**1. Project title:**
**Phoenix Area Monitoring for the Joint Air Toxics Assessment Project (JATAP)**

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**3. Work plan**

**3.1 Project Background**

The Joint Air Toxics Assessment Project (JATAP) of the greater Phoenix metropolitan area is an effort that has been jointly planned by the Environmental Protection Agency (EPA) Region 9, EPA-Office of Air Quality Planning and Standards (OAQPS), the Arizona Department of Environmental Quality (ADEQ), the Maricopa County Environmental Services Division (MCESD), the Pinal County Air Quality Control District (PCAQCD), the Intertribal Council of Arizona, the Gila River Indian Community (GRIC), the Salt River-Pima Maricopa Indian Community (SRPMIC) and the Fort McDowell Yavapai Nation. The effort has been facilitated and supported by the Institute for Tribal Environmental Professionals (ITEP) at Northern Arizona University. The first phase of JATAP activities was a review of the existing air toxics knowledge base in the Phoenix area and the creation of a comprehensive blueprint for the assessment of risk from air toxics in the Phoenix metropolitan area through monitoring, emission inventories, modeling and risk assessment. The blueprint further calls for a concurrent public outreach and community-based early action risk reduction program that would broaden the work of the ongoing South Phoenix Multi-media Toxics Reduction Pilot Project to other jurisdictions. This proposal represents the first full step in the implementation of the program described in that document.

The roots of JATAP are found in several EPA initiatives. Primarily, it is a response to the EPA National Air Toxics Program. Two key areas in this program are the National Air Toxics Assessment (NATA) and the efforts to assess and reduce multimedia exposure to toxics

at the national, regional and community levels. The monitoring component of NATA must meet several objectives: it needs to provide a reasonable quantification of concentrations of air toxics in communities for use in risk assessment; it must provide data for comparison to emission inventories; and it must provide data of sufficient quality to identify trends in air toxics that allows for assessment of the effectiveness of MACT standards and other emission reduction efforts. Among the projects that have resulted to address multimedia exposure at the community level is the South Phoenix Multi-media Toxics Reduction Pilot Project; supporting the air toxics monitoring needs of this pilot project is one of the objectives of JATAP. Another root of JATAP was articulated in the *Joint Statement of Visions and Goals* issued in December 2000 by a group of senior federal, state, local and tribal air quality Project Managers convened by the USEPA Assistant Administrator for the Office of Air & Radiation to begin looking at a vision for air quality management in the first decade of the new century. The strategy outlined in this document included, as a key element, building partnerships among co-regulators through collaboration on specific projects. JATAP is the first multi-jurisdictional effort to be undertaken in response to this strategy.

Two previous studies have provided a basis of information for this effort. The Arizona Hazardous Air Pollutant (HAP) Study concluded in 1995 by ADEQ and the NATA results from modeling of the 1996 National Toxics Inventory (NTI) data for Maricopa and Pinal Counties provide a fragmentary and not entirely consistent view of the magnitude of risk from air toxics and the geographic distribution of that risk. The Arizona HAP study relied primarily on model results, but did have one year of air toxics monitoring at the Supersite in Phoenix for model-to-monitor comparison. Overall, the Arizona HAP study attributed much of the risk to broadly distributed on-road mobile sources (primarily due to 1, 3-butadiene) while the 1996 NATA results more heavily implicated the industrial emissions concentrated in south Phoenix. The NATA data also identified a significant hot spot of non-road mobile emissions at the Phoenix airport. The NATA results indicated that eleven census tracts in this core industrial area of central and south Phoenix exceeded an excess lifetime cancer risk of 100 per million inhabitants due to exposure to air toxics (excluding diesel particulate matter).

