

AMBIENT AIR QUALITY MANAGEMENT IN SURABAYA¹

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ABSTRACT

One of the important environmental problems as the consequence of the development growth is the air pollution. Air is required as a resource for life, so that the quality of air have to be managed wisely to be always better.

With the growing activities, the emission of pollution into air. However, experiencing the economic crisis, Indonesia now could face the environmental problem because of the lack of attention in controlling the pollution sources including from in industrial sectors. This matter also affects to the environment quality.

Ambient air quality in Surabaya day by day is decrease which is caused by air pollution from mobile source and non mobile source, so that should be hold air quality management in Surabaya. Air quality management in Surabaya with several activity improving its urban air quality by integrated ambient air quality monitoring system, improving transportation system, guidance for industrial polluter potency in order to used air pollution protection, air pollution controlling and environmental awareness.

The problem of air pollution in Surabaya is caused by the imbalance ratio between the increasing capacity of the joint roads as compared to the addition of the amount of vehicles every year, not every vehicle pass test gas emission, there was no enough urban forest/green belt area as compared to the city area and its population, there was no community development program in the ambient air quality management including reward and punishment program.

Surabaya is being prepare the role about ambient air quality in Surabaya : Every public transport must past test emission and is being prepared regulation about Inspection and Maintenance for private transportation. Surabaya undertook a test emission from vehicle in some road side and 70 % emission from transportation.

We have already done all activities to improve air quality in Surabaya but from data ambient air quality monitoring in 2001 compared with 2002 degradation of ambient air quality, because in the night more pollution from another city (closed Surabaya : Gresik, Sidoarjo) influence ambient air quality (PM_{10} , SO_2) high.

We need more information from another country and technical know how and application/implementation of the monitoring data for reducing the ambient air pollution concentration in Surabaya.

AMBIENT AIR QUALITY MANAGEMENT IN SURABAYA

I. BACKGROUND

Surabaya is the second largest city in Indonesia. The area is about 326 square kilometer in a coastal and lowland area. The altitude varies from 3 to 10 m above the sea level. Surabaya is a tropical city. The temperature is almost constant throughout the year, from 25 °C during the night to 34°C during the day. The average humidity varies from 65% to 85 %. Rainy season starts from October to April, and dry season from May to September.

Surabaya has about 2,8 million inhabitants during the night, and in addition about 300 thousands people commute every day to Surabaya from surrounding areas. Transportation is mainly dominated by private vehicles. According to a study few years ago, the composition of transportation scheme in Surabaya was 35% public transport and 65% private transport. Nowadays, the percentage of private cars is even higher due to the increase on vehicles. Average velocity in the center of the city is about 15-20 km/h due to the high volume of the traffic.

The city of Surabaya is trying to improve the transport service within the city, so air pollution due to vehicle emissions can be reduced. To improve the transport condition, the city is promoting the air quality and transportation improvements by involving its citizens.

One of the important environmental problems as the consequence of the development growth is the air pollution. Air is required as a resource for life, so that the quality of air have to be managed wisely to be always better.

With the growing activities, the emission of pollution into air hence is more severe. However, experiencing the economic crisis, Indonesia now could face the environmental problem because of the lack of attention in controlling the pollution sources including from in industrial sectors. This matter also affects to the environment quality.

During the normal condition, every pollution that is emitted into the air will be neutralized by nature itself (Self Purification). But on the other side, the environment has different carrying capacity, so that if the pollution exceeds the carrying capacity of the environment, it will result in the contamination of air.

There are many factors that influence the level of air contamination, such as the condition of topographic area, the condition of meteorology, the source of emission, the amount of population, the used energy and others.

The source of air pollution in Surabaya comes from various sources, namely:

1) Air pollution from non mobile source :

a) Pollutant from refining industry (fuel consumption) : food, beverage, wood refining, chemical, mineral non metal industry, textile, metal refining.

Average pollutant from those activity (Table 1) : dust (5.204,66 ton/year), SO₂, (0 ton/year), NO_x (19,825 ton/year), HC (236,72 ton/year), CO (255,20 ton/year), others (0,015 ton/year) (data 2000).

