< Session 2> Air quality improvement in urban area

Environmental Quality Outline Of China in 2000

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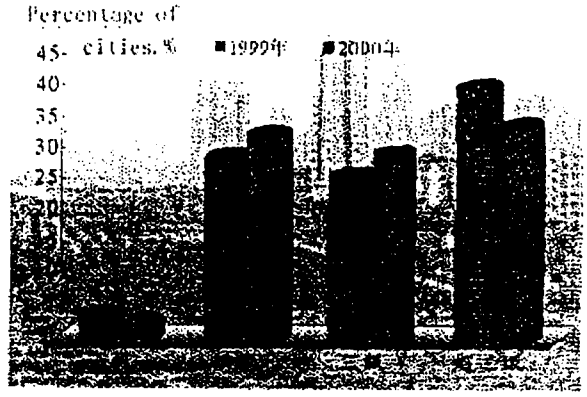
In 2000, the mainly characteristic of environmental pollution in China as following:The Urban air pollution is predominantly resulted from coal-burned, few big cities NOx had contaminated serious. The main regions of acid rain have no changed.

Urban Air quality

The status and trends of urban air quality

In 2000, in 36.4 percent (123 cities) of the 338data-collected cities, urban air quality had achieved the National Ambient Air Quality Standard (NAAQS) of grade Two (The annual concentrations of the main pollutants, SO2, NOx and TSP, were all incompliance with the NAAQS). Among of them, Haikou, San Ya and other seven cities had good air quality in compliance with the NAAQS of grade One. 63.8 percent of the cities (215 cities) exceeded the NAAQS of grade Two and 137 cities among them had one or more pollutant concentration exceeding the limit of NAAQS grade Three, occupying 34.0 percent of all data-collected cities.

In comparison with last year, the quality of urban air had been improved all over the country. The air quality of 36.4 percent cities had achieved the National Ambient Air Quality Standard (NAAQS) of grade Two more than last year (33.1 percent), and the air quality exceeding the limit of NAAQS grade Three from 40.6 percent descended to 34.0 percent. In recently years, the concentration of TSP and SO2 in ambient air is seeing stable decrease. But some cities in North China and Northwest China are still with high TSP concentration and a few cities SO2 polluted serious. The average of NOx concentration is almost the same with previous year. The deterioration trend of urban air pollution as a whole in China has been controlled, and the air qualities in some cities have been improved. However, the pollution in some cities is still very serious.



In 2000, in 36.9 percent (124 cities) of the 338 cities annual average of TSP concentrations had achieved the National Ambient Air Quality Standard (NAAQS) of grade two. In 63.1 percent (210 cities) exceeded

The air quality of 21.3 percent cities had exceeded the National Ambient Air Quality Standard (NAAQS) of grade Two less than last year 7 percent, among them, 11.7 percent of all data-collected cities exceeded grade than.

NAAQS of grade Two, and 101 cities exceeded grade three, occupying 30.3 percent of all data-collected cities.

The top cities of the highest TSP concentration value are accumulated in Gansu province, Shanxi province, Shanxi province, Inner Mongolia Autonomous Region, NingXia Hui Autonomous Region and XinJiang Autonomous Region etc.

Table 1-1 The Grade percentage of TSP concentration

Percentage of cities, % / Grade of TSP Concentration	In 1999	In 2000
Achieved the NAAQS of Grade Two	39.3	36.9
Exceeded the NAAQS of Grade Two	60.7	63.1
Including: Grade Three	35.7	30.3
Average of TSP concentrations in China (mg/m^3)	0.275	0.270
Annual concentration limit of Grade Two of NAAQS (Standard for Residential area)	0.20 mg/m^3	
Annual concentration limit of Grade Three of NAAQS (Standard for Industrial zone)	0.30 mg/m^3	

Cities, which are seriously polluted by SO2, are distributed in Shanxi, Guizhou, Hebei, Chongqing Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, Shanxi, Gansu, Sichuan, Hunan, Guangxi provinces.

Table 1-2 The Grade Percentage of SO_2 Concentration

Grade of SO_2 Concentration \ Percentage of cities, %	In 1999	In 2000
Achieved the NAAQS of Grade Two	71.6	78.7
Exceeded the NAAQS of Grade Two	28.4	21.3
Including: Grade Three	11.9	11.7
Average of TSP concentrations in China (mg/m^3)	0.052	0.049
Annual concentration limit of Grade Two of NAAQS (Standard for Residential area)	0.06 mg/m^3	
Annual concentration limit of Grade Three of NAAQS (Standard for Industrial zone)	0.10 mg/m^3	

Sixty-five cities among data-collected are located in the SO2 Controlling Zone, annual Concentration of 47.74 percent or 31 cities met the standard of grade two, more than last year 15 percent. 34 cities exceeded the standard of grade two, Serious NOx pollution mainly occurred in big cities which populations are over one million and too much automobiles. The consecutive NOx pollution in Beijing, Shanghai, Guangzhou etc. cities had been controlled, the concentration value of among them 18 cities exceeded the standard of grade three. By now, 112 cities are within Acid Rain Controlling Zone, 21 cities of SO2 annual concentration exceeded the standard of grade two, and 14cities exceeded grade three.

Table 1-3 The Grade Percentage of SO_2 Concentration of "Two Controlling Zones" Cities in 2000

Grade of SO_2 Concentration	SO_2 Controlling Zone	Acid Rain Controlling Zone
In compliance with Grade II of NAAQS	47.7%	81.25%
Grade III	52.3%	18.75%
Exceeded Grade III	27.7%	12.5%

NOx is also experiencing decline in last two years. All data-collected cities annual average of NO2 concentrations had achieved the National Ambient Air Quality Standard (NAAQS) of grade two (0.08mg/m3).

Air qualities in mainly concerned cities

In 2000, air quality in 27 cities of 47 selected cities of China reached the NAAQS of grade two, 7 cities reached grade three, 13 cities beyond the limit of NAAQS grade three.

According to the integrated pollution index, the top ten most severely polluted cities were selected as follows: Taiyuan, Urumuqi, Shijiazhuang, Lanzhou, Beijing, Chongqing, Guiyang, Changsha, Hohehot, and Tianjin.

Table 1-4 The grade Percentage of Urban Air Quality in mainly concerned cities, 1999 and 2000

Percentage of cities% / Grade of Air Quality	In 1999	In 2000
Grade II	34.0	57.4
Grade III	66.0	42.6
Exceeded Grade III	38.3	27.7

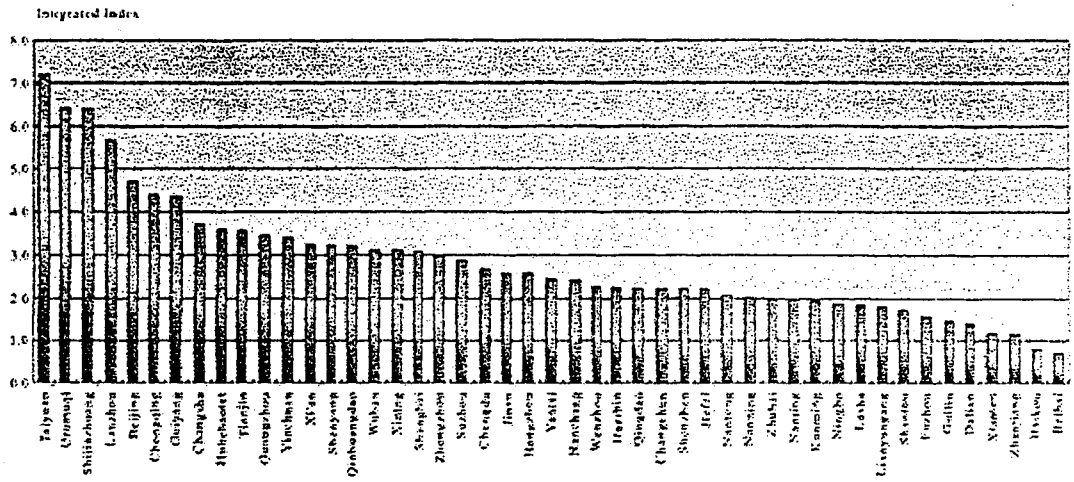


Fig. 1-2 Comparison of Integrated Index of Air Pollution in mainly concerned cities, 2000