Although the tribal lands in the study area are not highly urbanized, development of the rapidly expanding urban area is in the process of enveloping them. For example, growth in Scottsdale and Mesa has filled in lands on two sides of the Salt River Pima-Maricopa Indian Community, and a major new freeway, the Loop 101, runs along the western boundary of the reservation. The Arizona Department of Transportation has developed plans for a major transportation route through the Gila River Indian Community from Chandler, AZ to West Phoenix, called the South Mountain Freeway. The proposed freeway would add a possible 75,000 to 100,000 vehicles per day in the St. John's community. This freeway project would expose the GRIC to possible increases of emissions and pollutants, particularly toxics from diesels and other on-road vehicle emissions. The Community has a strong interest in obtaining background (pre-freeway) monitoring data that may also be of substantial national interest if the freeway is constructed, since it would document the air quality impacts (particularly toxics) due to the introduction of a freeway into a low population density area.

Given the overall distribution of sources of air toxics, concentrations are likely to be lower on tribal lands in the study area than in the urban core. There is, however, a strong tribal interest in participating in JATAP. For example, members of the Gila River Indian Community experience high rates of diabetes, asthma and other respiratory illnesses; these conditions can increase their sensitivity to air toxics. The GRIC Department of Environmental Quality (DEQ)

has a close working relationship with the GRIC Public Health Department, and the departments are studying how air pollution exposure may be related to other trends in public health.

Although no comprehensive study of air toxics has been conducted across the Phoenix area, there is now a sufficient database to serve as a strong foundation for the proposed monitoring project. Air toxics monitoring at the Supersite has been continuous since 2001 and it has been designated a National Air Toxics Trends Site (NATTS) starting in January 2004. Additional seasonal monitoring has been carried out periodically at various sites in the region since 1995. In 2003, JATAP initiated a small area study of air toxics with three monitoring sites in south Phoenix and the Gila River Indian Community. We are currently in the process of collecting one year of volatile organic compound (VOC) samples on a one-in-six day sampling schedule at three monitoring locations in this subset of the larger JATAP area of concern.

### 3.2 Scope of Work

The Phoenix Area JATAP Monitoring Project will involve measuring air toxics at seven locations in the Phoenix area, augmented by measurements made with a mobile monitoring lab. The funding requested in this proposal will fund air toxics monitoring at five of these locations and will support the coordination of the overall air toxics monitoring network. Two of those five sites will be a continuation of the existing JATAP small area study; the other three locations are sites where air toxics monitoring has not been conducted previously, including a site near the airport, a site west of downtown Phoenix and a site on the Salt River Pima Maricopa Indian Community. Monitoring site names, locations and characteristics are listed in Table 1. A map of monitoring locations is shown in Figure 1.

The proposed monitoring network is designed to answer several key questions about air toxics in the Phoenix metropolitan area:

- What is the range of concentrations of air toxics in the downtown industrial core of Phoenix?
- How is the prevailing pattern of westerly upslope flow during the afternoon and easterly downslope flow during the night and morning reflected in the spatial and temporal distribution of air toxics?
- Is there a toxics hot spot affecting neighborhoods near Sky Harbor International Airport?
- What is the magnitude of exposure to air toxics in neighborhoods located near freeways and other sources of on-road emissions?
- What is the impact of air toxics from greater Phoenix on immediately adjacent tribal lands?

Based on previous modeling efforts and monitoring of CO and $PM_{2.5}$, it seems likely that the highest concentrations of species such as benzene and 1,3-butadiene will occur to the west of the downtown core during the early morning when the nocturnal inversion is still in place and the flow is from the east. Monitoring Site B was chosen to investigate this possibility. Species for which secondary production is likely to be significant (such as formaldehyde) may more closely follow the pattern of ozone, which often exhibits an afternoon maximum to the east of downtown Phoenix. Sites E and F are most likely to be influenced by this afternoon transport. Hourly measurements of PM, speciated PM and NMHC (at site A and/or site F) will provide the temporal resolution necessary to determine how air toxics vary with the diurnal wind flow.

