

Global Partnerships: A Collaborative Effort to Improve Air Quality in Developing Countries

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ABSTRACT

Since 1970, the World Health Organization (WHO) and the United Nations Environmental Programme (UNEP) has coordinated the operation of a worldwide air pollution monitoring program, formerly known as the Global Environmental Monitoring System/Air (GEMS/Air) and now a part of the WHO's Air Management Information Systems (AMIS). GEMS/Air has operated more than 250 ambient air monitoring stations in more than 50 nations since 1970. The focus has been on improving air quality data and emission inventories in developing countries, ultimately leading to setting appropriate health standards and developing national plans for air quality improvements. As funding is often limited in these countries, WHO has established the "twinning concept" of matching air pollution agencies in Europe and the United States with those developing countries needing assistance. The notion is for a donor agency to provide used air monitors and technical assistance to a "sister city or country." Such monitors, though not necessarily state-of-the-art in the United States but clearly operational, would provide improved monitoring data in many developing countries, thus leading to a better understanding of the worldwide impacts of air pollution on public health and natural resources. The twinning program began in late 1994 with the Ventura County, California and Manila, Philippines. Since 1994, more than 26 countries and organizations have expressed interest in participating in the twinning program. Besides the Philippines, completed twinning arrangements include Nepal, Kenya, Ghana, and Tanzania as recipients and donor agencies in California, Maryland, and the Netherlands.

This paper will describe the process, participation, and the ultimate goals of developing a Global Air Quality Partnership among the participants. It addresses worldwide air quality problems, especially in the megacities of the world. Finally, it discusses problems encountered in providing technical assistance to developing countries and how international organizations, such as A&WMA, might help improved air quality management in these areas.

INTRODUCTION

Worldwide Air Quality Problems

Many major cities of the world are suffering from a series of environmentally-related problems, not the least of which is their deteriorating air quality. Exposure to air pollution is now an almost

inescapable part of urban life throughout the world. Air pollution is not just a nuisance issue. It is a serious health problem and a threat to many pristine areas on the globe. A recent study in Bangkok found 13 species of pathogenic fungi and 16 types of bacteria in the city's dust in 1995.¹

Until 1960, only New York City qualified as a world "megacity," i.e., greater than 10 million populations. By 1980, the number of megacities in the world reached six, and by 1990, twelve. In 2000, there will be at least 21 megacities, 17 of which are found in "developing countries" (the only exceptions are New York City, Los Angeles, Tokyo, and Osaka).² Perhaps even more astonishing is the prediction that there are more than 90 metropolitan areas of three million or more population today and will be 145 such areas in 2015. Pollution levels are equally impressive in these megacities. The 20 megacities studied by the WHO/UNEP all exceeded at least one of the WHO health guidelines, 14 exceeded the guidelines for two major pollutants, and seven have three or more major pollutants that exceeded the guidelines.³ The most polluted city in the world, by all accounts, is Mexico City that exceeded WHO guidelines for all six major pollutants. The other six megacities that exceed at least three major pollutant health standards are Beijing, Cairo, Jakarta, Los Angeles, Moscow, and Sao Paulo.

Programs to Assist Developing Countries in Air Pollution Control Efforts

United States Assistance Programs

The United States has several programs to help developing countries in their air pollution control efforts. The major environmental agency in the U.S., the U.S. Environmental Protection Agency (EPA), provides technical assistance to many areas through its Office of International Activities. Specific areas of expertise include global warming, acid rain, and the phase out of lead in gasoline. The U.S.-Mexico Border program, initiated in the 1980's resulted in an Environmental Plan signed by the presidents of the two countries in 1992.⁴ The goals of that plan included strengthening enforcement of existing laws, reducing pollution through new initiatives, increasing cooperative planning and training, and improving understanding of the border environment. The NAFTA agreements furthered funding and cooperation between the U.S. and Mexico, and also with Canada. The Asia Environmental Partnership (AEP) is another example of cooperative partnerships between the U.S. and many countries of Asia. Other examples of U.S. assistance programs include the Agency for International Development (AID), the Overseas Private Investment Corporation (OPIC), the Export-Import Bank of the U.S., Inter-American Development Bank (IDB), and the U.S. Environmental Training Institute (USETI).