Acid Rain

Status of acid rain

In 2000, annual average pH in 254 cities is between 4.1 (in Zhunyi) and 7.7 (in JiaoZuo). Cities whose annual average of pH are les than 5.6 reached 92, or 36.2 percent. 157 cities have acid rain sometimes, reaching the 61.8 percent of 254 cities.

Annual average pH of the precipitation in National Acid Rain Monitoring Network's 99 cities are between 4.1 (in Zhunyi) and 7.67 (in Yuncheng). Cities whose annual average of pH are less than 5.6 reached 40, or 40.4 percent. The annual average of pH in Zhunyi and Huaihua are less than 4.5, and the frequency of acid rain is 80 percent. 70 cities had acid rain occupied 70.7 percent, among them, 44 cities located in the Acid Rain Controlling Zone, 9 cities located in SO2 Controlling Zone, and 17 cities outside of "The two Controlling Zones".

Table 2-1 The pH of cities in National Acid Rain Monitoring Network

pH	4.0-4.5	4.5-5.0	5.0-5.6	5.6-7	>7
Cities	2	21	17	48	11
Percentage(%)	2.0	21.2	17.2	48.5	11.1

Table 2-2 The Frequency of acid rain of cities in National Acid Rain Monitoring Network

Frequency(%)	0	≤20	20-40	40-60	≥80
Cities	29	30	10	14	7
Percentage(%)	29.3	30.3	10.1	14.1	7.1

Annual average pH of the precipitation in the Acid Rain Controlling Zone 102 cities is Between 4.1 (in Zhunyi) and 6.90 (in Qujing). Cities whose annual average of pH are less than 5.6 reached 72, or 70.6 percent; 95 cities has acid rain sometimes, reaching the 93.1 percent of 102 cities. Among them, the frequency of acid rain in Fuzhou is 100 percent. Shanwei, Chaohu, Qujing, Ma'anshan, Chibi, Qianjiangand Deyang have no acid rain in 2000.

Table 2-3 The pH of cities in the Acid Rain Controlling Zone

pH	≤4.0	4.5-5.0	5.0-5.6	5.6-7	>7
Cities	0	4	36	30	0
Percentage(%)	0	3.92	35.29	29.41	0

Table 2-4 The frequency of acid rain of cities in the Acid Rain Controlling Zone

Frequency(%)	0	≤20	20-40	40-60	60-80	≥80
Cities	7	20	22	27	14	12
Percentage(%)	6.86	19.6	21.57	26.47	13.72	11.76

The distribution of acid rain area

Compared with the last years, there are no obvious changes in the term of acid rain allocations. The annual average of pH less than 5.6 areas are mainly located to the south of YangZe River, eastern parts of YingHai-Tibet Plateau and Sichuan Basin. Central China, South China, Southwest China and East China coastal areas all have their serious acid rain areas. Some region in North China could also see acid rain sometimes. Actidity and frequency of acid rain change fast in different acid rain areas.

The East China acid rain area covers broad regions, and the acidity in the rainfall change fast. Hangzhou, ningbo, wenzhou and Xiaomen are still seriously acid rain polluted regions. The deterioration trend of acid rain in this area will more serious, among of 7 cities whose frequency of acid rain more than 50 percent, 5 cities annual average of pH less than 5 and the frequency of acid rain more than 50 percent.

The acid rain in the south China is still very seriously, expect Haikou, Sanya and Liuzhou, the annual average of pH in the other 12 cities are all less than 5.6, among them, 50% percent cities' frequency of acid rain more than 50 percent. The mainly located to Zhujiang Delta and east of Guangxi province.

Based on Huaihu, Changsha and Zhuzhou, the central China acid rain area have some good change but the overall pollution there are still fairly serious.

The central China acid rain region, which based in Zhunyi, Yibin, Nancong and Chongqing, kept it's the most severe acid rain polluted region in China. But the cities located in center of acid rain region had been improved.

In north of China, only TuMen's annual average of pH less than 5.6 (is 5.32), and the frequency of acid rain is 48.9 percent, it has improved.