Table 1. Air Pollution from refining industry

Parameter	Dust Ton/year	SO ₂ ton/yr	NO _x ton/yr	HC ton/yr	CO ton/yr	Others ton/yr
1. Food	4.442,42	0,00	0,00	0,00	0,00	0,015
2. Beverage	0,02	0,00	0,00	0,00	0,00	0,00
3. Woods and other forest product	42,47	0,00	19,82	0,00	0,00	0,00
4. Chemical	29,59	0,00	0,00	236,72	0,00	0,00
5. Mineral non metal	0,00	0,00	0,00	0,00	0,00	0,00
6. Metal	31,68	0,00	0,00	0,00	255,20	0,00
7. Metal Refining	0,00	0,00	0,00	0,00	0,00	0,00
8. Textile	658,50	0,00	0,00	0,00	0,00	0,00
	5204,66	0,00	19,82	236,72	255,20	0,015

Source : Environment Quality Scale Surabaya, Book III

b) Air pollution from non mobile source (fuel consumption) : (data 2000)

Pollutant from non mobile source (fuel consumption) that is used electric power, fireplace commercial/industry, and fireplace domestic (coal, fuel, nature gas/LPG/wood) : dust (0 ton/year), SO₂ (0,37

ton/year), NO₂ (4,9 ton/year), HC (0,17 ton/year), CO (0,79 ton/year), others (121,1 ton/year).

2) Air pollution from mobile source (fuel consumption) : (data 2000)

Dust (3,35 ton/year), SO₂ (0,26 ton/year), NO_x (46,2 ton/year), HC (28,45 ton/year), CO (9,5 ton/year), others (0,8 ton/year).

Starting from the last year, the growth of Surabaya is very fast either from physical and also non physical aspects, because of the multi dimensional functions of the city. The growth of industrial sectors is enough to bring the implication and impacts to all environment sectors in Surabaya.

Besides the positive impact of the city growth that drives the increase in the mobility of residents and goods, it causes a progressive traffic jam, where the traffic density is relatively high enough (current ratio of flow : capacities is 0,8 - 1,6). The total length of road in the city of Surabaya is approximately 2,035.95 km (in 2000), and the amount of passenger vehicles, wagon car, motorbike have reached approx. 909.131 (2000) that tends to increase every year. As the implication, it results in the increase of the air contamination from both mobile sources as well as from non-mobile sources (industry).

According to the previous study, the dominant air pollution source in metropolis - including the city of Surabaya - is from the activity of transportation (mobile source) that contributes to 65 – 75 %.

To identify and control the quality of ambient air, it hence needs a regular measurement and the application of the ambient air quality standard. The ambient air quality standard is specified as the maximum concentration of ambient air quality that could prevent the occurrence of air pollution, and it will be revised every 5 years. The ambient air quality standard of Surabaya is set exclusively for the ambient air in Surabaya City, while the ambient air quality standard for the East Java Province is set by the Governor with the consideration of the national ambient air quality standard.

The ambient air quality is set based on the research on the data base of the potency source to air pollution, the condition of meteorology and geographical position. If during the set up the ambient air quality of

Surabaya is greater than the National ambient air quality standard, hence the Governor will state that the ambient air quality of the city is polluted.

II. PROBLEM

From the description above, the problem of air pollution faced by the city of Surabaya is :

1. The imbalance ratio between the increasing capacity of the joint roads as compared to the addition of the amount of vehicles every year.
2. The gas emission measurement of every vehicle to 100 vehicles which use gasoline and diesel fuel in the year of 2002, showed that the amount of vehicle with the emission rate above the emission quality standard is as follows :
 - a. Personal vehicle with gasoline fuel : 19 % (CO), 11 % (HC).
 - b. Public Vehicle with gasoline fuel : 16,5 % (CO), 214 % (HC).
 - c. Personal Vehicle with diesel fuel : 49,5 % smoke.
 - d. Public Vehicle with diesel fuel : 44 % smoke
3. There was no enough urban forest/green belt area as compared to the city area and its population.
4. There was no community development program in the ambient air quality management including reward and punishment program.

III. IMPROVEMENT CAPACITY BUILDING OF SURABAYA GOVERNMENT IN URBAN AIR QUALITY MANAGEMENT

Activity of Urban, like sector housing of resident, transportation, commerce, industrial, solid waste management and related other activity have potency to

alter air quality at urban areas. Transmitted air pollution from existing sources distributed to atmosphere, passing spreading process according to wind direction. To overcome air pollution in urban area, hence needed by real step which in the form ambient air quality management.