United Nations Assistance

Many agencies of the United Nations have environmental programs that provide assistance to developing nations. Among them is the UNEP, the World Bank, the WHO, the United Nations Industrial Development Organization (UNIDO), the United Nations Development Programme (UNDP), the World Meteorological Organization (WMO), and the International Atomic Energy

Agency (IAEA). The United Nations Centre for Human Settlements (UNCHS) works to improve urban governance through its Sustainable Cities Program. WHO coordinates the worldwide Healthy Cities Programme, which now houses the Air Management Information System, a global air quality information exchange system. One can learn more about AMIS by contacting Dr. Dieter Schwela at <Schwelad@who.ch>.

Other Participating Organizations

Many financial, research institutes, and non governmental organizations provide assistance to developing nations. The Asia Development Bank (ADB) in Manila is an important source of public and private sector projects in 32 developing countries in Asia. The Japan International Cooperation Agency (JICA) provides technical assistance and grants to initiate air pollution programs. The Regional Environmental Center for Central and Eastern Europe (REC) has played a growing role in that important area of the world.

Priorities for Assistance

A major concern resulting from all of the above-mentioned programs to help developing countries in addressing environmental pollution problems is that of coordination and prioritization. As part of the “reinventing” process by the new Secretary General of the United Nations, there are ongoing discussions over consolidation and improved management of environmental programs. One possibility is that of centralizing the programs into one agency. Until such changes are made, however, several major contributors to the UN, most notably the United States, have drastically cut back funding programs that have affected environmental assistance to the developing countries. This will be discussed later when describing the problems in the GEMS/Air Twinning program.

Concerning air pollution control, the priorities for developing countries should be to enact air quality legislation, establish standards, collect sufficient data to detect ambient and emission levels, then develop air quality management programs to improve the quality of life.

WHO’S AIR MANAGEMENT INFORMATION SYSTEM (AMIS)

Background

The remainder of this paper will focus on a particular aspect of air pollution assistance to developing countries — that of monitoring the air to find out the health impacts and assisting the development of air quality management programs. The only global effort of monitoring air pollution was the Global Environment Monitoring System (GEMS) Air, managed by the WHO and the UNEP. Other GEMS programs do similar global monitoring for Water and for Human Exposure Assessment. Because of funding reductions within the United Nations, the GEMS/Air program has been incorporated into AMIS, which fully operates under WHO’s Healthy Cities Programme.

GEMS/Air evolved from a pilot WHO air quality monitoring project, started in 1973. UNEP joined the operation of the program in 1975, and GEMS is also a component of the UN Earthwatch system. The original objectives of GEMS/Air were to strengthen urban air pollution monitoring and assessment capabilities in participating countries, improve the validity and comparability of data among cities, provide global assessments on levels and trends of urban air pollutants and their effects on human and ecosystem health, and to focus data collection on sulfur dioxide and particulate matter. The monitoring systems are run by the national city or country authorities who voluntarily contribute their data to the GEMS/Air worldwide data base. The cities represent a wide range of climatic and socioeconomic conditions, and different levels of air pollution control capabilities. It is the only global program providing long-term air pollution monitoring data for cities in industrialized and in developing countries.