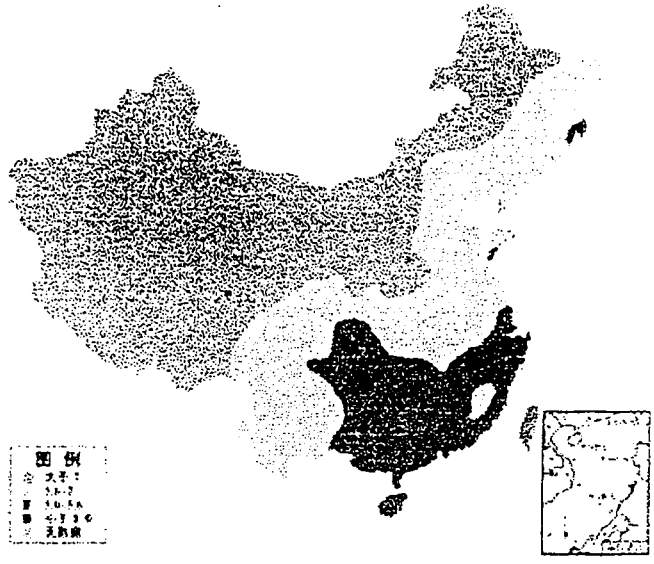


Fig. 2-1 The distribution of pH of rainfall in China, 2000

Measures for the Preservation of the Atmospheric Environment in Hyogo Prefecture

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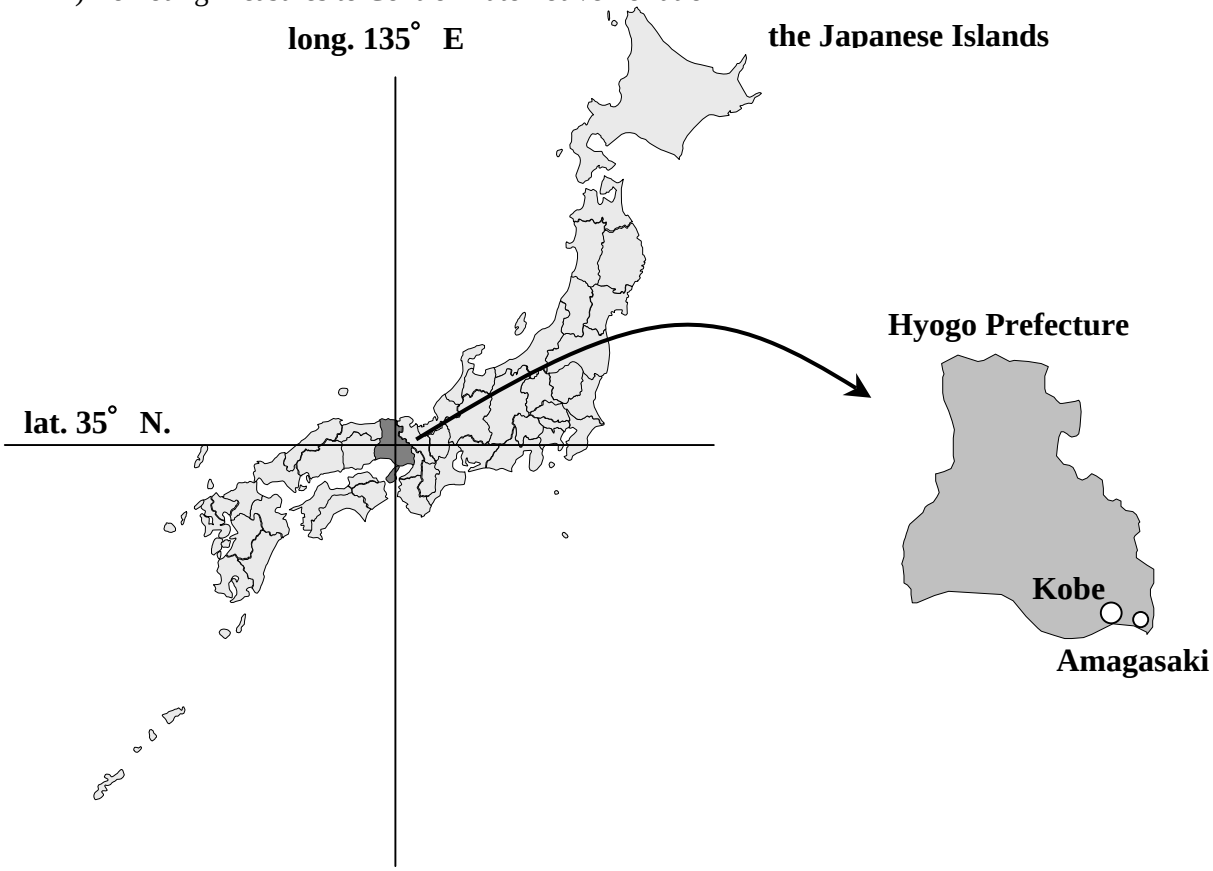
1. Introduction

Hyogo Prefecture is located roughly in the center of Japan, with the 135° East meridians that determines Japan Standard Time. The area is of approximately 8,400 square kilometers and its 5.57 million inhabitants make it the eighth most populous prefecture. The problem of pollution was recognized in Amagasaki and other cities in Hyogo's industrial belt as early as the latter half of the 1940's, following World War II. Pollution increased in the mid 60's to late 70's with the rapid popularization of automobiles and also because of the huge amounts of nitrogen oxide emissions, and health problems resulting from photochemical smog began to appear in the early 70's. In response to these problems, the prefecture began to devise measures intended to check pollution, enacting the "Pollution Control Ordinance" in 1965 and setting up governmental agencies responsible for implementing measures to reduce pollution in 1971. At the beginning of the 80's, the effect of the two oil crises popularly known as "oil shocks," one in 1973 and the other in 1978–9, caused the country to shift from an age of high growth to a low-growth. However, increasing urbanization changes in lifestyle, and other factors also brought changes in the nature of pollution problems, resulting in the need for new ways of dealing with these issues.

The prefecture is tackling mainly following 3 issues concerning atmospheric environment at present.

1)Promoting Measures to Control Automotive Pollution



2)Promoting Measures to Reduce Hazardous Air Pollutants

3)Measures to Reduce Suspended Particulate Matter

The outline of these promotions is described below.

2. Measures for the Preservation of the Atmospheric Environment in Hyogo Prefecture (Except for Acid rain and Green effect gasses)

(1) Promoting Measures to Control Automotive Pollution

a. Measures to Reduce Pollution from Automobile Traffic

Based on the Automobile Pollution Control Plan established in January 1998, the prefecture has been working together with related organizations to promote comprehensive pollution control measures against sources, distribution of goods, human flows, and vehicular traffic. Furthermore, trial adoption of a "road pricing" system was instituted in November 2001 with the aim of improving the environmental quality along the roadways in the urban area by leading automobile traffic away from urban areas and out to coastal roads.

Measures to Reduce Pollution from Automobile Traffic

(A) Measures Focusing on Automobiles
- Regulations governing automobile exhaust emissions and classifications
- Measures to reduce black smoke from diesel-powered automobiles etc.

(B) Adjustment and Reduction of Traffic Congestion
- Promotion of New Universal Traffic Management Systems (UTMS)
- Implementation of Traffic Demand Management (TDM)

(C) Measures Targeting Traffic Flow
- Environmental Road Pricing etc.

(D) Measures Targeting Roadway Structures
- Installation of low-noise pavements and sound barriers
- Provision of emergency areas in case of environmental disaster etc.

(E) Surveys and Measurements
- Monitoring of air quality at the Automobile Exhaust Gas Monitoring Stations

b. Promotion of Plans to Reduce the Total Amount of Nitrogen Oxides

Based on the "Automobile Nitrogen Oxides Plan" enacted in November 1993, the prefecture has promoted reduction of automobile NOx emissions by supporting companies' own pollution management programs, accelerated wider use of low-pollution and low-emissions vehicles through projects to introduce and support cars for public use, and developed measures such as "Idling-Stop" and "Eco-Driving" movements.

Now, following amendment of the "Law Concerning Special Measures to Reduce Total Automobile Nitrogen Oxides Emissions in Specified Areas" (Automobile NOx Law) in June 2001 and the "Law Concerning Special Measures to Reduce Total Automobile Nitrogen Oxides Emissions and Particulate Matter in Specified Areas" (Automobile NOx–PM Law), the prefecture is developing a new "Plan to Reduce Total Amount of Automobile Nitrogen Oxides and Particulate Matter Emissions" in 2002.

c. Efforts to Reduce the Number of Diesel Powered Vehicles

Due to the effects on health recently tied to particulate emissions from diesel-powered vehicles, the prefecture is promoting counteractive measures such as provision of subsidies to help private businesses purchase natural-gas-powered garbage trucks and install diesel particulate filters (DPF).

(2) Promoting Measures to Reduce Hazardous Air Pollutants

In order to prevent damage to public health from exposure to benzene, dichloromethane, and other hazardous air pollutants, the prefecture has been monitoring air quality, implementing surveys to track the state of emissions from factories and providing guidance in ways to reduce factory emissions.

234 substances are listed as hazardous air pollutants by Ministry of the Environment and the Hyogo prefecture is monitoring the 21 substances listed in the right table.

Hazardous air pollutants

1	Tetrachloroethylene	11	Acetaldehyde
2	Trichloroethylene	12	Formaldehyde
3	Vinyl chloride monomer	13	Nickel compounds
4	Chloroform	14	Arsenic and its compounds
5	Ethylene oxide	15	Manganese and its compounds
6	1,2-dichloroethane	16	Beryllium and its compounds
7	Dichloromethane	17	Hexavalent chromium compounds
8	Acrylonitrile	18	Mercury and its compounds
9	1,3-butadiene	19	Benzo[a]pyrene
10	Benzene	20	Talc (including asbestos fiber)
		21	PCDFs and PCDDs and co-PCBs

(3) Measures to Reduce Suspended Particulate Matter

The Air Pollution Control Law determines discharge standards for soot- and dust-type suspended particulate matter (aerosols) discharged from fixed sources according to the type and scale of factories or facilities generating soot and smoke. Working to ensure rigorous adherence to the discharge standards, the prefecture has given guidance in ways to reduce the amount of particulate matter being discharged, including guidance provided through environmental preservation (pollution prevention) agreements, and promoted the use of clean fuels and installation of particulate filters.

