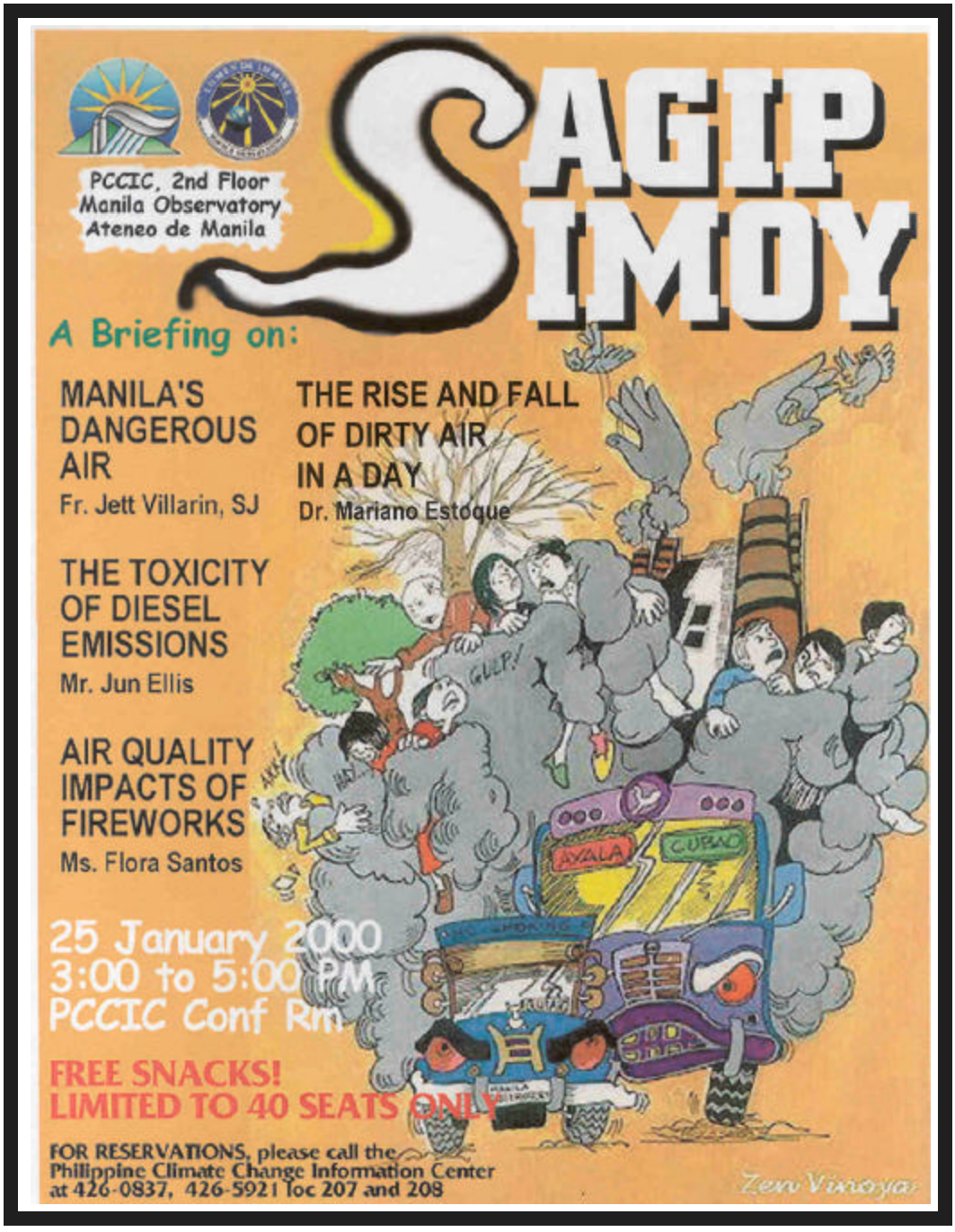
PHILIPPINE CLIMATE CHANGE INFORMATION CENTER
Manila Observatory

BRIEFING MANUAL



PHILIPPINE CLIMATE CHANGE INFORMATION CENTER (PCCIC)

Manila Observatory

OVERVIEW

The Philippine Climate Change Information Center (PCCIC) is a joint project of the Inter-Agency Committee on Climate Change, Department of Environment an Natural Resources, and the Department of Energy (IACCC, DENR, DOE), in cooperation with the Manila Observatory and with funding assistance from the United States Agency for International Development (USAID) through the Philippine Climate Change Mitigation Program (PCCMP).