The air quality management of the Surabaya Government is conducted by the cooperation between several departments, institutions, community and NGO. The **Blue Sky Program** was created as the response to the increasing of population, transportation and industrial growth in urban area, also to the deterioration of air quality and the community health, especially in Surabaya.

A. The Execution of Blue Sky Program

- a. **Blue Sky Program (PLB)** is the air pollution control program from the non-mobile and mobile sources.
- b. **The goals of Blue Sky Program** are :
 - The creation of mechanism to control the air pollution effectively.
 - The control of air pollution under ambient standard.
 - The creation of ambient air quality needed for the health of human being and others.
 - The creation environmental awareness of the resident.
- c. **Targets of the Blue Sky Program target (PLB)** in Surabaya:
 - The decreasing of air pollution from non-mobile and mobile sources.
 - The establishment of the operation system of ISPU/PSI monitoring (Air Pollution Standard Index) in Surabaya and integrated in AQMS (Air Quality Monitoring System).
 - The development of coordination and partnerships in creating the ambient air quality in Surabaya.
 - The increasing of environmental awareness among the community and their role in the air pollution control in Surabaya
- d. **Regulation Base:** State Constitution, Governmental Regulation, Environment Ministry Regulation, Government Decree.
- e. **Implementation activities of Blue Sky Program in Surabaya:**
 1. **Year 1996 – 2000.**

- Ambient air quality monitoring along the high density road, with the dominant result of measurement: **dust**.
- Existence of Taxi with gas fuel (BBG) since 1997, and own its fill station.
- Conducting guidance and monitoring program to potential industries.
- Founding the KPPLH Team (the Commission for Operation and Controlling the Environment Pollution) in 1999 to monitor the industry with potency for air pollution.

2. Year 2001

- Measurement of Hb and Pb concentration in blood,, specially society which close to the source of pollution (*enclosed*).
- Measurement of ambient air quality and noise from transportation and industry sector.
- Measurement of emission air quality from industrial sectors.
- Monitoring of ambient air quality using automatic instrument and integrated continuously with the Monitoring Center in the Minister Office of Environment - Jakarta executed every day.
- Car Free Day (CFD) in several streets in the heart of the city to promote optimization of public transport and environmental awareness of the people. For a long day from 06.00 am to 06.00 pm all vehicles were abandoned to enter the car free day zone. During the day, a lot of activities were carried out to support the car free day. Citizens got together for the activities such as aerobic exercise, fun bike, fun rickshaw (becak) race, skateboard race, photo and poster exhibition/display, food bazaar, live music show, drawing contest for children. All events dedicated to environmental awareness improvement. Each activity promoted messages of environmental awareness to the audience and to the participants. The car free day was successfully implemented. As part of the system to improve the environmental quality, car free day is not a stand-alone

activity, it needs follow-up action plans in order to achieve its objectives. Action programs in urban transportation and environmental protection are being carried out by the city. Surabaya is going to do all necessary actions to achieve good environmental quality.

3. Year 2002

- Measurement test gas emission from motor vehicles.
- The effective regulation for the feasibility of public vehicle test; (Regulation for the Emission Test of Public and Private Transports).
- Execution Blue Sky Program Campaign with activity distribution of masker to motorcyclist, public transport (bus), plantation work along with Tunas Hijau NGO that involving elementary school.
- Car Free Day at several street in the heart of the city.
- Data application of Ambient air Quality in Surabaya by research students with the following results:
 - a. Study influence of SO₂ and NO_x to the rainwater in Surabaya, showed that the southern part of the city is the most risk area from the acid rain.
 - b. Stipulating of Priority for Program Activity of the Ambient Air Quality in Surabaya using the Analytical Hierarchy Process (AHP) approach.
 - c. Information System for Monitoring Air Pollution in Surabaya.
 - d. Study on the COHb concentration of the Traffic Police blood in the Metropolis of Surabaya 2002.
 - e. Evaluating the Data Record-Keeping and Reporting System for Air Pollution Standard Index in Surabaya.
 - f. Literature Study on the Air Quality Monitoring System.

4. Year 2003

- Mathematical Model of Air Quality Distribution Pattern in Surabaya.