The prefecture is also gaining a better idea of the amount of "condensation dust," particulate matter in fumes formed when factory smoke mixes and condenses with the surrounding air immediately after the high-temperature gases are discharged. The prefecture continues to monitor discharge conditions even more intently, with urban incinerators the center of attention.

Recent studies, including epidemiological studies conducted in the United States investigating the health impacts of fine aerosol particles with diameters of 2.5 μm or less (PM2.5). In order to gain a better grasp of conditions regarding PM2.5, the Hyogo Prefectural Institute of Public Health and Environmental Sciences is running trials of low-cost samplers that employ filtering methods with high precision. Measurement results obtained in monitoring by the institute, which is located in Kobe, indicate that 60%–80% of what was previously classed under earlier environmental standards as PM10 can now be classed as PM2.5.

3 Conclusions

As it is mentioned above, the measures against air pollution have been conducting by the prefecture. The outline of these promotions is as follows;

(1) Against the Automotive Pollution: The prefecture is promoting, Reducing black smoke, Reduction of traffic congestion, Road pricing. etc. And also recommending Idling-stop, Eco-driving. Making efforts to reducing the number of diesel powered vehicles.

(2) Against the Hazardous Air Pollutants: The 21 hazardous substances are listed and the monitoring has been conducted.

(3) Against the Suspended Particulate Matter: Providing the guidance about use of clean fuels and installation of particulate filters. And, the investigation of PM2.5 is started by the prefecture because of the measurement results obtained by the institute, 60%–80% of PM10 can now be classed as PM2.5.

References

Ministry of the Environment (Japan): 2002 Environmental White Paper (2002)
Hyogo Prefecture: 2001 Environmental White Paper in Hyogo Prefecture (2001)

兵庫県における大気環境保全政策

1.はじめに

兵庫県は日本のほぼ中央に位置しており､日本の標準時を決める東経 135 度の子午線が、南の東浦町から北の但東町まで５市８町を通っている。兵庫県の面積は約 8400㎢2 で 47 都道府県中第 12 位、人口は約 557 万人で同じく第 8 位である。瀬戸内海沿岸部を中心として工場地帯が形成され、それに伴い様々な環境問題が生じ、その解決への対策も講じられてきた。兵庫県では、尼崎など第２次世界大戦前からの工業地帯において 1940 年代後半から公害の発生が見られるようになった。1950 年代後半からの高度経済成長期には、エネルギー消費が急速に増大するとともに、石炭から石油へとエネルギー源の転換により、大気汚染が当初は粉塵を中心としたものから硫黄酸化物を中心とした汚染に形態を変化させつつ広域化、深刻化させていった。1960 年代後半に入ると急速な自動車の普及ともあいまって窒素酸化物による汚染が進み、1970 年代初めには光化学スモッグが発生するようになり、健康被害が生じるようになった。県では、これに対応するために、1965 年には、「公害防止条例」を制定するとともに、公害対策を実施していくための行政機構を整備し、国に先駆けて公害対策の展開を始めた。1960 年代後半は、この公害防止条例に基づき、指定施設や排出基準の設定などにより、公害の抑制に努めた。国においては、1967 年に環境行政の枠組みを規定する「公害対策基本法」が制定され、以後、同法を受けて、1968 年には「大気汚染防止法」及び「騒音規制法」が、1970 年には「公害紛争処理法」､「公害防止事業費事業者負担法」「水質汚濁防止法」及び「廃棄物の処理及び清掃に関する法律」が制定され、今日の環境行政に係る法体系の基礎が整備された。1980 年代に入ると、1973 年及び 1978 年～79 年の２度の石油危機等の影響を受け、高度成長の時代から低成長、安定成長期へと転換し、省エネルギーやこれまでの公害対策の進展とあいまって、環境の状況は総体的に改善された。しかし、都市化の進展や生活様式の変化等により、公害問題は様相を変え、新たな対応が求められるようになった。

大気環境に目を向けると、硫黄酸化物による汚染は、総量規制や脱硫装置の導入、燃料の低硫黄化により、着実に改善された。一方、窒素酸化物については、1973 年に環境基準や工場に対する排出基準が定められ、1970 年代後半には改善の傾向が見られるようになったが、自動車交通量の増加等により、1985 年を境に再び濃度の上昇の傾向が見られるようになった。

2.兵庫県における大気環境の保全の施策

(1) 自動車公害防止対策の推進（別紙資料参照）

a.総合的な自動車公害対策の推進

1998 年 1 月に策定した「自動車公害防止計画」に基づき、発生源・物流・人流・交通流等の各種対策を、関係機関と連携を図りながら、総合的に推進している。なお、阪神間における沿道環境の改善を図るため、2001 年 11 月から、都市部の交通を臨海部に誘導する環境ロードプライシングが試行されている。

b.自動車排出窒素酸化物総量削減計画（自動車 NOx 計画）の推進

1993 年 11 月に策定した「自動車 NOx 計画」に基づき、事業者の自主管理による自動車 NOx 排出量の削減、県公用車への導入や補 助事業等による低公害車・低排出ガス車の普及促進、アイドリング・ストップ等のエコドライビング運動などの施策を推進している。

なお、「自動車から排出される窒素酸化物の特定地域における総量の削減等に関する特別措置法」（自動車 NOx 法）が、2001 年 6 月に改正され、「自動車から排出される窒素酸化物及び粒子状物質の特定地域における総量の削減等に関する特別措置法」（自動車 NOx・PM 法）に改正されたことに伴い、県においても 2002 年度に新たに「自動車 NOx・PM 総量削減計画」を策定する。

c.ディーゼル車対策

近年、ディーゼル車から排出される粒子状物質による健康影響が指摘されていることから、民間事業者に対する天然ガス塵芥車の購入費補助や DPF 導入補助などの施策を推進している。

(2) 有害大気汚染物質対策の推進

ベンゼンやジクロロメタン等の有害大気汚染物質による健康被害を未然に防止するため、大気環境モニタリングを実施するとともに、工場等における排出状況の実態調査及び排出抑制の指導を実施している。

(3) 浮遊粒子状物質対策

大気中の浮遊粒子状物質（エアロゾル）のうち、固定発生源から排出されるばいじんについては、大気汚染防止法に基づき、ばい煙発生施設の種類及び規模ごとに排出基準が定められている。兵庫県では、大気汚染防止法に基づく排出基準の遵守を徹底するほか、環境保全（公害防止）協定による指導などにより、良質燃料の使用及び集じん機の設置など、ばいじん排出量の低減指導に努めている。

また、工場の煙突から出た高温のガスが大気中に排出された直後に大気との混合冷却等により粒子化する「凝縮性ダスト」の実態把握も進めている。測定方法の検討や固定発生源からの排出実態を調査し、国を中心とする調査検討会において、工場から排出されるばいじんの 30%が凝縮性ダストであると推定されている。今後さらに都市ごみ焼却炉を中心に排出実態調査を進めていく。