VISION

The PCCIC is a focal point for national and regional information sharing and capability building on climate change.

MISSION

We aim to promote climate change awareness through information, education, and communication. By function, we hope to link, acquire, store, and disseminate information on Climate Change, Global Warming and its Impact in the Philippines, "Climate-friendly" energy technologies, and related policies to and from identified stakeholders and institutions to provide the public a singular authoritative venue for specialized research.

Selga Hall, 2nd Floor, Manila Observatory, Ateneo de Manila University Campus,
Katipunan Avenue, Loyola Heights, Quezon City
P. O. Box 122, UP Diliman Post Office, Quezon City 1101

M E S S A G E

We are happy to announce the launching of our CLIMATE CHANGE SERIES, a monthly briefing on climate change awareness issues.

The "SAGIP SIMOY" briefing is our first module for the year 2000. It is aimed at promoting awareness of the deteriorating air quality in Metro Manila. The succeeding modules will tackle other important topics related to climate change, global warming and climate-friendly energy technologies.

We hope that through such activities, the Philippine Climate Change Information Center will become the focal point of information sharing and capability building on Climate Change in the country as well as in Southeast Asia.

Thank you.

Ramon Mendoza
Center Coordinator
Philippine Climate Change Information Center (PCCIC)

"SAGIP SIMOY" BRIEFING

25 JANUARY 2000, 3:00 – 5:00 PM
PCCIC Conference Room

RESOURCE SPEAKERS

Fr. Jose Ramon "Jett" T. Villarin, S.J.

Title of Lecture: ***"Manila's Dangerous Air"***
Position:
• Head, Climate Studies Division, Manila Observatory
• Associate Professor, Physics Department, Ateneo de Manila University
Academics:
• PhD Atmospheric Sciences, Georgia Tech, Atlanta, USA
MS Physics, Marquette University, USA
• BS Physics, Ateneo de Manila University, QC
Research Interests: Atmospheric Physics

Dr. Mariano A. Estoque, Ph.D

Title of Lecture: ***"The Rise and Fall of Dirty Air in a Day"***
Position:
• Consultant, Regional Climate Modeling Group, Manila Observatory
Academics:
• PhD Meteorology – New York University
• BS Geodetic Engineering, UP Diliman, Q. C.

Research Interests: Regional Climate Modeling; Air Quality Modeling (Use of computers in modeling the air & the oceans)

"SAGIP SIMOY" BRIEFING

25 JANUARY 2000, 3:00 – 5:00 PM
PCCIC Conference Room

RESOURCE SPEAKERS

Mr. Ernesto "Jun" Ellis, Jr.

Title of Lecture: "The Toxicity of Diesel Emissions"

Position:
• Market & Product Developer,
Philippine Catalytic Converter Corporation

Academics:
• BS Environmental Science, Ateneo de Manila University

Mrs. Soledad S. Castañeda

Title of Lecture: "Air Quality Impacts of Fireworks"

Position:
• Research Specialist, Analytical Measurements Research
Philippine Nuclear Research Institute

Academics:
• MS Chemistry, UP Diliman, Q. C.

Research Interests: Metro Manila Air Pollutant Characterization & Source Identification"

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Metro Manila's Dangerous Air

Jose T. Villarin S.J*., Gemma Narisma*, Jun Ellis+
*Manila Observatory,
+PhilCat Converter Corp

There was a time when, after a long commute through the city, one could easily seek refuge in the sprawling campus of the Ateneo de Manila in Loyola Heights, QC. There was a shade of green to soothe the soul, and a clear clean breeze to wash the urban weariness away.

What is happening to the Ateneo de Manila is only symptomatic of the collective damage we are wreaking on the urban atmospheric environment. The university's airshed is only a microcosm of the more extensive airshed of the metropolis. The almost geometric rise in campus vehicle population, the periodic congestion of its narrow arteries, the daily transport load along C5, and Marikina Valley's fumes sloping up the eastern ridge, all of these have comprised to foul the breeze of this once quiet suburban retreat.

The quality of campus air represents a baseline level by which we are to judge the urban deterioration of the atmospheric environment in various parts of the metropolis. The various ambient air quality sensors installed at the Manila Observatory (in the campus of the Ateneo de Manila) are designed to track the rise and fall of pollution levels in an area that is still considered relatively cleaner than most parts of the city. If the air quality on campus declines, a fortiori, Metro Manila's fumigation will be worse.

