JOINT AIR POLLUTION SAMPLING PROGRAM IN TWIN CITIES ON THE U.S.-MEXICO BORDER[1]

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Air quality programs in areas that straddle international boundaries present a special set of conditions that must be dealt with. The border cities of El Paso (Texas) in the United States of America and Ciudad Juárez (Chihuahua) in Mexico are conducting a joint air pollution sampling study that exemplifies the technical, administrative, and international aspects involved.

Air Pollution in the Twin-City Areas

A deterioration in air quality has recently been observed in some of the twin-city areas along the U.S.-Mexico border. This deterioration, a cause of increasing concern among health authorities and the general public, is attributed to rapid population growth, accelerated economic development, and consequent urban expansion. Climatic and geologic factors in the region also add to the problem, notably: sharp fluctuations in temperature from day to day, scant rainfall, low relative humidity, bright sunlight, and dryness of the soil.

Each twin-city area along the border, from San Diego-Tijuana to Brownsville-Matamoros, constitutes an environmental system sharing the same natural resources, especially the air and water. The population in the cities and the surrounding area receives the benefit of these shared resources and at the same time is adversely affected by any impairment in their quality or reduction in their availability. By the same token, there is an intrinsic interdependence in the lives of the two cities, which work side by side, despite the marked differences in culture, to ensure the economic and social well-being of their inhabitants within a single metropolitan area.

Winds carry the air back and forth between the two cities, picking up at each end the contaminating particles and gaseous residues that are generated by urban activity. While they both contribute to the problem to some degree, the air pollution is not necessarily distributed in proportion to that contribution. The threat is a single one common to both cities, compromising the health and economic life of the entire metropolitan area.

The international border that traverses the twin-city environmental system acts as a barrier posing special requirements in terms of law, science and technology, economics, urban planning, etc.

The El Paso-Ciudad Juárez Environmental System

El Paso (Texas), in the United States of America and Ciudad Juárez (Chihuahua) in Mexico constitute perhaps the most important metropolitan area along the border. In all it has nearly 900,000 inhabitants, 500,000 of whom reside in

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Ciudad Juárez. Air Pollution is plainly discernible to the naked eye in both cities; no instruments are needed to confirm its presence. Temperature inversions are frequent, and clear-cut layers of polluted air can readily be seen over the two cities at daybreak.

In view of this problem, the municipal and county health authorities for the two cities decided to undertake a joint air pollution monitoring program with assistance from the Pan American Health Organization's U.S.-Mexico Border Field Office. The program was launched in early 1972. By the end of the year it had been extended to include the city of Las Cruces (New Mexico) in the United States, fanning out over a radius of 50 miles from the El Paso-Ciudad Juárez nucleus, it being felt that the entire area constitutes a single atmospheric basin and that the three cities were economically interdependent.

The chief sources of pollution in this area with a population of slightly over a million are:

• *Automotive vehicles*: About 250,000 vehicles are registered in the area. In addition, an undetermined number of vehicles from other places use its highways, which include one of the major east-west routes across the southern United States. Moreover, according to 1972 U.S. Immigration Service data, an average of 40,000 vehicles crossed from Ciudad Juárez to El Paso each day, for approximately 1,000,000 vehicle crossings a month—possibly the largest volume at any border point in the world. This will give some idea of the intensity of the flow of vehicular traffic in and around the two cities.

• *Industry*. Various large industrial plants operate in the area, including ore smelters, oil refineries, scrap steel smelters, sulfuric acid and cement plants, brick kilns, and other establishments.

• *Other sources of pollution*. Open burning of garbage and farm wastes and the existence of many unpaved streets and roads are also important factors contributing to air pollution in the area.

The problem is compounded by the metereologic and topographic conditions mentioned earlier.

Bases for the Joint Sampling Program

In a document entitled "Bases of Cooperation" the health authorities of El Paso and Ciudad Juárez set forth the program's purpose and objectives, presented a plan of action, and defined the respective parties' responsibilities. The document does not have the force of an agreement; rather, it is a memorandum of understanding between these authorities serving as the basis for a joint program of mutual benefit.

It was agreed that in the early stages the program would operate within the framework of three criteria, which would be subject to change, as necessary, in accordance the program's progress and future needs:

• Its operations would be kept simple, so that only minimal technical and administrative support would be needed from the participating agencies.

• The requirement for human and financial resources would likewise be kept to a minimum—that is, within the regular budgets of the health services without recourse to special appropriations.

• The program would be complementary to other air pollution sampling programs being run by the participating services. The regular work procedures, forms, and so on of each unit would be used.