さらに近年、粒子径が 2.5μm 以下の微小なエアロゾル粒子 PM2.5 の健康影響が米国での疫学調査等から指摘されているが、兵庫県下の実態把握はあまり進んでいない。兵庫県の健康環境科学研究センターでは、PM2.5 の実態把握を進めるため、測定精度が高くなおかつメンテナンスが容易で、重量濃度測定の基本であるフィルター法を用いた安価なサンプラーを試作し、測定性能の評価を進めている。神戸市にある当研究所でのモニタリングでは、従来の環境基準項目である浮遊粒子状物質 PM10 の 60～80%が PM2.5 という測定結果が得られている。

自動車交通公害対策

(A)自動車単体対策

1.自動車排出ガス規制、車種規制

2.ディーゼル車の黒煙対策

・ディーゼル車に対する集中自主点検等を推進する。

・ディーゼル車の黒煙取締りを実施する。

・黒煙監視モニター（公募）制度を実施し、通報により自動車使用者を指導する。

3.低公害車導入の促進

4.特殊車両通行許可違反、過積載車両の取締り

(B)交通需要の調整・低減

1.新交通管理システム（ＵＴＭＳ）の推進

・公共車両優先システム（ＰＴＰＳ）

・交通公害低減システム（ＥＰＭＳ ）

2.ＴＤM施策の推進

自動車交通から公共交通への転換など総合的な交通需要マネジメント（ＴＤM）施策を進める

(C)交通流対策

1.道路ネットワークの整備等による交通流の分散、円滑化

2.交通円滑化のための道路改良等

3.環境ロードプライシング

4.ドライバーへの情報提供の強化

(D)道路構造等対策

ａ 低騒音舗装、遮音壁等の整備

・沿道における自動車騒音等を緩和するため、低騒音舗装や遮音壁の設置等の整備を推進する。

ｂ 環境防災緑地等の整備

ｃ 沿道地区整備

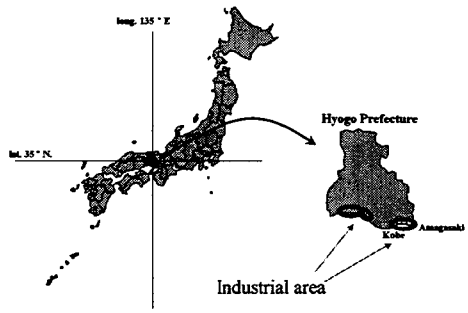
ｄ 土壌脱硝及び光触媒のフィールド実験

(E)調査・測定

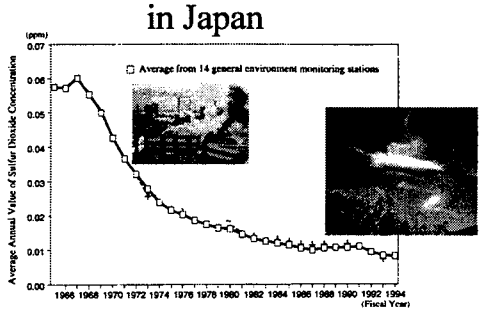
自動車排ガス測定局による大気モニタリング

Measures for the Preservation of the Atmospheric Environment in Hyogo Prefecture

Akira YOSHIMURA
The Hyogo Prefectural Institute of Public Health and Environmental Sciences , KOBE JAPAN



Changes in average annual SO_2 in Japan



Source:Environment Agency of Japan

The prefecture is tackling mainly following issues.

1)Promoting measures to control automotive pollution
2)Promoting measures to reduce hazardous air pollutants
3)Promoting measures to reduce particulate matters

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1)Promoting measures to control automotive pollution
2)Promoting measures to reduce hazardous air pollutants
3)Promoting measures to reduce particulate matters

Route43

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution
(A) Measures focusing on automobiles

1. Regulations governing automobile exhaust emissions and classifications
2. Measures to reduce black smoke from diesel-powered automobiles
3. Accelerated introduction of low-emission automobiles

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
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1) Promoting measures to control automotive pollution
(B) Adjustment and reduction of traffic congestion

1. Public Transport Priority System
2. Promote to shift private automobile traffic to public transport

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution

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1) Promoting measures to control automotive pollution
(C) Measures targeting traffic flow

1. Dispersion and harmonization of traffic flows
2. Improvement of roads to smooth traffic flows
3. Environmental Road Pricing
4. Stronger efforts to provide information to drivers

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
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1) Promoting measures to control automotive pollution

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(E) Surveys and measurements

1) Promoting measures to control automotive pollution
(D) Measures targeting roadway structures

1.Installation of low noise pavements and sound barriers
2.Run field tests on de-nitrification of soil and photo-catalysts

Field test on de-nitrification of photo-catalysts

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution

(A) Measures focusing on automobiles
(B) Adjustment and reduction of traffic congestion
(C) Measures targeting traffic flow
(D) Measures targeting roadway structures
(E) Surveys and measurements

1) Promoting measures to control automotive pollution

(E) Surveys and measurements

- Monitoring of air quality at the roadside measurement stations. (SO_2,NOx,CO, Particulate Matters(PM_{10}))
- There are about 30 stations in the prefecture.

Roadside Measurement Station

The prefecture is tackling mainly following issues.

1)Promoting measures to control automotive pollution
2)Promoting measures to reduce hazardous air pollutants
3)Promoting measures to reduce particulate matters

The prefecture is tackling mainly following issues.

1)Promoting measures to control automotive pollution

2)Promoting measures to reduce hazardous air pollutants

3)Promoting measures to reduce particulate matters

2) Promoting measures to reduce hazardous air pollutants

- In order to prevent damage to public health from exposure to the hazardous air pollutants, the prefecture has been monitoring air quality since 1997.
- 234 substances are listed as hazardous air pollutants by Ministry of the Environment.

21 Hazardous Substances

Volatile organic compounds
1. Tetrachloroethylene
2. Trichloroethylene
3. Vinyl chloride monomer
4. Chloroform
5. Ethylene oxide
6. 1,2-dichloroethane
7. Dichloromethane
8. Acrylonitrile
9. 1,3-butadiene
10. Benzene

Aldehydes
11. Acetaldehyde
12. Formaldehyde

Metals
13. Nickel
14. Arsenic
15. Manganese
16. Beryllium
17. Chromium
18. Mercury

Others
19. Benzo[a]pyrene
20. Asbestos fiber
21. Dioxins

The prefecture is tackling mainly following issues.

1)Promoting measures to control automotive pollution

2)Promoting measures to reduce hazardous air pollutants

3)Promoting measures to reduce particulate matters

3) Promoting measures to reduce particulate matters

- Discharge standards for particulate matters discharged from stationary sources are determined.
- The prefecture has given guidance in ways to reduce the amount of particulate matters being discharged.
- Condensation Dust
- $PM_{2.5}$

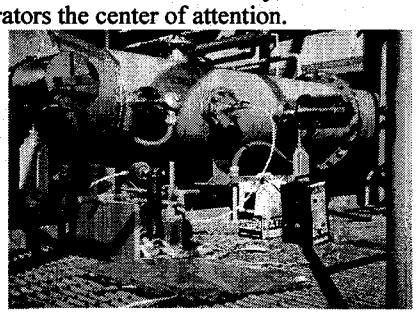
Monitoring of stationary sources

Condensation Dust

- Particulate matters in fumes formed when factory smoke mixes and condenses with the surrounding air immediately after the high-temperature gases are discharged.

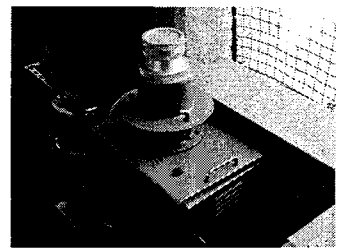
Condensation Dust

- The prefecture continues to monitor discharge conditions even more intently, with urban incinerators the center of attention.