For the first time, we have valuable data on the severity of particulate pollution in various parts of the city. Sustained levels of air pollution due to particles, mostly coming from transport sources, are shown listed in Table 1. The values in this table are annual averages of the 24-hour concentration of what is known as PM-10, particles of diameter less than or equal to 10 microns (where a micron is a thousandth of a millimeter) which are deemed hazardous to the airways of the human respiratory system. The two columns denote arithmetic and geometric annual means of data gathered on an almost weekly basis from 13 monitoring sites. These are in dimensions of ug/m^3 (microgram per cubic meter of air). The focal point of concern here is that all stations exceed the annual health threshold of 50 ug/m^3 by at least twice this standard.

Simple dispersion modeling allows us to estimate the ambient levels of air quality in various parts of the city. Figure 1 shows a picture of the pollution in the Quezon City sector of the metropolis, due mainly to vehicular emissions. Low to high values are denoted by the progression of shades from yellow to red. The blue contour line indicates the 100 ug/m^3 level while the green, the 150 ug/m^3, or thrice the health threshold. It is not surprising to find alarmingly high levels along EDSA extending all the way to the Elliptical Road. We also note pollution hot spots along Marcos Highway, Commonwealth, Magsaysay Avenue, and España. Residential areas surrounding these major arteries are most vulnerable to the dangers of particulate pollution.

With grave concern, we observe dangerously high doses of dirty air in the so-called East and North Triangle areas. Several major hospitals and parks are located in these regions.

This deplorable state of our urban atmosphere is worsened by the fact that the severity of the pollution is not just occasional or episodic but pervasive and constant throughout the entire year, peaking generally during the colder months of the year.

Symbolic of our disregard for the air we breathe, we begin each year with a lethal dose of smoke and gunpowder. One of the most visible and dramatic of injuries we inflict on ourselves is the maiming of limbs and life from the firecrackers and stray bullets we fire every time we celebrate New Year. Less visible yet more subtle is the collective damage we wreak on the respiratory health of our people and on our atmospheric environment. While this is just a one-day episode in the life of the city, this can be just as devastating especially to many unwilling victims who suffer by breathing the poisonous wind of New Year. We refer not only to those with existing respiratory ailments but also to our children who inhale high levels of toxic contaminants in the air during the most dangerous of celebrations.

Ambient air quality data collected on three successive New Year's eve celebrations all show dangerously high particulate levels, as much as 10 to 20 times the 24-hour health threshold. Figure 2 shows a set of contour plots which prove the point. The 1500 and 3000 ug/m^3 concentration contours are highlighted by the red line.

Most of the heavy pollution is within the perimeter of EDSA. The central Manila area, in particular, is most vulnerable to this threat. Ironically, the pollution seems to be most severe where the population density is highest.

Unlike previous years where we had monitoring sites at various major arteries of the metropolis, we conducted the New Year sampling at various residential areas of varying socio-economic levels in Quezon City. A table of these measured concentrations is shown in Table 2. We had hoped to see differences between the poorer sections and those of the more affluent. But no substantive conclusion could be reached regarding a determining socio-economic factor in the level of pollution. This only goes to show how we all share the damage wrought by the individual yet cumulative action of those who reside in the metropolis.

There is no doubt that the pollution levels in Metro Manila are alarmingly high and the clear hazard to public health particularly during the recent New Year celebrations must be addressed as soon as possible. The hazards of cardio-pulmonary disease are suffered most especially by those who are weak (children and old people, in particular), and unknowingly, by most of our poor urban settlers who live in open areas in the city.

All this may not be new to most of us who have a sense of the air's heaviness in the city. But with the growing urbanization, we can no longer afford to just shake our heads in frustration, in the hope that this problem will just disperse itself with the wind.

These results are presented to hasten the formulation of relevant environmental policies and regulations that will protect the health of our people and the air that we breathe. We advocate a total ban on firecrackers used for individual household celebrations of the New Year. We support more creative, more communal, less dangerous ways of lighting up the New Year.

We advocate the immediate implementation of the Clean Air Act.

* * *

We have reported here the degree of environmental devastation wrought by our indifference. While destruction of forests and waterways are more tangible and dramatic, damages to the airshed are more subtle and hopefully not irreversible. As we are gradually discovering, the atmosphere is a critical element in the climate balance of the earth system. We have long entertained the notion that the sky is infinitely high. This is no more dangerous than hoping the wind will wash our sins away.