Current Status

As noted earlier, the GEMS/Air program is now a part of the AMIS. The AMIS has the objective of transferring information on air pollutant concentrations and air quality management tools among countries. In this context, AMIS acts as a global air quality information exchange system. AMIS program activity areas include:

- ◆ Coordinating databases with information on air quality issues in major cities and megacities
- ◆ Acting as an information broker between countries
- ◆ Providing and widely distributing technical documents on air quality monitoring and management
- ◆ Publishing and widely distributing annual trend reviews on air pollutant concentrations
- ◆ Giving training courses respect to air quality monitoring and management
- ◆ Linking donors and needy recipients for monitoring equipment (GEMS/Air)
- ◆ Running Regional Collaborative Centers to support data transfer activities, perform training courses, and carrying out twinning projects

In the existing GEMS/Air program, data from about 60 cities in 30 countries is represented. The core database is expected to increase the number of contributing cities to 100 by the end of 1998 and 300 by 2000. Besides continued air data collection from existing sites, the pollutants that AMIS will monitor include gaseous pollutants such as ozone, nitrogen oxides, carbon monoxide, and lead. In 1993, the U.S. EPA signed a bilateral agreement with WHO for long-term computer, data analysis, quality assurance, and technical support.

THE WORLD HEALTH ORGANIZATION TWINNING PROGRAM

Background

The 1992 United Nations Conference on Environment and Development (UNCED), in its Agenda 21 action plan, made several specific recommendations regarding enhanced monitoring capabilities.⁵ Two specific recommendations pertinent to the WHO Twinning program goals are as follows:

Development of appropriate urban air pollution management capacities in large cities and the establishment of adequate environmental monitoring capacities for surveillance of environmental quality and the health status of populations

Improvement of data collection and of methods of data assessment so that national and international decisions can be based on sound information; and strengthening of United Nations data collecting activities, particularly of the Global Environmental Monitoring System

To carry out the UNCED recommendations, and as funding is often limited in these countries, WHO has established the “twinning concept” of matching air pollution agencies in Europe and the United States with those developing countries needing assistance. The idea is for a donor agency to provide used air monitors and technical assistance to a “sister city or country.” The monitors, though not necessarily state-of-the-art in the United States but clearly operational, would provide improved monitoring data to developing countries and lead to a better understanding of the worldwide impacts of air pollution on public health.

In early 1993, several activities took place at the WHO Headquarters in Geneva to initiate the concept of a twinning program. First, the author, an EPA employee on detail to the WHO at the time, contacted the California Air Pollution Control Officers Association (CAPCOA). He described the idea of developing a “sister-city” relationship between California air pollution control agencies and cities in the developing world. Many cities in the United States have established “sister cities” in one or more countries, leading to exchange of information, students, cultural exhibits, etc. It was felt by the author and his colleagues at the WHO/UNEP that there might be similar interests in air quality management. A sister-city or twinning relationship in air quality might involve exchange of technical assistance, consultants, training opportunities, and actual air monitoring and meteorological equipment. Agencies in the United States were undergoing major upgrading of their air monitoring capabilities under the 1990 Clean Air Act. Accordingly, the time was “ripe” for establishing a program for these agencies for donating older, but fully-operational equipment to countries that were, or willing to become participants in the GEMS/Air monitoring program. CAPCOA received immediate interest from several California agencies, including the California Air Resources Board (CARB).

Pilot Program

A first effort at “twinning” occurred in 1994 between the Ventura County, California, Air Pollution Control District and the Philippines Department of Environment and Natural Resources (DENR). Several cities in Southeast Asia showed an interest in being recipients of air monitors during a series of air pollution workshops conducted by the World Bank in early 1994. The first serious interest by a potential donor agency (Ventura County Air Pollution Control District) also occurred in 1994. The WHO agreed to provide travel funding for the Ventura agency’s director, Richard Baldwin, to visit and evaluate three potential recipient cities: Bangkok, Thailand; Manila, Philippines; and Jakarta, Indonesia. The Philippines were selected as most appropriate. The Ventura County Air Pollution Control Board approved the pilot twinning program and the Director of the DENR signed an agreement with WHO in late 1995 to assure funding to operate the new monitoring system.