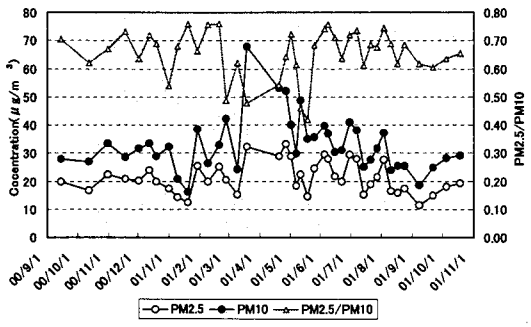


$PM_{2.5}$

- Fine aerosol particles with diameters of 2.5 μm or less
- The prefecture is running trials of low-cost samplers that employ filtering methods with high precision.



$PM_{2.5}$ and PM_{10} monitoring in Kobe



Conclusions

(1) Automotive Pollution

The prefecture is promoting, reducing black smoke, reduction of traffic congestion, road pricing. etc.

And also recommending idling-stop, eco-driving. Making efforts to reducing the number of diesel powered vehicles.

Conclusions

(2) Hazardous Air Pollutants

The 21 hazardous substances are listed and the monitoring has been conducted since 1997.

Conclusions

(3) Particulate Matters

Providing the guidance about use of clean fuels and installation of particulate filters.

And the investigation of $PM_{2.5}$ is started by the prefecture because of the measurement results obtained by the institute, 60%–80% of PM_{10} can now be classed as $PM_{2.5}$.

Air Quality Management in Korea

By Na Jung Kyun, Deputy Director
Air Quality Policy Division
Ministry of Environment, Republic of Korea

1. Air Quality Status in Korea

Air quality in Korea is gradually improving, with a number of air pollutant levels being within environmental standards. However, in the case of some large metropolitan cities, pollution levels of nitrogen dioxide, particulate matter, and ozone have intermittently exceeded the standards, showing a tendency of increasing pollution.

Sulfur dioxide and carbon monoxide levels have generally satisfied the environmental standards.

- SO_2: Following the expanded supply of clean fuel and low-sulfur diesel fuel, the air pollution measurement stations that have been installed nationwide are showing levels that meet the environmental standard of 0.02 ppm on the average per year, except for some stations installed in the Ulsan area.

- CO: The environmental standard is being satisfied in most areas. However, along roads in some large metropolitan cities, the pollution level intermittently exceeds the environmental standard of 9 ppm average per 8-hour period.

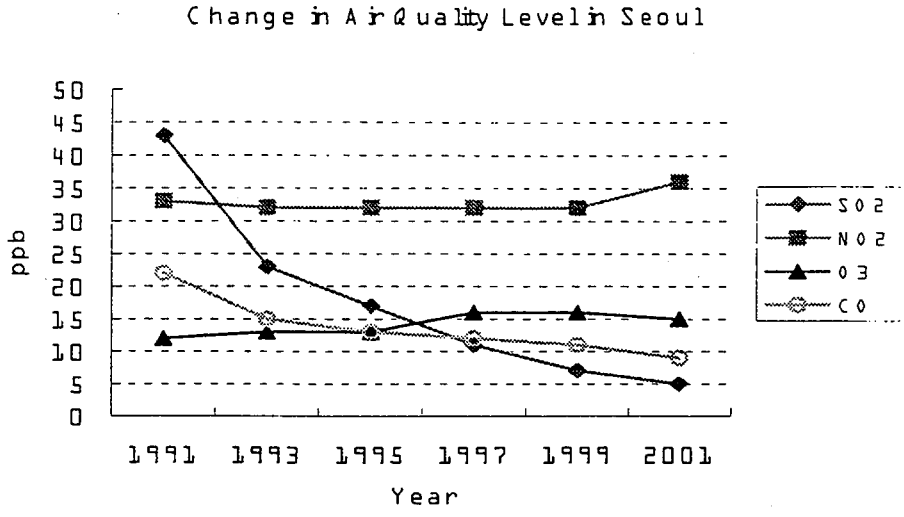
Due to increased overall vehicular emissions and the increasing frequency of the regional yellow dust phenomenon, the pollution level of particulate matter (PM10) continues to gain severity, despite the expanded use of clean fuels and strengthened emission standards. Compared to selected major cities of other industrialized countries, PM10 is 2-4 times more concentrated:

Seoul:	71	/	(2001)
London:	20	/	(2001)
Paris:	20	/	(2001)
Tokyo:	40	/	(2000)

Due to the increase in PM10, visibility in Korea has decreased from 13 km in 1996 to 10 km in 2000.

Nitrogen dioxide levels also show an increasing trend according to the increase in the number of automobiles. In 2001, of the 148 measurement stations on-line, seven exceeded the environmental standard of 0.08 ppm average per 24-hour period.

Lastly, ozone also continues to trend upwards. In 2001, of the 148 measurement stations nationwide, 113 have exceed the environmental standard of 0.1 ppm average per 1-hour, and the number of the summer ozone warnings is on the rise.



The general increase in air pollution is due to following causes:

- ✓ high population density
- ✓ high pollutant emission volume per unit area
- ✓ high rate of increase in automobile ownership and energy use

Of these, the rapid increase in the rate of automobile ownership is the most important contributor to air pollution in large cities. The number of automobiles has increased by a factor of approximately 100 over the past 30 years.

1970	130,000 cars
1980	530,000 cars
1990	3,400,000 cars
2000	12,050,000 cars
2002	13,734,000 cars

2. Policy Direction for Air Quality Management

- Emission Inventory Survey

To pursue scientific and systematic management of air quality, the Ministry of Environment is carrying out a survey to prepare an emissions inventory of pollutants. Initially, the survey was being conducted using energy statistics. However, since 2001, it has been including other variables such as production processes and waste incineration.

- Expansion of Air Pollution Monitoring Stations

Currently there are 76 monitoring stations at the national level and 231 stations at the local level. The Ministry plans to increase the total number of stations to 457 by 2005.

- Management of Special Policy Areas

The Ministry has designated industrial complex areas with serious air pollution as "special policy areas," where stricter emission standards are applied. Areas that have exceeded or are likely to exceed standards have also been designated as "air environment regulation areas" for stricter management.

- Strengthening of Vehicular Emissions Management

The Ministry is particularly concerned about reducing vehicular emissions, which is the biggest source of air pollution in large cities. The Ministry plans to reduce vehicular emissions by strengthening automobile emission standards, implementing defect inspections more strictly, strengthening fuel quality standards, and improving urban traffic systems.

- Strengthening of Point Source Emissions Management

For stricter management of point sources such as factories and other non-residential facilities, the Ministry plans to strengthen emission standards that specifically target the industrial sector. The Ministry also plans to mandate installation of automatic pollution measurement devices on factory smokestacks.

- Research on Ozone and Particulate Matter

The Ministry launched a five-year research project to identify the mechanisms involved in the generation and elimination of secondary pollutants such as ozone and particulate matter.

3. Management of Vehicular Air Pollution

In large metropolitan cities, vehicular emissions are the major source of air pollution. In Seoul, for example, a large proportion of air pollutants are generated by vehicles, as follows:

CO	89%
PM10	70%
NOx	56%
SO2	13%

The policy direction in this field can be summarized as follows:

- Motor vehicle manufacture:
  - Promote the supply of motor vehicles that use cleaner fuels such as natural gas.
  - Strengthen vehicular emission standards to promote the development of low-pollution engines.