Table 1: Annually averaged 24-hour PM-10 levels in Metro Manila

STATIONS	A-MEAN	G-MEAN
Monumento	199	188
NAIA 1	193	181
España	239	221
Nagtahan Bridge	188	147
Quirino Avenue	161	181
Vito Cruz	108	221
Ortigas Ave.	211	101
Commonwealth Avenue	226	195
Roosevelt Avenue	135	160
Elliptical Road	170	131
West Avenue	177	113
White Plains	122	170
Sta. Lucia East	199	187

Courtesy: First Signs Inc.

Table 2: New Year PM-10 levels

Station	1998	1999	Station	2000
Roosevelt	2695	3059	Ateneo	624
Ateneo	552	1855	Ateneo	650
Pateros	1527	1723	Pateros	1511
Commonwealth	1142	1480	Fairview	743
Sta. Lucia East	1147	1305	Cainta	1063
White Plains	1056	1071	Valle Verde 5	1045
Vito Cruz	2381	913	Olandes	1195
NAIA	1093	569	West Triangle	1159

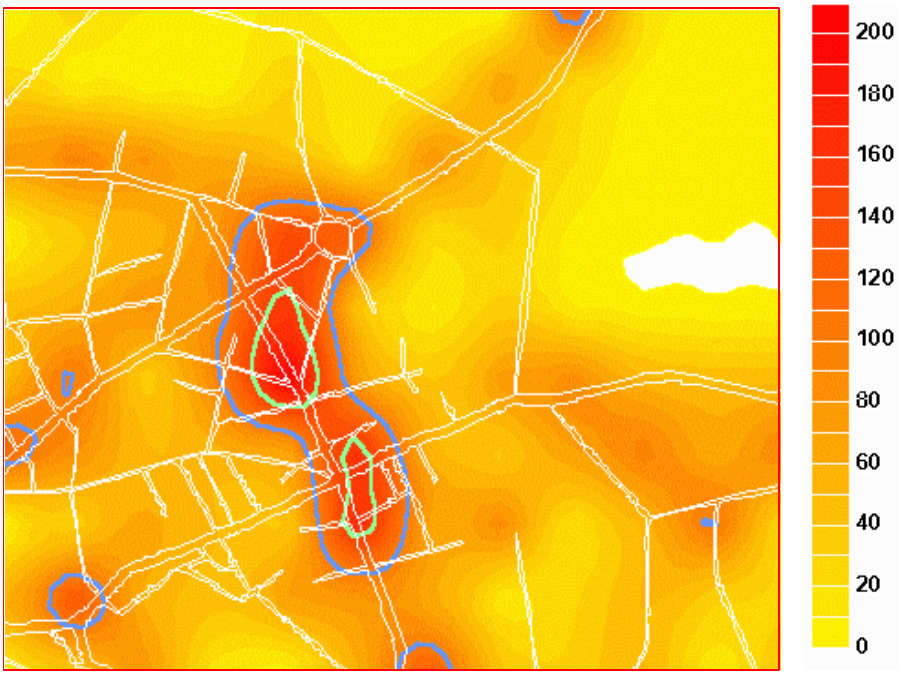

Figure 1: PM-10 concentration in Quezon City. Blue and green lines denote the 100 and 150 ug/m^3 concentration respectively.