In order to obtain the results desired from the monitoring program, i.e. comparable technical data on conditions in each city, the program provided for:

• The adoption of technical working standards for field and laboratory use.

- The use of identical sampling equipment.
- The selection of comparable study areas with similar activities.
- The training of program staff in uniform work procedures.
- The adoption of identical sampling schedules.

An Air Pollution Control Subcommittee was established to coordinate the program. It comes under the El Paso-Ciudad Juárez-Las Cruces Area Environmental Health Committee, which in turn reports to the El Paso-Ciudad Juárez Binational Health Council. The Subcommittee meets at quarterly intervals to assess the program's progress, decide on future action, and review the data obtained. Its members are technical representatives of the following institutions participating in the program: El Paso City-County Health Departments; Ciudad Juárez Health Center A; the Mexican Department for Environmental Improvement, acting through its representative in Ciudad Juárez; Region V of the New Mexico State Environmental Improvement Agency; the Texas Air Control Board at El Paso; and U.S.-Mexico Border Field Office of PAHO, which coordinates the work of the Subcommittee and of the program in general.

Each participating agency is responsible for the program's operation in its own area of responsibility. The information obtained by each agency is submitted periodically to the PAHO Field Office, which prepares a consolidated report and distributes it with copies of the original information to all participants.

Studies Underway

Three studies on particulates in the ambient air are now in progress. A total of 10 high-volume filters are used to take weekly samples in selected commercial, residential, and rural districts throughout the area. A fourth study is aimed at determining sulfur dioxide levels by the use of sulfation plates. Sixty such plates are used to take samplings every three months at selected sites in the twin-city area. In each sampling the plates are exposed for 30 days and then processed in the laboratory. The results are measured in micrograms (μg) of SO_2/cm^2 per day.

Results

Table 1 presents the data on particulates, measured in $\mu g/m^3$, on the basis of samplings taken during 1972 in commercial, mixed commercial and residential, and purely residential areas of El Paso and Ciudad Juárez. Parallel information for Las Cruces and for two selected rural communities—Anthony (New Mexico) and Clint (Texas)—is given in Table 2. The U.S. Federal primary standards for particulates sets values not in excess of 75 $\mu g/m^3$ for the annual geometric mean and 260 $\mu g/n^3$ for the maximum permissible level in a 24-hour period, not to occur more than once a year. A comparison between these values and the figures in Table 1 shows that the El Paso-Ciudad Juárez urban area has a serious problem in regard to particulates. The data in Table 2 are closer to the reference standard.

In regard to sulfur dioxide, Table 3 provides, by way of illustration, data from a study conducted in March 1972. Subsequent studies with sulfation plates will be carried out to obtain similar data for charting the levels of this pollutant and identifying the areas of greatest concentration. This information will provide guidelines for a study of sulfur dioxide levels in which more specific procedures will be used.

The program also calls for gathering climatologic data on the three cities in order to facilitate subsequent analysis of the information.

Table 1. Joint El Paso-Ciudad Juárez Air Pollution Sampling Program: Data on particulates in selected urban districts, March-December 1972 (in $\mu g/m^3$).

Month of 1972	Filters 1.1 Commercial area				Filters 1.2 Mixed commercial-residential area				Filters 3.1 Residential area			
	Ciudad Juárez		El Paso		Ciudad Juárez		El Paso		Ciudad Juárez		El Paso	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
March	130	312	125	281	133	292	137	1844	172	236	109	509
April	123	221	154	333	162	267	154	333	118	242	442	1884
May	133	267	98	302	242	260	162	371	224	295	168	298
June	300	497	76	416	173	226	118	125	64	229	60	470
July	98	428	68	170	NR	NR	79	177	NR	NR	99	271
August	NR	NR	87	237	NR	NR	67	182	NR	NR	62	152
September	103	685	88	343	104	386	82	278	89	346	73	191
October	79	336	78	254	345	1030	84	207	447	708	63	348
November	NR	NR	59	205	NR	NR	77	174	NR	NR	89	150
December	NR	NR	71	250	NR	NR	66	142	NR	NR	49	110
Mean	138	392	90	279	193	410	103	383	186	343	121	438

NR = Equipment did not run.

Other, less tangible but equally important results provided by the program are:

- Closer relations among health workers from the participating agencies, facilitating dialog on the problem.
- Increased understanding of the air pollution problem in the area and knowledge gained about the relevant legislation in force in the three cities, as well as about the control activities being undertaken by the participating agencies.
- Development of a mutual sharing of services and facilities, including information, available resources, laboratory services, training activities, etc.