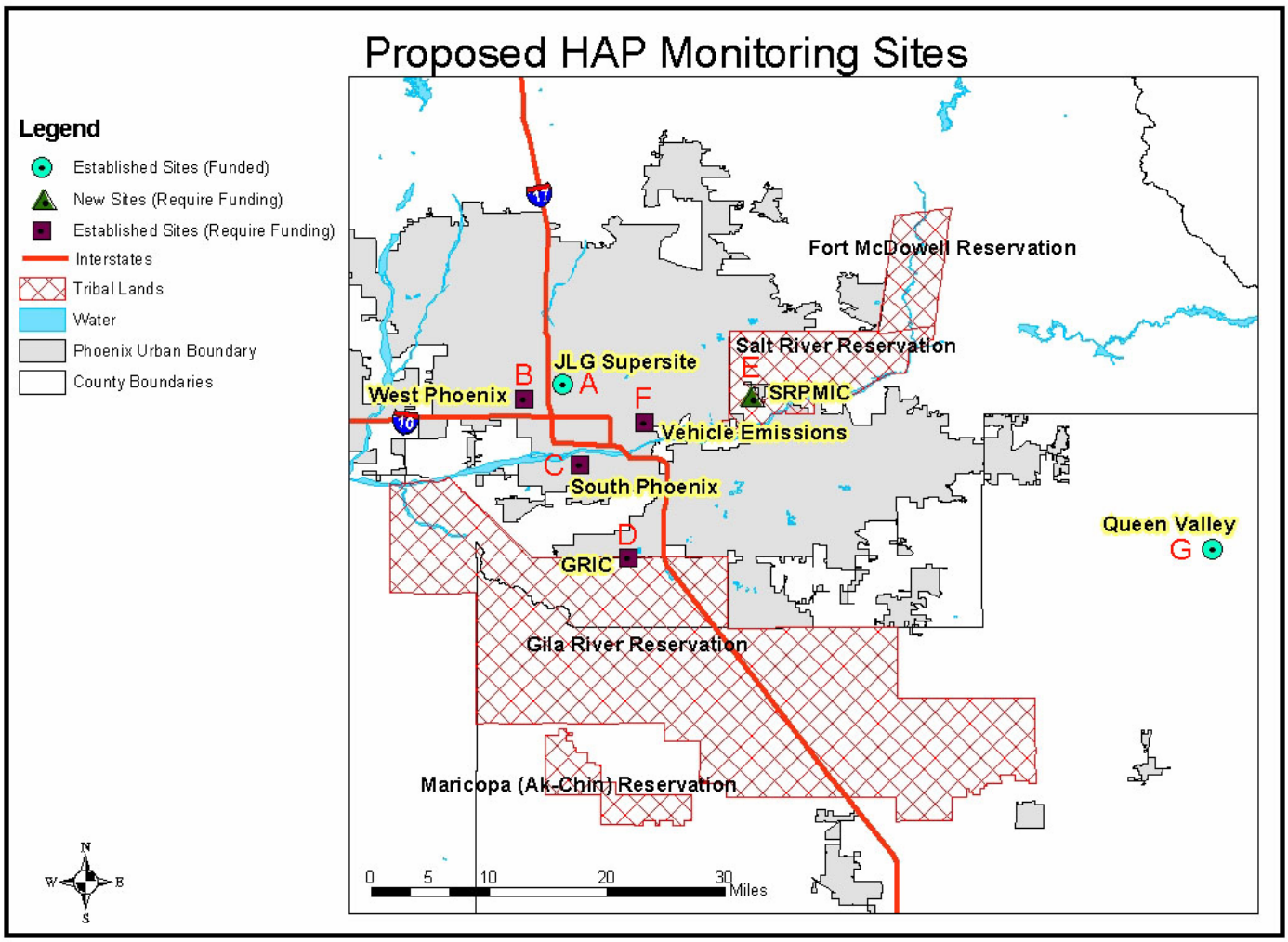
Table 1. Proposed sites included in JATAP monitoring network. Funding requested under this grant will support air toxics activities in **bold type** and coordination of the entire monitoring network.