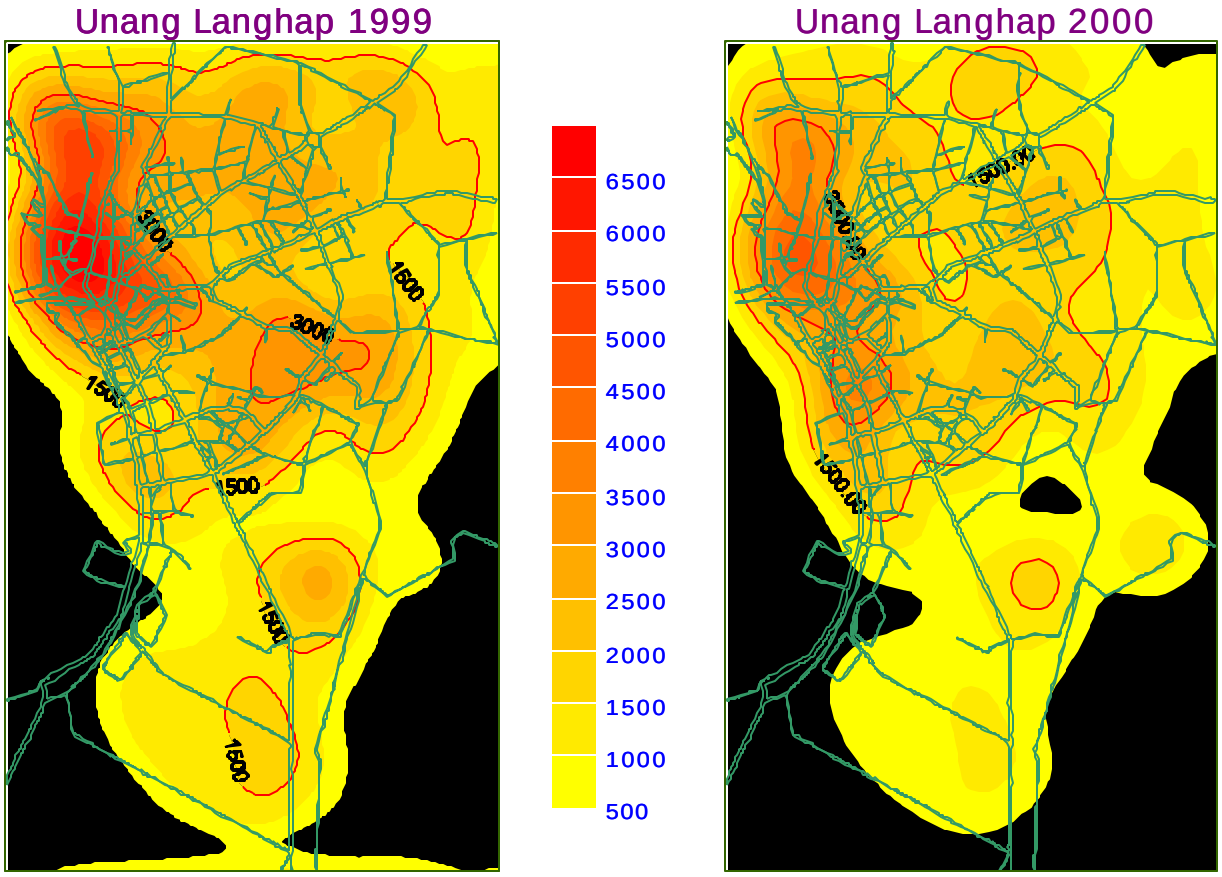

Figure 2: PM-10 levels during New Year in Metro Manila. Red lines denote the 1500 and 3000 ug/m^3 contours.

THE RISE AND FALL OF DIRTY AIR

by

Mariano A. Estoque

This report is concerned with a study of the variations in the concentration of pollutants over Metro Manila. The pollutants are SO_2, CO, NO_2, NO, HC, O_3, and particulate matter. These were observed at five stations, namely, Cubao, Quiapo, Herran, Pasay, and Bicutan. The National Pollution Control Commission selected these stations and made observations during the 3-year period, 1975-1978.

We conducted this research to find out the significant variations of pollution concentration within a day. Before analyzing the data, we formulated a hypothesis based on several factors that affect the concentration. These factors are: space and time variations of the concentration levels, horizontal wind transport, vertical transport by air motions, photochemical reactions, and sinks (sedimentation, washout and rainout). Our analysis of these factors showed that the lack of vertical transport of pollutants by air motion tend to produce high concentrations during the early morning hours and in the evening. On the other hand, the strong vertical transport, which happens when the sun is high in the sky, tends to produce low concentrations during the day time. Moreover, the intensity of the pollution sources has maxima in the morning and in the late afternoon. These two factors, in combination, produce two peaks in the concentration: one at about 8 am and the other at about 9 pm. The observations confirm our analysis of the data.

In summary, the analysis of the variations of the concentrations within a day indicate the following general characteristics:

a. Minimum concentration for pollutants at about 4 am.

b. Maximum concentration for pollutants at about 8 am.

c. Minimum concentration again at about 2 pm, followed by a relative maximum at about 8 pm.

The difference in the variations of the different stations is based on transport, and other processes.

The dependence of the variations on the southwest and northeast monsoons have also been studied. This was done by determining the average variations separately for each of the two monsoons. It was observed that they have similar trends. The concentrations during the southwest monsoon, however, are generally lower than the corresponding concentrations during the northeast monsoon season. This is presumably due to the transport of less polluted air from the sea into the area, ad to the scavenging by rain during the southwest monsoon.

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THE TOXICITY OF DIESEL EMISSIONS

by

Ernesto Ellis, Jr.