A key part of any donation of air monitoring equipment to a developing nation is adequate training of the staff of the recipient agency. Ideally, regional training programs funded and coordinated by WHO can be established to reduce travel costs and more efficiently train several participants at once. Since such training was not readily available at the time of the Philippines/Ventura’s County twinning decision, alternate means of training were pursued. With the assistance of the Asia Foundation offices in San Francisco and Manila, a member of the air monitoring program of DENR was provided an environmental fellowship. He came to the U.S. for training with the equipment that would be donated by Ventura County. Ventura provided for three weeks of training, then the California Air Resources Board staff provided an additional week’s training. The training proved extremely helpful when setting up and operating the air monitors, and the additional training in state air pollution control programs will be very useful for other activities of the DENR. In summary, training is a very crucial activity in any twinning agreement and it serves to assure the donor agency that the equipment will be put to good use and maintained.

Expansion of the WHO Twinning Program

Outreach

With the success of the Ventura pilot program, the WHO/UNEP began to carry out a much broader program to identify donors and recipients of air monitoring equipment. WHO included discussions about the twinning program as part of its routine collaborative effort with EPA to provide quality assurance and technical assistance to the GEMS/Air program. The internet bulletin board of EPA’s Technical Transfer Network provided space for discussion of the WHO twinning program and whenever a specific equipment request was identified, an “Alert” was provided on the network (www.epa.gov/ttn/amtic/gemsair.html). Several articles on the twinning program were published in national journals, including the EM of the Air & Waste Management Association. A key outreach effort was conducted by the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials

(ALAPCO), which sent a survey out to all of its members soliciting interest and available equipment. Visits were also made by the author, who by 1995 had retired from EPA, to several US agencies to encourage participation. Most of the potential donors learned about the WHO twinning program through these various efforts.

Identification of Donors

Agencies that showed an interest in donating equipment to a GEMS/Air participant were asked to complete a questionnaire to help arrange a successful twinning recipient. The questions were designed to help prevent sending inoperative equipment to a recipient as the ability to repair defective equipment in developing countries is quite limited and would likely defeat the purpose of twinning. Questions included power requirements, warranties, operating manuals, spare parts, shipping materials, and training availability. Donors were also asked to identify any specific countries where they felt their city/state might want to establish a long term sister-city relationship.

Identification of Recipients

A modest amount of funding was allocated to cover equipment shipping costs and travel for a consultant to visit and assess countries that showed a need for donated equipment. The author visited several countries in Asia as part of training lectures for WHO and traveled to South America to discuss potential twinning programs with Argentina, Brazil, Uruguay, and Ecuador. Recipients were asked to sign an agreement with WHO and the donor agency to assure continued support for the program. Suggested items to cover in the agreement include full use of the equipment in a monitoring program, adequate staff and funding to operate and maintain monitors, adequate structures to house equipment, application of a quality assurance program, identification of at least three sites (industrial, residential, and commercial) for placement of monitors, provision of all data from monitors to the GEMS/Air (AMIS) data base, and waiving of custom fees for importation of equipment.

Current Status of Implementation

Completed Twinning Agreements

Five Twinning Programs, including the Ventura/Philippines pilot, are currently underway and described in the Table 1 at the end of this paper.

Countries Interested in Participation

There are many other nations in various stages of initiating participation in the WHO Twinning program. Those furthest along are Argentina, Armenia, Ecuador, India, Lake Baikal (Russia), and Peru. Others with interest include Brazil, Uruguay, Bolivia, Romania, Pakistan, Viet Nam, Thailand, Nigeria, and Zambia. Active participation must wait new funding for shipment and

training costs by WHO/UNEP. Several of these countries are willing to consider paying for shipment once a willing donor with the desired air monitoring equipment is found.