- Compilation of Inspection Role and Treatment of Personal Car Passenger.
- Campaign for using CNG fuel for motor vehicles (100 Government Vehicles) executed by the Government of Surabaya since year 2002/2003.
- Car Free Day at several street in the heart of the city.

To achieve the target in the Blue Sky Program above, it is then needed to monitor ambient air quality to identify the condition of ambient air quality continuously. The result will be used to decide the control regulation by the municipal government in order to create the condition that is suitable for the quality to public health. The implementation of this program was aided by the soft loan of the installation of equipment of network monitoring ambient air quality from the Government Austria through BAPEDAL together with another 10 big cities in Indonesia.

The monitoring equipments are installed in 5 different places in Surabaya, and 1 RAQMC Room (Regional Air Quality Monitoring Center) including 1 Room for Operation Maintenance. The ambient air quality parameters which are measured in Surabaya are 5 key parameter, that is: PM₁₀ , SO₂, O₃, NO₂, CO and also the condition of meteorology (temperature, dampness , global radiation, wind direction and wind speed). The information of air quality index (ISPU/PSI) is publicized everyday by the public data display at 3.00 pm, internet (<http://www.surabaya.go.id>), radio and also newspapers. The scoring system and the interpretation of the ISPU/PSI could be seen in Table 2, and the actions required is in Table 3

Table 2. Division of category as according to KEP-107/KABAPEDAL/11/1997 and its influence

Category	Index	Clarification	CO	NO₂	O₃	SO₂	PM₁₀	
Good	0-50	Level of air quality which do not give effect to human health or animal and do not have an in with plant, building and or assess esthetics	There is no effect	A little a few/little	Hurt [at] some plant species effect of SO ₂ combination (during 4 hour)	Hurt [at] some plant species effect of O ₃ combination (during 4 hour)	There is no effect	
Moderate	51-100	Mount the quality of air which do not have an in with human health or animal and do not have an in with sensitive plant, and esthetics value	Chemical change of blood but do not detect	Smelling	Hurt at some species plant	Hurt at some species plant	Happened degradation [at] approach distance	
Unhealthy	101-199	Level of air quality having the character harm at human and or sensitive animal group or can generate damage at plant and or assess esthetics	Make up at cardiovascular at ill smoker of heart	Smell and losing of color, makeup of red lane small channel reactivity at asthma patient	Degradation of Ability at athlete exercising to ossify	Smell The increasing of crop damage	Approach distance go down and happened defilement by dirt	
Very Unhealthy	200-299	Level of air quality able to harm health at segment a number of population which is disposure	Mounting cardiovascular at ill smoker of heart, and see some seen weakness is reality	Mounting sensitivity at bronchitis and asthma patient diseased	light Athletic result respiration influence at chronic lung patient diseased	Mounting sensitivity at bronchitis and asthma patient diseased	Mounting sensitivity at bronchitis and asthma patient diseased	
Dangerous	300 more	Mount the quality of dangerous air which in general can harm serious health at Population which is disposure Dangerous story; level for all population which is disposure	dangerous level for all population which is disposure					

Table 3. Approach Mount ISPU to all Stakeholder

Level	Action Plan
100-200	<p>Precaution Selected by precaution done by government officer to limit certain activity, and demarcation at certain industrial activity</p>
200-300	<p>Alert Action Immediately limit activity of air-gap combustion, lessening big emission potency, Either from transportation and also industry and is other</p>
300-400	<p>Action Commemoration Government have decided the prohibition order usage of combustion, demarcation, usage of factory reactor, reduction operate for at certain factory facility, and ask society limit usage of private transport and public transport, and other activity which trigger mount concentration polluter. Government have drawn up limited evacuation, at ill people, old man and children, and usage of masker. Conscription of Emergency Task Force</p>
More than 400	<p>Emergency Measure Governmental decide stop from most or all industrial activity and commercial Activity, usage enjoinder all personal vehicle and other activity which trigger Amount polluter concentration. Government have done evacuation totally step by step and usage of masker. Conscription of Emergency Task Force controlling and set help of technical equipment</p>

**Result of Measurement of Ambient Air Quality Monitoring 2001
(Months; March – December)**

- The equipment of Ambient Air Quality Monitoring Station was installed in November 2000, but starting to operate in March 2001.
- The Air Pollution Standard Index (PSI/ ISPU) Category in Surabaya for 2001 was counted to start from March to December.