| Site | City/Site and Address | Operator | Parameters to be Measured During Project Period | Scale |
|---|---|---|---|---|
| A | Phoenix – JLG Supersite, 4530 N. 17th Ave | ADEQ | -Meteorology<br>-CO, $NO_2$, $O_3$<br>-continuous carbon, nitrate, sulfate and NMHC<br>-$PM_{10}$ and speciated $PM_{2.5}$ (IO-3, IMPROVE, filter based and continuous)<br>-VOCs (TO-15)<br>-carbonyls (TO-11)<br>-hourly EC/OC (experimental)<br>-black carbon (aethelometer) | Neighborhood |
| **B** | **West Phoenix - 3847 W. Earll** | ADEQ/ MCESD | -speciated $PM_{2.5}$ (IO-3)<br>**-VOCs (TO-15)** | Neighborhood |
| **C** | **South Phoenix – 33 W. Tamarisk, near Central and Broadway** | ADEQ | -Meteorology<br>-CO, $O_3$, $PM_{10}$<br>-carbonyls (TO-11)<br>-**VOCs (TO-15)** | Neighborhood |
| **D** | **Gila River Indian Community, St. Johns – 4208 W. Pecos Rd.** | GRIC | -Meteorology<br>-$O_3$, $PM_{2.5}$,<br>- **VOCs (TO-15)**<br>**- speciated $PM_{2.5}$ (IO-3)** | Neighborhood |
| **E** | **Salt River Pima-Maricopa Indian Community – 10005 E. Osborne** | SRPMIC | -Meteorology<br>-$O_3$, $PM_{10}$, $PM_{2.5}$<br>**-VOCs (TO-15)**<br>**- speciated $PM_{2.5}$ (IO-3)** | Neighborhood |
| **F** | **Vehicle Emissions Lab, 600 N. 40th St., Near Airport** | ADEQ | **-VOCs (TO-15)**<br>-speciated $PM_{2.5}$ (IO-3)<br>-black carbon (aethalometer) | Neighborhood |
| G | Queen Valley | ADEQ/ PCAQCD | -$NO_2$, $O_3$<br>-VOCs, (TO-15)<br>-$PM_{10}$, speciated $PM_{2.5}$ (IO-3, IMPROVE) | Regional/ Background |
| H | EPA Mobile Rapid Response Lab (MRRL), September to December, 2004 | ADEQ/ GRIC/ SRPMIC | -Meteorology<br>-CO<br>-real time VOCs by portable GC-MS (Hapsite monitor)<br>-multiple VOC and carbonyl species by DOAS<br>-passive canister samplers (VOCs)<br>-PM2.5 | Neighborhood/QA |

Note on abbreviations: ADEQ is the Arizona Department of Environmental Quality, MCESD is the Maricopa County Environmental Services Division, GRIC is the Gila River Indian Community, SRPMIC is the Salt River Pima-Maricopa Indian Community, PCAQCD is the Pinal County Air Quality Control District, DOAS is the Differential Optical Absorption Spectrometer.

Figure1. Map of project area and monitoring sites. The Phoenix urban area is highlighted, as are the Indian Communities and Reservations in the Phoenix Metropolitan area. Red letters adjacent to site locations correspond to letters used for site designation in the text and Table 1.