Donor Agencies Interested in Participation

Many states and local air pollution control agencies showed an initial interest in participating in the program. Greatest interest was from agencies in California, though a broad spectrum of geographical locations throughout the nation showed interest. We have not pursued many of these agencies in the past two years while WHO awaits news on additional funding sources for AMIS overall. Some of the states include Arizona, Washington, Oregon, Colorado, Wisconsin, Vermont, Iowa, Georgia, Missouri, and New Jersey. The Virgin Islands are also interested in twinning with Latin American recipients. California agencies include the Mojave Desert AQMD, the Sacramento AQMD, and the San Francisco Bay Area AQMD. Other areas showing an interest include Tampa, Phoenix, Cincinnati, Reno, Seattle (Puget Sound), Wichita, Houston, and Chattanooga. The private sector has also shown an interest, with Husky Oil in Alberta an example. Finally, the Earth Island Institute, an NGO, has a particular interest in getting some fairly exotic sampling equipment for a project in the Lake Baikal region of Siberia.

REFLECTIONS AND RECOMMENDATIONS

Success Stories

In Nepal, despite a lengthy process in getting final approval by the Nepalese government authorities, the result will be the establishment of the first air monitoring network in the Kathmandu Valley. This is an area that has nearly one million persons residing in severe air pollution during portions of the year. Nepal has committed to developing air quality management programs and legislation once clear evidence can be measured of exceedances of the health standards. An added value to this twinning effort is the protection of vistas and actual wilderness areas of one of the most pristine and scenic areas of the world.

The twinning program in Tanzania was an example of how communication technology and outreach programs could result in a very short time from conceptualization to achievement. The State of Maryland learned about the Twinning program when its air monitoring staff “surfed” the EPA’s Technical Transfer Network bulletin board and read the newly posted section on GEMS/Air. They contacted the WHO, were open to donating to a nation in need (Dar es Salaam, Tanzania), and agreed to send three particulate monitors within several months of first learning about the program.

A unique success story is that of Accra, Ghana. This became the first “multi continent” twinning program as particulate monitors were sent by a California agency, sulfur dioxide monitors by a research institution of the Netherlands, and they were provided to a nation, Ghana, on a third continent. The only negative aspect of this story is that the monitors from California were apparently “lost in the mail” in Ghana, though we hope to find them eventually.

Lessons Learned

While the initial twinning effort has been successful, there are many pitfalls to be concerned about in assuring Twinning's continued success. First, and foremost, is adequate funding. Start-up costs include not only shipping, but converting the equipment by the donor agency to operate on different voltages in the recipient country. Training is a key expense that must be worked out in each case. As the program matures, undoubtedly there will be a need for funds for spare parts, training of new personnel, and selected reviews by the donor agency. While it is not always necessary to fund a trip such as was made during the pilot program, undoubtedly there will be instances where the donor agency insists that its own air pollution control officer or air monitoring director visit the potential recipient. Better accountability and follow-up by the WHO country office on the shipment arrival and activation of sampling is similarly important. Assuring that the donated equipment will be adequately used and protected is important. The continuing financial support of AMIS will play a major role in these twinning efforts.

Remaining Problems and Solutions

Funding for Training & Shipment of Monitors

A major selling point in convincing potential air monitor donors to participate in the Twinning program has been the offer by WHO to pay the donor's shipping costs and support for recipient training programs. Shipping costs are relatively low - less than \$5,000 was expended to ship the entire Ventura County monitoring network to Manila. The current United Nations budget situation does not permit sufficient funds for expansion of the twinning efforts and thus, creative means of twinning must be explored. One approach is to involve the private sector, particularly the equipment manufacturers. Finally, there is a strong potential for future marketing by a participating manufacturer as key contacts and visibility with the recipient country could result from cooperatively joining in donating equipment. Dasibi, manufacturers of ozone monitors, has discussed possible participation with staff of the California Air Resources Board. Another example might be an airline company that is willing to ship monitors, free, on a space available basis. The public relation benefits from helping a developing country address its air pollution problems should not be overlooked by the private sector and by potential agency donors.