From January - December 2002, the PSI/ ISPU category in Surabaya showed that dust is a dominant parameter.

During year 2001 and 2002, it can be concluded (Table 4) :

1. Most dominant category is Moderate.
2. The dominant parameter is PM10 (dust), and next is O₃ (ozone)

Table 4. PSI/ISPU Score in 2001 and 2002

PSI/ ISPU	2001	2002
Good	27	40
Moderate	272	314
Unhealthy	7	11
Very Unhealthy	0	0
Dangerous	0	0

It was concluded also that by 2001 (March-December), there were 7 unhealthy days, while in 2002 (January-December) there were 11 unhealthy days, so it shows that the degradation of ambient air quality has taken place.

In addition, the parameter of SO₂, NO₂ and CO at all of stations shows the tendency of increasing in the morning. The PM₁₀ has the tendency to increase in the midnight and morning, while O₃ concentration increases in morning until evening.

The increase concentration in the morning is correlated by the increase in the number of vehicle as it was monitored by the ambient air quality monitoring station. But during the night, the air condensation occurred so that the dispersed pollutants finally precipitate as it was noted by the ambient air quality monitoring station.

From the data, it shows that the air quality Surabaya tends to decrease gradually so that it requires conduct air pollution control.

B. Efforts to reduce air pollution from Mobile Sources, executed to through activities :

- 1) Substituting of vehicle fuel from BBM to BBG (CNG) for governor Surabaya.
- 2) Test Drive CNG at several public transport of Surabaya City.
- 3) Developing the Regulation for Public Transport Management (limitation of age / vehicle operational permission.
- 4) Operation of traffic lamp with Area Traffic Control System (ATCS).
- 5) Traffic management and traffic engineering.
- 6) Traffic demand management plan.
- 7) Mass public transport development plan.
- 8) Evaluate the quality of public transport service plan.
- 9) Integrated land transport mode , air and sea plan.
- 10) The development of unmotorised vehicle and pedestrian facility plan.
- 11) Emission test of public vehicle as mobile plan.
- 12) Development of regulation about Public Workshop (which carry out examination of motor vehicle plan.
- 13) Socialization of the usage BBG (CNG) upon which alternative fuel for public transport, person and government vehicle.
- 14) Enforce the vehicle owner to comply its gas emission with Standard of Quality.
- 15) Executing plantation in the form of urban forest, green garden, green band by the government, private sectors and society.
- 16) Development of Regulation Inspection and Maintenance for Private Vehicle where their vehicle should comply with the emission quality standard in 2003.

C. Efforts to degrade Air pollution from None Mobile Source, executed to pass activity:

- 1) Administering of the most potential air polluter.
- 2) Determinating the Goals monitoring program.
- 3) Initial monitoring.
- 4) SUPER (Letter of Statement Signing).
- 5) The structure of air quality control and operation :
 - The supporting is adequate.
 - The supporting is not adequate.
- 6) The structure is adequate, than is continue by air quality monitoring :
 - The air quality monitoring is adequate.
 - Otherwise the air quality monitoring is not adequate it should be followed by guidance and routine monitoring and applying of law enforcement.
- 7) If the structure is not adequate it should be continued by the air quality monitoring :
 - The air quality monitoring is adequate.
 - Otherwise the air quality monitoring is not adequate it should be followed by guidance and routine monitoring and applying of law enforcement.

V. CONCLUSION

Finally Ambient air quality management of good ambient air and supported by all participant in Surabaya (**Governmental** : Coordinating in every institution, implementation regulation; **Private sector** ; **Society** : more used public transport ; plantation, etc) will yield the make-up of the air quality continuity of better life in period to come, because this country only grandchild children's looking after we let us take care of its.