Figure 1




At seven sites, air toxics monitoring will include canister sampling for VOCs using EPA method TO-15. Target compounds will include benzene and 1,3-butadiene as well as halogenated hydrocarbons such as carbon tetrachloride, chloroform, 1,2-dichloropropane, methylene chloride, tetrachloroethylene, trichloroethylene and vinyl chloride. We will also work with the contract laboratory to extend the method to measure formaldehyde and acetaldehyde from these canister samples. Monitoring at six sites will also include speciation of particulate metals from $PM_{2.5}$ samples using method IO-3, including arsenic, beryllium, cadmium, chromium, lead, manganese and nickel. At sites A and C, cartridge samples will be analyzed for carbonyls by method TO-11A. At site A, elemental and organic carbon will be monitored continuously with an experimental analyzer (model R&P 5400C with $PM_{2.5}$ inlet). Sites A and F

will also utilize an aethalometer to quantify black carbon by optical absorption using EPA method 861. We will conduct one-in-six day sampling at all sites. At sites A, C, F, and G, samples will be collected over a 24-hour period. At sites B, D and E, we will collect one 24-hour VOC sample, then two 12-hour VOC samples on an alternating basis; therefore, two 12-hour VOC samples will be collected at these locations every twelfth day. The 12-hour samples (midnight to noon and noon to midnight) will provide information on diurnal variations and additional insight on the east-west transport of air toxics.

Initial approval has been granted for JATAP to use the EPA Mobile Rapid Response Lab (MRRL) from September to December of 2004. During this period of the monitoring project, the MRRL will be rotated between different fixed monitoring sites during the project. This will provide collocated measurements of a number of key VOC constituents using largely independent analytical methodology. Use of the Differential Optical Absorption Spectrometer (DOAS) will allow truly continuous measurements that can be compared to the discrete results from canister samples. The DOAS open path technique is able to concurrently monitor for a number of key air toxics, including benzene, toluene, xylenes and formaldehyde. This will also provide a significant test for the DOAS system. A Hapsite portable GC-MS system will also provide data on VOC concentrations.

This monitoring network is very similar in scale to the network that is proposed by JATAP in the blueprint document. It will provide data for neighborhood scale assessments of risk from air toxics at six locations, ranging from industrial to residential to rural/agricultural. It will also provide background data at a regional scale from one site. In its totality, the network will provide us with our first real look at the spatial gradients in concentrations of air toxics in the Phoenix region. Although the network does not extend across the entire metropolitan area, it provides reasonable coverage of the most heavily industrialized areas in central and south Phoenix and the heavily traveled downtown freeways and will likely capture the key features of the east-west concentration gradients. It also extends far enough from the primary sources to allow a preliminary assessment of the transport of air toxics out of the Phoenix metropolitan area. For example, the GRIC monitoring station (site D) at St. Johns is located in a possible transport corridor of air masses from the western side of Phoenix. This site is located between two mountain ranges, South Mountain and the Estrella Mountains, just south of Phoenix that create a channel between the Phoenix urban area and an open basin to the south.

Monitoring in this region will also support the trends measurements that are ongoing at site A (Supersite) by providing a picture of concentration gradients around the site. Interpretation of Supersite measurements will be aided by gaining a better understanding of where the site is relative to the concentration maxima identified in the proposed study.

The integrity of the data produced in this monitoring effort will be supported by the development of a consistent Quality Assurance Project Plan (QAPP) among the three agencies carrying out the monitoring. ADEQ currently has a QA plan for air toxics monitoring and this will serve as an important starting point for the development of the QAPP for this multi-agency project. Measurements at site A are conducted in accordance with the Technical Assistance Document for NATTS; all monitoring activities funded by this grant will also follow the NATTS guidance. Cost estimates for this project assume that a minimum of 10% of the funds will be used for replicate samples and duplicate analyses for QA purposes. Collocated sampling for VOC analysis is built into the analysis budgets for the three agencies. At the Supersite (Site A), ADEQ is in the process of establishing collocated $PM_{2.5}$ speciation samplers. This aspect of the QA for the speciated $PM_{2.5}$ sampling will be paid for by separate EPA funding that has already

been secured. In addition to this, the collocated monitoring conducted by the MRRL will provide an additional database for validation purposes. A rigorous process of quality assurance and data validation will be employed through an experienced contractor to minimize the likelihood of significant errors.