Thirty percent of the almost 3.3 million registered vehicles in the country in 1998 had diesel engines. Seventy-two percent of the diesel fleet are utility vehicles, 22% are heavy duty trucks, the balance buses and passenger cars. In Metro Manila, there are more than 67,000 public-utility vehicles with diesel engines (buses, jeepneys, mega taxis). Emissions from these diesel engines significantly contribute to the deterioration of air quality and, consequently, public health and welfare.

Diesel engines emit visible as well as invisible air pollutants. The visible component is referred to as particulate matter (PM). About three-fourths of the time, the concentration of inhalable PM at street-level in Metro Manila is above the air quality standard meant to protect public health. Highest levels occur on Tuesdays, while the lowest ones on Sundays. Inhalable PM also builds up during the Christmas season mainly because of poor dispersion.

Diesel PM (DPM) is very respirable. They can reach the alveolar region of the lungs where gas exchange occurs. When deposited in the alveoli, they can be engulfed by alveolar macrophages (AM). (AMs engulf large substances (e.g., PM, bacteria) that deposit in the alveoli.) When the lung is overloaded with PM, there is a general weakening of the lung's function and defense mechanism making the individual more susceptible to infectious diseases.

Exposure of rats to diesel exhaust has demonstrated DPM's ability to cause lung cancer. The response of mice, however, is ambiguous, and DPM has not been shown to cause lung cancer in hamsters. For humans, studies of occupationally exposed individuals indicate a causal association between lung cancer and DPM. In 1989, the International Agency for Research on Cancer classified DPM as a probable human carcinogen. In 1999, the US EPA in a draft Health Assessment Document of Diesel Emissions proposed to classify diesel exhaust either as a "highly likely" or "likely" carcinogen.

A cost-effective way to reduce the emission of diesel engines is the use of oxidation catalysts (DOC). DOCs can neutralize around 80% of the invisible carbon monoxide and hydrocarbons, and can reduce the opacity of the exhaust by around 40%. Following the "Polluter Pays Principle", privately-owned motor vehicles may absorb the cost of the technology while public-utility vehicles may pass on the cost of the technology through fare increases.

MULTIELEMENT CHARACTERIZATION OF AIR PARTICULATES: TOOL FOR UNDERSTANDING CHANGES IN THE ENVIRONMENT

by

Flora L. Santos, Katherine Mandap, Luz V. Esguerra,

Soledad S. Castañeda, Concepcion R. Matias

Philippine Nuclear Research Institute

In response to growing concern about current and future levels of environmental pollution, The Philippine Nuclear Research Institute (PNRI), in support of regulation started a collaborative study with the DENR-NCR-EMPAS for the multielement characterization of Metro Manila aerosol leading to pollutant source identification.

In undertaking this study, it has established linkages with other agencies and institutions concerned with air quality assessments in the community. Among these institutions are the Ateneo de Manila University, the University of the Philippines in Diliman, and the First Signs Corporation. One of the PNRI air sampling stations has been set-up at the Manila Observatory in Ateneo. The University of the Philippines undertakes monitoring activities in the same area. The PNRI has provided analytical services to the First Signs Corporation for the analysis of Pb and Br on PM10 air particulate samples collected from 12 air monitoring stations operated by the company from 1997 to 1998.

An interagency synchronized air monitoring activity was undertaken by First Signs Corporation, UP Diliman, Ateneo de Manila University and PNRI on New Year's Eve 1997. Analysis of the samples collected indicated very high enrichment of the elements used in the manufacture of fireworks such as Ba, Cu, Cl, K, S, Pb, and Zn. These were evident in the samples collected by the First Signs Corporation, the University of the Philippines and the PNRI. Particulate mass concentrations of sample collected on New Years Eve of 1998 and 1999 exceeded the Philppine 24-hour regulatory standard for PM10 of 150 ug/m^3. The US EPA 24-hour regulatory standard for PM2.5 of 65 ug/m^3 was exceeded in 1998 but not in 1999.

The documentation of the haze due to the forest fires in Indonesia was also another significant information obtained from the multielement data on the air particulate samples. A time series plot of the elements showed concentration peaks for K, S, Cl, and other elements associated with wood burning in the third week of September. This coincided with the local press report of poor visibility in Davao and Palawan due to the haze.

Multielement analysis of air particulate samples was performed with a KEVEX 771 X-ray Fluorescence Spectrophotometer. X-ray fluorescence is a useful tool in aerosol studies due to its multielement capability, rapidity, and minimal sample preparation requirements. Particulate sampling and analysis generate useful information for understanding aerosol composition and pollutant dynamics in the atmosphere. These are important considerations for policy formulation for the improvement of air quality.

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