Table 2. Joint El Paso-Ciudad Juárez Air Pollution Sampling Program: Data on particulates in Las Cruces (New Mexico) and two rural communities, October 1972-February 1973 (in $\mu g/m^3$).

Month (end of 1972, early 1973)	Filters Doña Ana County, New Mexico				Filters Clint, Texas	
	Las Cruces		Anthony			
	Min.	Max.	Min.	Max.	Min.	Max.
October	44	93	58	296	41	80
November	137	203	60	284	32	49
December	91	184	89	254	NR	NR
January	42	172	20	296	17	124
February	10	178	50	189	29	NR
Mean	65	166	55	264	27	84

Table 3. Joint El Paso-Ciudad Juárez Air Pollution Sampling Program: Results of sulfur dioxide (SO_2) measurements in the air (sulfation plates method). Study No. 2. Period of exposure: 30 days, 1 February-2 March 1972.

Ciudad Juárez			El Paso		
Station	Location	$\mu g/SO_2/cm^2/day$	Station	Location	$\mu g/SO_2/cm^2/day$
1	V. Guerrero and I. Ramírez	4.3	1	Doniphan and Redd	0.0
2	E. Mejía and H. Escobar	5.1	2	4505 Skylark	3.17
3	V. Guerrero and Lerdo	4.2	3	Thunderbird and Cherry Hill	1.58
4	16 de Septiembre and Oro	4.2	4	Executive and Doniphan	1.58
5	Col. San Felipe Welfare Center	Destroyed	5	Robinson Street	3.48
6	Revolution Park	4.2	6	Rim and Hawthorne	1.58
7	Las Moras diversion dam	3.3	7	1834 Grandview	1.27
8	Arroyo de las Víboras and 16 de Septiembre	1.0	8	Oregon and Yandell	2.06
9	Emiliano Zapata School	2.7	9	Mills and Octavia	2.06
10	Health Center "C"	1.2	10	222 S. Campbell	2.06
11	Bonampak and Perimetral Highway	1.8	11	Tenth and Park	2.06
12	Ciudad del Niño	1.5	12	Lee and Olive	1.58
13	Sanders and Reforma	3.3	13	Piedras and Texas Overpass	1.27
14	Presidente Elías Calles and De la Raza	4.2	14	Albany and Threadgill	1.52
15	C. Grandes Highway, Tlalnepantla	1.8	15	Chaffes Street	0.0
16	C. Grandes Highway, Colinas	1.8	16	3924 Altura	1.27
17	Commercial Crossroads	Destroyed	17	7100 Bellrose	1.27
18	Jardines Eternos Pantheon	2.7	18	Market Avenue	2.22
19	Rayón and Hidalgo (Zaragoza)	1.5	19	7740 Mazatlan	0.0
20	Calgódromo Highway	7.2	20	256 Smith	0.0
	Average	3.1111		Average	1.5015

Future Outlook for the Program

Since the program became operational more than 18 months ago, its work has moved satisfactorily toward the objectives set. The method of operation has proven useful and practical, to the point that other communities along the border are beginning to adopt the same strategy.

Future research should be expanded to include other important pollutants. It would also be helpful to take an inventory of emissions throughout the area in order to strengthen monitoring activities and identify the nature and characteristics of the sources of pollution.

The elements resulting from the program will provide a basis for discussion, for the setting of priorities in the prevention and control of air pollution, for the adoption of air quality criteria, and for the formulation of joint action to help ensure a better level of health for the inhabitants of this important international metropolitan area.

SUMMARY

Ciudad Juárez (Chihuahua) and El Paso (Texas), two cities on the U.S.-Mexico border, form a single environmental system in which the same natural resources, especially air and water, are shared. It also constitutes a single metropolitan area which is characterized by high rates of population growth, economic development, and urban expansion, all these factors mitigating

against air quality. Early in 1972 the health authorities in El Paso and Ciudad Juárez initiated a joint air pollution sampling program with assistance from the Pan American Health Organization. The nearby city of Las Cruces (New Mexico) was later included in the program as well. Activities are carried out in accordance with a document entitled "Bases of Cooperation." The guiding criteria of the program are: functional simplicity, operational economy, and complementarity with other sampling programs conducted by the participating services. An Air Pollution Control Subcommittee is responsible for execution and coordination of the program.

Three studies are currently underway to determine levels of dust pollution in the air. A fourth study is aimed at measuring sulfur dioxide levels through the use of sulfation plates. The results collected reveal concentrations of particulates in the ambient air at levels higher than the U.S. Federal primary standards.

The program should be expanded to include the study of other pollutants and a joint inventory of emissions. In this way criteria on air quality may be established and joint plans of action and strategies drawn up for the control of air pollution in this important area.