3.0 Proposal for an air quality monitoring demonstration project in Pune, India.

3.1 Observations on current monitoring activities

This proposal is based on our observations of the network in Pune and discussions that developed out of the air monitoring course. Following are key recommendations developed by the Region 5 air monitoring team.

1. Four of the 5 monitoring sites are adjacent to high traffic roadways or inside busy traffic intersections. While this may provide useful data on traffic emissions, these measurements are not appropriate for determining population exposure. We recommended that 3 of the 5 stations be located in residential communities to better represent city-wide concentrations. One of the 5 sites is located on the roof of a short building in the industrial section of the city. We believe that this monitoring site is good and should be continued.

2. There is a need for continuous meteorological monitoring in Pune. This data will be essential for detailed data analysis as well as to support dispersion modeling for air quality strategy development.

3. We recommend that the sampling schedule be reevaluated. The current schedule collects samples on two consecutive days once per week. This is inefficient since measurements on consecutive days are correlated. The Indian standard requires 114 measurements per year. A more efficient sampling schedule that meets the 114 measurement requirement would be to collect samples every 3 days. If at all possible, this should be followed at all sites on the same days.

4. We recommend that sampler inter-comparison studies be carried out to assess the equivalence of the 4 PM sampling methods used in India. Currently, measurements are being carried out for TSP, PM10 using two sampler designs (a cyclone and an impactor), and PM10 using a Thermo-Environmental beta gauge. We suggested that these methods be installed at the industrial site where there is a large open roof and operated together for a minimum of 12 days to define the equivalence between these methods.

5. Current laboratory procedures in Pune include folding the filters before they are used and conditioning at 110 degrees centigrade. The folding will break the fibers in the filter and may cause underestimation of the true concentration. A modification to the balance where the filters will not have to be folded was discussed. We also suggested that conditioning be done at room temperature and that the effect of heating the collected PM to 110 degrees studied.

3.2 Monitoring Proposal

To address these concerns and observations, we recommend that a 5-site monitoring demonstration project be developed for Pune.

3.2.1 Network Design

The objectives of the monitoring network are to:

1. Develop a quality-assured monitoring program for PM10 in Pune, India.
2. Develop procedures for measuring monitor precision and accuracy.
3. Test locally used PM10 methods to determine precision and accuracy of the Indian methods.
4. Establish continuous meteorological monitoring in Pune.
5. Establish a program for the statistical evaluation of air quality data.
6. Using trace metals data, begin to establish source apportionment work in Pune.

Following are the key elements of the network design.

1. Develop five air monitoring stations in Pune: one background site outside of the city to the West or East (note that this site will be either up-wind or down-wind of the city depending on the season); one urban industrial location (similar to Pimpri-Chinchwad); one urban roadside location (similar to Swargate or Nalstop); and two urban residential locations not adjacent to a busy roadway or industrial source of particulate matter.

2. The network should be based on PM10 hi-vol mass flow controlled samplers (the USEPA reference method). The samplers should have mechanical timers and elapsed time meters. This will assure that power interruptions will not invalidate samples. I obtained a price quote from Thermo Electron Corporation for these instruments. The cost of six, mass-flow controlled hi-vols that operate at 220 volts, 50 hertz, with a calibration kit, quartz filters and spare parts is approximately $42,000.

3. Co-locate two PM10 monitors at one site. The co-located monitor will be used to measure monitor precision.

4. Co-locate one of each of the Indian PM10 samplers at one site. This information will support an analysis of the accuracy of Indian sampling methods.

5. Operate a continuous meteorological monitor at one site. This information is critical for data analysis.

6. The sampling schedule should be based on 24-hours samples collected midnight to midnight, once every six days, for a minimum of a full year. All monitors should be operated simultaneously.

3.2.2 Laboratory Procedures

Laboratory procedures that conform to the USEPA reference method will have to be established in Pune. This may require obtaining an appropriate balance for hi-vol filters. The balance we saw in Pune can not be adapted to hold an un-folded filter. It is best to avoid putting a fold in the filter before sampling. It would also be useful to look for a laboratory in India that can analyze samples for heavy metals. Atomic absorption spectroscopy would be appropriate, is probably available locally, and is not too expensive. Metals of interest include (but are not limited to) Al, Si, Fe, S, K, Ni, Cr, Mn, V, Cu, As, and Pb.

3.2.3 Quality Assurance

Working with partners in Pune, develop a Quality Assurance Project Plan (QAPP) for the demonstration project that includes procedures for filter weighing and handling, sampling, calibration, chemical analysis and data analysis.

3.2.4 Data Analysis

Develop procedures to summarize and evaluate network results. This will include summary statistics, wind frequency summaries, pollution trends by season and wind direction, and if metals data are available, source apportionment model development.