- Motor vehicle operation:
  - Street-level enforcement
  - Institutionalize regular inspections
  - Discourage idling

- Transportation demand management:
  - Road pricing (Congestion pricing)
  - Expansion of transfer terminal networks
  - Enhanced parking management and parking fees in urban areas
  - Car-free day initiatives

The Ministry of Environment has continually pursued these measures. In particular, the Ministry has already met with some success in a number of areas, as outlined below:

- Strengthening of the emissions standard for newly manufactured automobiles.

  - The standard for newly manufactured cars has been strengthened a few times in Korea to promote the manufacture of automobiles that generate fewer pollutants. However, the Korean standard lags behind standards in other industrialized countries.

  - In the case of gasoline-powered automobiles, the Korean standard is equivalent EURO III and LEV levels. For the year 2006, the government plans to upgrade the standard to EURO IV and ULEV.

- Supply of natural gas buses

  - Large diesel-powered vehicles such as buses and trucks are quite major sources of the overall air pollution profile. The frequency of intra-city bus operation is the highest in large cities, and these buses have been recognized as the main cause of air pollution in large cities. Accordingly, the government has been promoting the supply of natural gas buses since 2000. The government is in the process of replacing 3,000 superannuated diesel-fuel city buses with natural gas buses by the end of 2002. The plan is to ultimately replace all 20,000 city buses nationwide by 2007.

  - To promote the replacement of diesel buses with natural gas versions, the government is providing bus purchase subsidies, financing the construction of refueling stations, offering cuts on value-added tax and acquisition tax, and administering an environment-friendly oil pricing system designed to favor natural gas buses over the conventional alternatives.

- Improvement and computerization of the automobile emissions certification system

  - Korea introduced a certificate system for automobile emissions in 1987. The system has been improved, reflecting the strengthened emission standards adopted since then.

- Also, the automobile import market has recently been liberalized in Korea. Certification of imported cars from the U.S., Europe, and other countries require standardization. Accordingly, improvements in the certification system as well as research into computerization have become necessary.

- The Ministry is currently examining and analyzing the problems of the Korean certification system and the systems used in the U.S., Europe, Japan, and other countries. The Ministry is engaged in improving and computerizing the system.

• Strengthening of Automobile Defect Inspection System

- In the case of the U.S., the inspection failure rate is close to 15%, whereas in Korea only one model car has failed in the past nine years.

- Accordingly, the following measures have been gradually implemented to select car models that would require defect inspections: surveillance tests, emission defect reporting requirements, and on-board diagnostic systems.

• Efforts to Develop Technologies for Low-pollution Automobiles

- The diesel engines currently produced in Korea lag behind diesel engines produced in Europe. Since 1998, projects have been pursued specifically for developing low-pollution automobile technology, such as the high-compression dispersion device-matching technology for mid-sized diesel engines.

• Emissions Regulation of Motor Vehicles in Operation

- Currently, motor vehicle emissions are measured using idling and/or a non-load rapid acceleration method in most cities. This method does not accurately reflect the emission amount of pollutants when the motor vehicle is actually in operation. Accordingly, in May of this year, precision measurement was implemented in Seoul using the in-operation load inspection method for old vehicles (i.e., passenger cars older than 12years).

- Personal habits, such as the long pre-heating of engines and not turning off the ignition key when parking or stopping the car, generate unnecessary fuel consumption and emissions. The government therefore plans to regulate idling in transportation terminals, motor vehicle depots, parking lots, and other special areas from 2003.

• Improvement of Automobile Fuel Quality

- The diesel price in Korea is significantly lower than gasoline, especially in comparison to other industrialized countries, while the percentage of diesel cars in Korea is relatively higher. Diesel cars in Korea generate approximately 52% of the total automobile air pollutants. To improve this situation, the government

plans to strengthen standards to raise the quality of gasoline and diesel fuel.

- The oil companies have endeavored to improve automobile fuel quality, in large part because the Ministry has monitored automobile fuel quality and released this information regularly since July of this year. Automobile fuel quality has improved dramatically since the Ministry began publicly reporting fuel quality data.

- Environmentally Sustainable Transport System

  - To reduce air pollution caused by automobiles, transportation demand management is critical. A road pricing system (congestion pricing) for passenger cars is in operation on some tunnels in Seoul. Private cars with more than two passengers are exempt from the fee. The Korean government encourages people to voluntarily leave their cars at home once every ten days. Cars that violate the campaign are supposed to be prohibited from entering government buildings. There are some other policies such as a carpool campaign, expansion of the subway system, expansion of transfer terminal networks, parking management and parking fees in urban areas, and car-free day initiatives to establish environmentally sustainable transport system and reduce transpotation demand

4. Management of Point Source Emissions

- Emissions Standards

  - There are currently explicit air pollutant emissions standards for 26 pollutants, including sulfur dioxide, particulates, and nitrogen oxide. Emissions standards have been strengthened a few times in consideration of the need to improve air quality, given current technological levels in Korea.

- Emission Charge System

  - To induce the voluntary reduction of air pollutant emissions, an emission charge system is being introduced. For ten pollutants, including sulfur dioxide and ammonia, charges are being levied according to the amount that emissions standards are exceeded. For sulfur dioxide and particulates, basic charges are levied, even for emissions below the emission standards.

- Stack Telemetry System

  - Stack Telemetry System (TMS) was introduced to monitor emissions from large-scale pollution-generating facilities on a real-time basis. Factories with boilers, power-generating facilities and incinerators with more than a certain capacity (e.g. boilers with a 40 ton capacity) are required to install stack telemetry devices. As

of the end of 2001, 867 measurement devices have been installed in 152 factories and the measurement data is being monitored in control centers operating in four special measurement zones. The data collected by the TMS devices is being used as the basis for determining emissions charges, and as guidance and inspection materials from 2002.

5. Special Measure on the Capital Region Air Quality Improvement

With a high population density (463 persons per square kilometer in Seoul) and a small landmass, Korea has a high pollutant emission level per unit area. The capital region including Seoul and its vicinities takes up only 12% of the total national land area, yet accounts for 46% of the total population and 58% of the emission volume. It is also projected that overcrowding in the capital region will continue, with the population expected to reach 22 million and the number of cars 8 million by 2012.

Regulating pollutant concentrations with end-of-pipe approaches will not be enough to fundamentally deal with the growing number of pollution sources; as a matter of fact, in some cases, it may only exacerbate the existing air quality. The situation calls for precautionary urban planning to prevent further urban concentration, which may include prior assessment of development projects' impacts on air pollution. In addition, since air pollution knows no boundaries, the current local management system has limitations in its ability to effectively improve air quality.

As such, drastic measures are called for to significantly improve the air quality in the capital region. Air pollution reduction measures, such as fuel policies, allowable emission standards and economic incentives should be carried out in earnest. At the same time, more aggressive policies should be adopted for those areas in the capital region with the worst air quality.

Korea is establishiong the "Special Measure on Capital Region Air Quality Improvement (2003-2012)" in order to lower air pollution levels of the captial region to parallel those of advanced nations. Key features of this measure include strengthening of preventive management mechanisms like the total maximum load system of pollutants and drastic reductions in vehicle-generated pollutants.

6. Conclusion

Keeping the air clean and fresh is the most urgent task we all have to face. How we manage it will not only affect our present health and livelihood but will also have implications for generations to come.

