AIR QUALITY, EARTH OBSERVATIONS AND HEALTH SIDE EVENT PRESENTATION: NEXT GENERATION (NGEN) AIR POLLUTION MONITORING – JUNE 2016 DRAFT

The organizers proposed to address advances in air quality monitoring and earth observations through the perspective of a number of presenters from member countries and multilateral organizations on new sensors, ground-based monitoring deployments and satellite missions. This description of the subject matter should be considered iterative with anticipated additional space-based mission inputs.

Air pollution continues to be a major source of health impact in communities across the globe. In May, the World Health Organization released updated data showing more than 80 percent of city residents around the globe are exposed to particulate pollution in doses that exceed the organization's recommended limits. New targets and indicators contained in the U.N. Global Goals adopted last fall will add to data and monitoring requirements.

The entire Air Quality community is meeting this challenge with a troika of approaches right now – new sensors, traditional monitors, and satellite data. Major changes have happened in all three in the last few years.

In sensors, there are new types and configurations now that were not deployed just three years ago. USEPA Office of Research and Development has developed evaluation projects to study their performance. USEPA has also developed the Village Green sensor package deployment, a community-based activity to demonstrate the capabilities of new real-time monitoring technology for residents and citizen scientists to learn about local air quality. The goal is to provide the public and communities with information previously not available about their local air quality and engage communities in air pollution awareness. UNEP has also developed an important small sensor package that could be deployed in large numbers very soon.

Traditional monitors, using proven sensors with some new configurations, are being installed all over the world whose sheer numbers adds to the mosaic of global data. The satellite community eagerly anticipates making use of the expanding trove of data from new monitors. U.S. specific contributions include 14 State Department monitors all over the world, with 12 more coming this year.

When sensor and monitoring data are combined with existing and new sensors anticipated in satellite-based observations missions over the coming years, and are then integrated with new algorithms to improve retrievals, there is the opportunity to improve forecasting, focus on the community level and help support policy efforts to improve national and subnational air quality protection programs.

Advances in air pollution sensor technology have enabled the development of small and low cost systems to measure outdoor air pollution. The deployment of a large number of sensors across a small geographic area would have potential benefits to supplement traditional monitoring networks with additional geographic and temporal measurement resolution, if the data quality were sufficient.

Air quality monitoring, including measurements of common gas-phase and particulate matter pollutants, has traditionally been conducted by regulatory organizations using specific instrumentation and protocols. For example, the United States Environmental Protection Agency (EPA) monitors criteria pollutants under the National Ambient Air Quality Standards (NAAQS) via a network of ambient monitoring sites operating Federal Reference Methods (FRM) or Federal Equivalent Methods (FEM). FRM and FEM designation for instruments is established through a strict testing protocol (Hall et al., 2014) and the overall network produces very high quality data, however generally sparse in geographic coverage.

Meanwhile, numerous field studies have established that outdoor air pollution can vary considerably at a fine spatial scale due to localized impacts of source emissions. Recent and fast-paced technology development has brought to the market portable and low-cost air sensor devices that may have potential to provide hyper-local air quality data through individual use or application in a dense sensor network. Low-cost sensor devices, defined here as below $2000 USD per pollutant (i.e., under $4000 USD for a two-pollutant device, and so on), typically utilizing electrochemical or metal oxide sensors for gas-phase pollutants such as carbon monoxide (CO), nitrogen dioxide (NO_2), nitrogen oxide (NO), ozone (O_3), and to some extent, total volatile organic compounds (VOCs). Commercially-available particle sensor devices currently use laser-based or light-emitting diode (LED)-based optical detection of particles.

EPA's NGEN program is doing field studies of this emerging air sensor technology with the interest to increase the spatial resolution of air quality data sets and empower U.S. cities and communities to measure air quality in their own environments, assess risks to sensitive populations and ultimately influence the relevant AQ management programs.

The current field project is a multi-year, multi-city effort to assess emerging ambient air quality sensors with existing or near-term commercial availability. Long-term evaluation will be conducted under real-world conditions, i.e generally low concentration, suburban environment with temperate winters and hot, humid summers.