As with shipping costs, the cost of setting up training programs is also being affected by the current United Nations funding crisis. The WHO had intended to conduct training in air pollution monitoring, emission inventories, and overall air quality management at each of its Collaborating Centers every two years. This would be an opportunity efficiently to train staff from future Twinning recipient countries and thus reduce the costs of individual travel to the U.S. donor agencies. These plans have been put on hold, and WHO must continue to try to find individual training fellowships to consummate many projected Twinning agreements. One suggestion has been for creating training videos in the US for specific types of monitors, demonstrating calibration, repair, and sampling techniques. The same video could have a series of soundtracks

in the language of recipient countries and thus allow the mailing of the video when training funds are not readily available.

Potential Solutions

Establishment of “Centers of Excellence” in the various parts of the world by WHO, or by contractual agreements with individual countries or universities, will become more crucial as the AMIS expands. The emphasis is also placed upon total air quality management such as emission inventories and modeling. As funding is restored, the WHO should begin to identify and establish these centers when possible. Over time, such centers will greatly reduce the costs of establishing individual training and maintenance programs at each recipient country.

Unique and creative solutions will become more necessary if the AMIS program is to expand. As noted earlier, involvement of the private sector or of other important U.N. agencies such as the World Bank, may help get the program through the current funding problems.

Finally, establishing an ongoing inventory of available air monitors, meteorological and laboratory equipment, and spare parts available from donor agencies are essential to maintain the momentum of the WHO twinning programs over the next five years and further the overall GEMS/Air goals.

CONCLUSIONS

Tremendous potential exists for global partnerships such as the WHO twinning programs. The author has collaborated with many air pollution officials, both in the US and in developing countries. He is frequently asked how they can transfer technical knowledge and skills between agencies. The brief experience of the Twinning program has been a useful mechanism for such international exchanges. Adding several air monitors to a nation’s air pollution program is not the ultimate result of the Twinning program; it is the initiation of long term program development and relationships between the participants. The success of the Twinning program will not be judged in numbers of air monitors, but in accomplishment of quality air management programs in the recipient countries.

The twinning concept should not be limited to exchange of air pollution monitoring equipment between urban air pollution agencies. Such an exchange could satisfy many other activities. For example, computers, laboratory equipment, water pollution monitors, and meteorological stations, is potential fodder for establishing global partnerships. I would encourage participants at A&WMA to consider unique twinning arrangements. As A&WMA expands to include Sections in other countries, i.e., the Sister Section idea could dovetail into the WHO twinning concept. Other potential “twins” could be the national park service of countries, or Native American environmental agencies.

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Table 1. Current WHO Twinning Programs.

Twin	Twin Donor	Equipment	Status
Philippines (Manila)	Ventura County, California	Seven NOx analyzers, two ozone analyzers, multi gas calibrators, dual & single pen recorders, flow meters, etc.	Staff trained in California Equipment shipped 8/95 & 1/96
Nepal (Kathmandu)	California Air Resources Board	1 ozone, 3 Hi-vols, 3 CO, 1 NO ₂	Approved by Ministry of Water Resources & National Planning Commission, 11/96. Staff trained by CARB, 3/97. Equipment shipment in early 1998 Assistance by NEERI ⁶ in setting up
Tanzania (Dar es Salaam)	Maryland Dept. of Environment Air & Radiation Management Administration	3 Hi-vols	Agreement signed by Dar es Salaam Sustainable Growth program, 7/96. Shipped by Maryland, 8/96
Ghana (Accra)	Great Basin Valley APCD, California; RIVM ⁷ , the Netherlands	GB: 3 Hi-vols RIVM: 3 SO ₂ monitors	Shipping funded for both agencies, and Ghana signed agreement, 7/96. Great Basin shipped hi-vols, 7/96. RIVM shipped SO ₂ monitors, 12/96.
Kenya (Nairobi)	CARB	Phase 1: One ozone, 1 Hi-vol; Phase two: 3 CO, 2 Hi-vols	Agreement concurred on by Kenya, 6/21/96. Staff trained by CARB, 3/97 Equipment shipment in early 1998