factsheets/fs313/en/
http://www.unep.org/transport/airquality/