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VII. ENCLOSURE

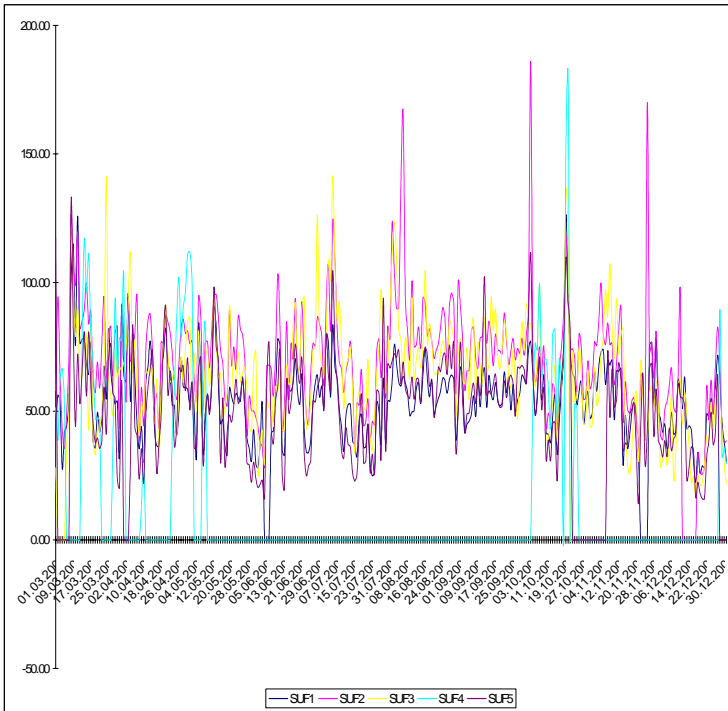
AIR QUALITY SURABAYA JUNE – OCTOBER 1999

NO.	Date	Location	SO2	CO	Nox	PKP	Dust	Pb	H2S	NH3	HC	Temp	Noise	Adv.
1	16.06.1999	Air Quality at cross section Demak- Dupak	0,0167	6,40	0,0107	0,0025	0,460	0,0024	0,0000	0,0025	0,21	32	77,9-81,3	Air Quality standard
2	16.06.1999	Air Quality in front of Plasa Jembatan Merah	0,0142	1,32	0,0145	0,0014	0,173	0,0018	0,0000	0,0014	0,06	32	73,3-84,2	Which is allowed
3	16.06.1999	Air Quality at cross section Tunjungan-Gentengkali	0,0268	2,33	0,0188	0,0003	0,253	0,0022	0,0000	0,0003	0,16	34	71,7-74,0	Regional Law Governor
4	16.06.1999	Air Quality at cross sect.Prof Mostopo-Dharmawgs	0,0161	1,60	0,0128	0,0014	0,360	0,0012	0,0000	0,0014	0,04	32	74,9-77,0	129/1996
5	16.06.1999	Air Quality at cross section Gubeng-Pemuda	0,0174	1,42	0,0015	0,0012	0,293	0,0011	0,0000	0,0137	0,08	30	70,4-76,2	
6	16.06.1999	Air Quality at Bratang Terminal	0,0161	5,80	0,0143	0,0009	0,473	0,0017	0,0000	0,0009	0,30	34	72,3-75,4	SO2 = 0,1 ppm
7	16.06.1999	Air Quality at cross section SIER Rungkut	0,0268	2,55	0,0161	0,0013	0,160	0,0014	0,0000	0,0003	0,33	33,5	71,6-75,6	CO = 20,0 ppm
8	16.06.1999	Air Quality at Purabaya Terminal	0,0104	4,67	0,0176	0,0100	0,453	0,0025	0,0000	0,0005	0,56	32	68,7-75,3	Nox = 0,05 ppm
9	16.06.1999	Air Quality at Mayangkara fly over	0,0155	7,15	0,0104	0,0006	0,627	0,0031	0,0000	0,0066	0,44	30	77,3-81,4	PKP = 0,10 ppm
10	16.06.1999	Air Quality at Joyoboyo Terminal	0,0167	2,06	0,0071	0,0015	0,373	0,0028	0,0000	0,0066	0,11	33	77,5-80,6	Dust = 0,260 mg/m3
														Pb = 0,06 mg/m3
1	26.07.1999	Air Quality at cross section Demak- Dupak	0,0186	7,41	0,0123	0,0027	1,000	0,0028	0,0001	0,0028	0,13	30	76,9-79,8	H2S = 0,03 ppm
2	26.07.1999	Air Quality in front of Plasa Jembatan Merah	0,0157	2,80	0,0135	0,0018	0,247	0,0019	0,0000	0,0015	0,06	31	68,3-72,1	NH3 = 2,0 ppm
3	26.07.1999	Air Quality at cross section Tunjungan-Gentengkali	0,0136	1,66	0,0147	0,0022	0,293	0,0024	0,0000	0,0014	0,02	33	72,3-77,0	HC = 0,24 ppm