The status of air pollution in Korea has gradually improved thanks to the extension of clean fuel supplies and strengthening of emission standards. However, ozone levels and the frequency of ozone warnings have continued to increase, mainly due to growth in private car use. Since the major contributor to air pollution in large cities is the motor

vehicle fleet, Korea has continually pursued measures to address this source. Korea's priorities for this year are the continued supply of the natural gas intracity buses and enacting the Special Measure on the Capital Region Air Quality Improvement.

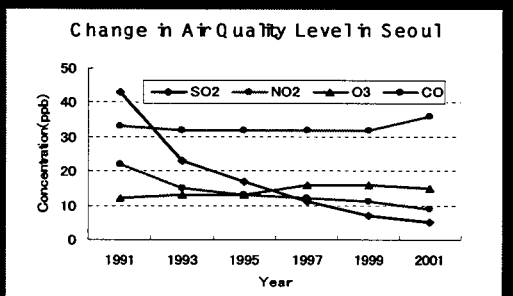
Korea is applying considerable domestic efforts to improve air quality, and is also cooperating with neighbouring countries to address regional issues that affect air quality, such as the yellow sand phenomenon.

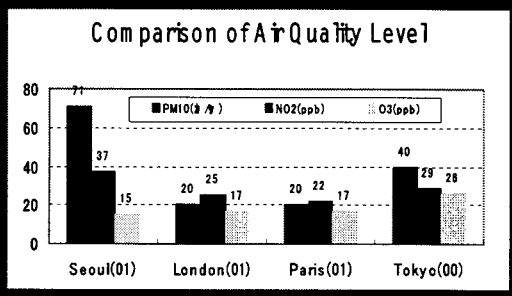
Air Quality Management in Korea

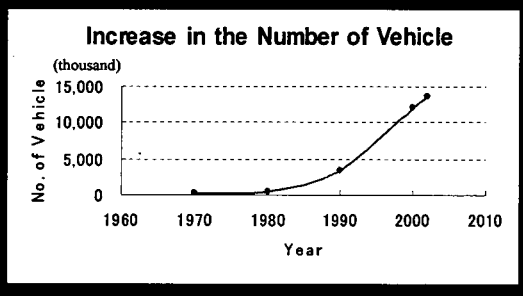
Na, Jung Kyun
Ministry of Environment
Republic of Korea

Air Quality Status in Korea

- **In early 80's, urban air pollution was serious**
  - SO_2 and dust from power plants, industries and domestic heating using high sulfur coal and heavy residual oil
- **Air quality is gradually improving**
  - supply of clean fuel and low-sulfur oil. SO_2 levels meet the environmental standard of 0.02ppm
  - but. NO_2, PM-10, and Ozone exceed the standard





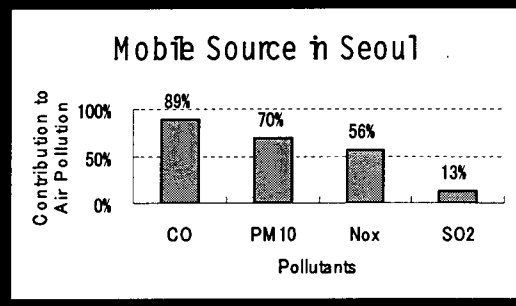


Policy Direction (1)

- **Emission Inventory Survey**
  - to pursue scientific and systimatic management of air quality
  - considering energy consumption, production process, waste incineration, etc..
- **Expansion of Air Pollution Monitoring Station**
  - currently 307 stations(76 national level, 231 local level)
  - by 2005, 457 stations
- **Management of Special Policy Areas**
  - industrial complex areas with serious air pollution
  - apply stricter emission standards

Policy Direction (2)

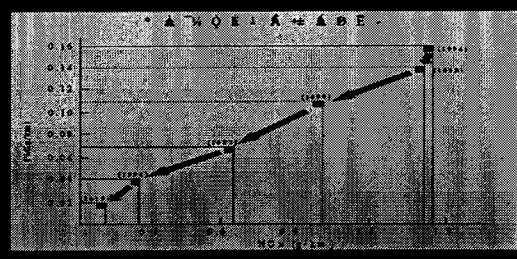
- **Strengthening of Vehicular Emissions Management**
  - strength automobile emission standards and fuel quality standards
- **Sterngthening of Point Source Emissions Management**
  - strength emission standards
  - introduce stack TMS
- **Research on Ozone and PM10**
  - a five-year research project to identify the generation mechanisms



Management of Vehicular Air Pollution(1)

- **Strengthening of the emission standards for newly manufactured automobiles**
  - currently EURO-3, LEV
  - from 2006, EURO-4, ULEV
- **Supply of NGV**
  - 3,000 intra-city buses by 2002
  - 20,000 buses by 2007
- **Improvement and computerization of the automobile emissions certification system**

Emission Standards of Small Diesel Powered Trucks



Management of Vehicular Air Pollution(2)

- **Development of technologies for low-pollution automobiles**
  - electric vehicles, hybrid vehicles
  - low emission diesel engines
- **Emissions regulation of motor vehicles in operation**
  - precision measurement using in-operation load inspection method
  - regulation of engine idling from 2003

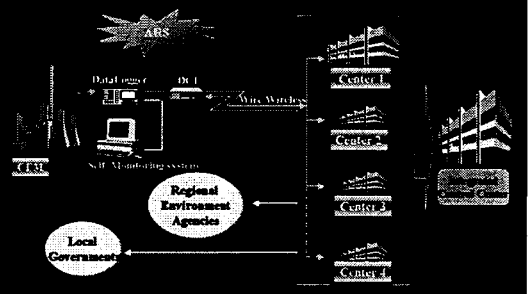
Management of Vehicular Air Pollution(3)

- **Improvement of automobile fuel quality**
  - strengthen fuel quality standards
  - monitor fuel quality and release the results regularly
- **Transportation demand management**
  - congestion pricing
  - leave cars at home once every 10 days
  - carpool campaign
  - parking management and parking fees in urban areas
  - car-free day initiatives

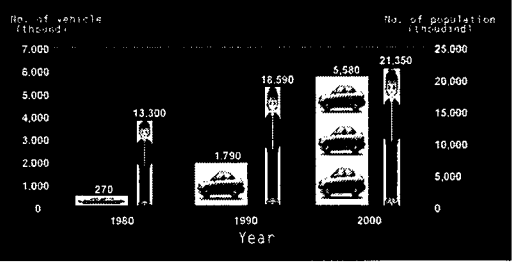
Management of Point Source Emissions

- **Emission standards**
  - considering economical and technological levels
- **Emission charge system**
  - levy according to the amount of emissions
- **Stack Telemetry System (TMS)**
  - to monitor emissions from large scale pollution-generating facilities (e.g. boilers with a 40 ton capacity)
  - used as inspection material(e.g. the basis for determining emissions charges)
  - 867 measurement devices installed in 152 factories

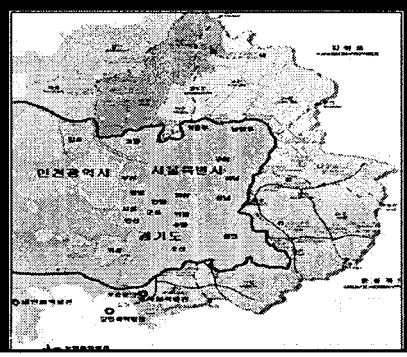
Stack TMS-Management System



Special Measure on the Capital Region Air Quality Improvement



Target Areas of the Special Measure



Key Features of the Special Measure

- Total maximum load system from 2005
- Emission trade system
- Low emission vehicles
- VOC management
- Environmentally sustainable land use planning and energy management

Regional Cooperation