ITEP will continue to facilitate the interactions between participating agencies that will be a key ingredient of this project. While the JATAP participants have a history of successful collaboration, JATAP members feel that it is important for overall project coordination to be done outside of the participating public agencies. This is due, in part, to limited resources in those agencies, but participants also recognize that this outside coordination promotes interagency trust by ensuring a more level playing field. ITEP has performed this function since the inception of JATAP.

ITEP's project coordination functions will include the development of a consistent QAPP, facilitating regular meetings among agency personnel during all phases of the project, and coordinating the final reporting of the results of the project. ITEP will also promote information exchange by developing a project website and organizing a JATAP data workshop, where the results of this study can be shared with other key agencies and organizations. This will also serve as a vehicle to communicate the findings to participants in the South Phoenix Multi-media Toxics Reduction Pilot Project and interested community members from across the Phoenix area.

The ITEP Tribal Air Monitoring Support (TAMS) Center will coordinate the use of the MRRL with EPA and will provide operator training for the use of the DOAS and other MRRL instruments. TAMS will also provide general air toxics training for tribal environmental personnel involved in this project. ITEP will work in close cooperation with EPA, ADEQ and the environmental staff from the Gila River and Salt River Indian Communities to develop course and instructional material useful to tribes across the country with air toxics concerns.

The agencies participating in JATAP are committed to the timely exchange of air toxics data collected in this project through the EPA Air Quality System (AQS) on a quarterly schedule within three months of the collection of the data. Additionally JATAP will participate in national data sharing workshops. A final report that summarizes the data and discusses the implications for risk will be submitted within three months of the end of the project period.

## 3.3 Satisfaction of Program Criteria

### 3.3.1 Clarifying Spatial Concentration Patterns

As discussed above, the design of the JATAP monitoring network is focused on providing the initial assessment of the spatial distribution of air toxics in Phoenix that is based on monitoring data. This network covers the region with the greatest concentration of air toxic sources. Monitoring locations in the Phoenix metropolitan area were chosen to assess the impact of air toxics on neighborhoods and urban areas within 500 m to 5 km of some significant known and suspected sources. Specifically, the monitoring sites in Phoenix are located near mobile source emissions (such as the major freeways) and the airport, which was identified as a hot spot in the 1996 NATA evaluation. Measurements from sites D and E on the Gila River and Salt River Pima-Maricopa Indian Communities will allow us to make a preliminary assessment of the extent to which these air pollutants are being transported from the primary sources. This picture of the spatial gradients will significantly help in understanding the ongoing measurements from the NATTS Supersite.

### 3.3.2 Utilization of Results for Assessment of Community Based Risk Reduction Efforts

The South Phoenix Multi-Media Toxics Reduction Pilot Project is currently in the process of building a community based organization of stakeholders that will develop a plan for reducing exposure to toxics. The monitoring being done as part of the current JATAP small area study will provide an important resource as the South Phoenix Project works to assess the overall threat from toxics and establishes priorities for emission reductions. The continuation of the South Phoenix monitoring in this proposal will provide the baseline data necessary for assessment of the effectiveness of any risk reduction measures that are undertaken as a result of the South Phoenix Project. The results of the proposed monitoring project will be shared with the South Phoenix Project at a data workshop organized by ITEP.

In addition to its support of the South Phoenix Project, a key component of the JATAP blueprint is an expansion of this community-based effort to include other parts of the metropolitan area and other jurisdictions. For example, we are actively seeking funding for a program that would provide outreach and education for tribal communities, and would help them participate in the effort to assess the threat posed by toxics and to suggest early emission reductions.

### 3.3.3 Model-to-Monitor Comparison

Currently, a detailed air toxics emission inventory is being conducted as part of the JATAP small area study. At the time that additional funds are secured, the modeling that will be conducted with this emission data will provide a picture of the geographic distribution of air toxics in much of the core area covered by the monitoring network discussed in this proposal. Model-to-monitor comparisons will allow us to learn more about our understanding of air toxics emissions and transport.