4	26.07.1999	Air Quality at cross sect.Prof Mostopo-Dharmawgs	0,0159	3,38	0,0168	0,0051	0,240	0,0024	0,0000	0,0012	0,04	32	72,5-76,8	
5	26.07.1999	Air Quality at cross section Gubeng-Pemuda	0,0193	1,27	0,0123	0,0042	0,307	0,0015	0,0000	0,0083	0,03	32	72,7-77,6	
6	26.07.1999	Air Quality at Bratang Terminal	0,0172	3,22	0,0153	0,0011	0,320	0,0019	0,0000	0,0012	0,06	32	67,6-72,9	Law Health Minister
7	26.07.1999	Air Quality at cross section SIER Rungkut	0,0271	4,01	0,0183	0,0098	0,133	0,0016	0,0000	0,0010	0,08	31	69,4-74,0	718/1987
8	26.07.1999	Air Quality at Purabaya Terminal	0,0162	6,84	0,0192	0,0000	0,320	0,0028	0,0000	0,0012	0,11	31	72,2-77,7	Zona D = 60-70 dBA
9	26.07.1999	Air Quality at Mayangkara fly Over	0,0178	9,30	0,0123	0,0012	0,227	0,0034	0,0000	0,0015	0,20	29	74,1-79,5	
10	26.07.1999	Air Quality at Joyoboyo Terminal	0,0183	2,47	0,0105	0,0012	0,207	0,0031	0,0000	0,0068	0,08	30	67,4-72,3	
1	11.08.1999	Air Quality at cross section Demak- Dupak	0,0236	8,90	0,0122	0,0029	0,960	0,0031	0,0009	0,0036	0,16	31	75,6-83,7	
2	11.08.1999	Air Quality in front of Jembatan Merah Plaza	0,0162	3,42	0,0134	0,0018	0,313	0,0019	0,0000	0,0023	0,08	33	70,2-75,8	
3	11.08.1999	Air Quality at cross section Tunjungan-Gentengkali	0,0165	3,63	0,0175	0,0041	0,293	0,0028	0,0000	0,0023	0,06	35	75,8-81,3	
4	11.08.1999	Air Quality at cross sect.Prof Mostopo-Dharmawgs	0,0142	1,72	0,0158	0,0025	0,273	0,0017	0,0001	0,0018	0,07	32	73,2-76,7	
5	11.08.1999	Air Quality at cross section Gubeng-Pemuda	0,0178	1,93	0,0196	0,0006	0,320	0,0018	0,0000	0,0007	0,17	34	70,5-74,7	
6	11.08.1999	Air Quality at Bratang Terminal	0,0185	3,28	0,0163	0,0010	0,827	0,0019	0,0000	0,0015	0,07	34,5	70,1-74,6	
7	11.08.1999	Air Quality at cross section Rungkut SIER	0,0286	4,12	0,0193	0,0048	0,287	0,0019	0,0004	0,0025	0,05	34	70,6-75,7	
8	11.08.1999	Air Quality at Purabaya Terminal	0,0184	6,88	0,0120	0,0012	0,707	0,0029	0,0004	0,0015	0,11	34	80,0-80,6	
9	11.08.1999	Air Quality at Mayangkara fly over	0,0199	10,32	0,0186	0,0013	0,500	0,0036	0,0001	0,0018	0,25	30	74,6-79,4	
10	11.08.1999	Air Quality at Joyoboyo Terminal	0,0189	2,58	0,0125	0,0009	0,300	0,0032	0,0005	0,0070	0,08	30	78,9-81,8	