Overall, however, it is clear to JATAP that a comprehensive approach will be required for a full understanding of the air toxics problem in Phoenix. Emission inventories from limited areas will never be able to capture a representative picture of an urban area that has complex meteorology and a mixture of primary and secondary, stationary and mobile sources of air toxics. Air toxics don't stay in the boxes we have drawn around our emission inventory domains. Thus, we are separately seeking the financial resources to conduct a high resolution, multi-jurisdictional air toxics emission inventory covering the metropolitan area. We hope to conduct this inventory within one to two years of the time of the JATAP monitoring, so as to maintain the maximum value of the model-to-monitor comparisons that will be carried out.

### 3.3.4 Use of Advanced Technologies for Monitoring

The use of Differential Optical Absorption Spectroscopy (DOAS) for measuring air toxics is still being evaluated by EPA. While DOAS has, in some cases, been established as an equivalent method for criteria pollutant monitoring, its use for VOC monitoring has been complicated by the overlap of VOC absorption bands in the UV with $O_2$ absorption bands. Only recently has the necessary high resolution spectral data become available to allow the quantification of many VOCs by DOAS. The preliminary results are promising, but further validation needs to be carried out. The use of DOAS for VOC and aldehyde monitoring is attractive because of the high analytical cost of methods TO-15 and TO-11 and the ability of DOAS to monitor these key air toxics continuously. EPA has agreed to provide the use of the Mobile Rapid Response Lab (MRRL) with a DOAS instrument for the first four months of the

proposed project (barring an unforeseen emergency that might require the redeployment of the MRRL elsewhere). We will collocate the MRRL with other stationary samplers to provide an opportunity to test the DOAS under a variety of conditions.

Currently, ADEQ is operating a beta test version of a continuous carbon monitor at the Supersite. The R&P 5400C has a $PM_{2.5}$ inlet and provides hourly measurements of elemental and organic carbon. Since diesel engines are a large source of black carbon emissions, the elemental carbon data from this instrument serves as a useful proxy for concentrations of diesel particulate matter.

Many of the air toxics measured at the Supersite are likely to come from nearby on-road mobile sources. We propose to put a second R&P 5400C carbon analyzer at the airport monitoring location (site F). This site will be in close proximity to an industrial area with many stationary sources and a high density of heavy truck operations.

### 3.3.5 Leverage of Other Resources

The design of the proposed JATAP monitoring network takes extensive advantage of other, already identified, monitoring resources. For example, it builds on the ADEQ Phoenix area PAMS network that provides funding ($100,000 for 2004 sample analysis) for VOC measurements at Supersite and Queen Valley during the ozone season (April 1 through October 30). The ADEQ Supersite operation, maintenance, and toxics sampling and analysis are also supported by the NATTS grant ($120,000 for 2004). It also takes heavy advantage of funding for the ADEQ $PM_{2.5}$ network ($170,000 for 2004 sampler operation and analysis) that provides speciated measurements of particulate metals at sites A, B, F and G. Use of the EPA MRRL will provide support for the project QA and will also produce a unique set of continuous data on air toxics. The Salt River Pima-Maricopa Indian Community will utilize CAA 105 Air Grant funds for personnel, fringe, indirect cost, site infrastructure and operation/maintenance of criteria pollutant monitors at their monitoring site (approximately $43,000). Additional support for this project is provided using funds from the Gila River Indian Community – CAA 105 Air Grant. This includes personnel cost, fringe, indirect cost, and operation/maintenance of criteria pollutant monitoring (approximately $36,000). The GRIC provides support thru funds appropriated by the Tribal Council to the GRIC DEQ (for JATAP) of approximately $75,000 for support functions. For monitoring at the Queen Valley site, the Pinal County Air Quality Control District provides approximately $2000 of in-kind support.