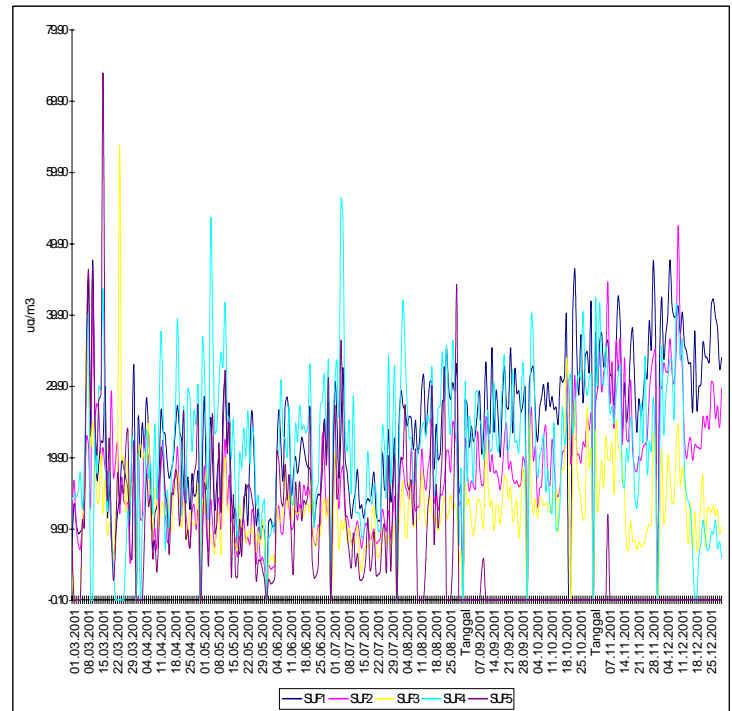
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NO.	Date	Location	SO2	CO	Nox	PKP	Dust	Pb	H2S	NH3	HC	Temp.	Noise	Adv.
1	15.09.1999	Air Quality at cross section Demak- Dupak	0,0212	7,68	0,0145	0,0019	0,813	0,0029	0,0009	0,0041	0,17	32	73,5-78,2	
2	15.09.1999	Air Quality in front of Jembatan Merah Plaza	0,0148	3,11	0,0123	0,0014	0,426	0,0015	0,0000	0,0019	0,07	33	66,4-74,7	
3	15.09.1999	Air Quality at cross section Tunjungan-Gentengkali	0,0152	3,43	0,0169	0,0021	0,305	0,0025	0,0002	0,0031	0,05	33	70,9-74,7	
4	15.09.1999	Air Quality at cross sect.Prof Mostopo-Dharmawgs	0,0136	1,76	0,0161	0,0029	0,258	0,0021	0,0001	0,0020	0,06	34	70,4-76,4	
5	15.09.1999	Air Quality at cross section Gubeng-Pemuda	0,0152	2,16	0,0187	0,0010	0,354	0,0020	0,0000	0,0012	0,15	30	70,8-76,7	
6	15.09.1999	Air Quality at Terminal Bratang	0,0186	4,15	0,0183	0,0010	0,718	0,0018	0,0002	0,0024	0,11	29	68,2-76,2	
7	15.09.1999	Air Quality at cross section Rungkut SIER	0,0222	3,51	0,0173	0,0035	0,279	0,0015	0,0000	0,0019	0,07	30,5	65,4-75,6	
8	15.09.1999	Air Quality at Purabaya Terminal	0,0200	7,59	0,0189	0,0045	0,816	0,0031	0,0015	0,0014	0,14	31	72,2-77,6	
9	15.09.1999	Air Quality at Mayangkara fly over	0,0251	11,78	0,0216	0,0019	0,614	0,0039	0,0004	0,0049	0,26	32,5	73,6-84,2	
10	15.09.1999	Air Quality at Joyoboyo Terminal	0,0193	4,12	0,0159	0,0012	0,355	0,0031	0,0004	0,0063	0,11	33	66,1-75,6	
1	06.10.1999	Air Quality at cross section Demak- Dupak	0,0218	6,51	0,0136	0,0015	0,553	0,0027	0,0008	0,0090	0,19	32	73,6-78,2	
2	06.10.1999	Air Quality in front of Jembatan Merah Plaza	0,0145	3,12	0,0127	0,0011	0,480	0,0017	0,0000	0,0217	0,05	33	66,4-73,7	
3	06.10.1999	Air Quality at cross section Tunjungan-Gentengkali	0,0143	3,40	0,0126	0,0016	0,333	0,0023	0,0004	0,0054	0,08	33	70,9-74,7	
4	06.10.1999	Air Quality at cross sect.Prof Mostopo-Dharmawgs	0,0138	1,07	0,0131	0,0021	0,213	0,0019	0,0001	0,0012	0,08	34	70,4-76,4	
5	06.10.1999	Air Quality at cross section Gubeng-Pemuda	0,0169	2,58	0,0193	0,0008	0,373	0,0022	0,0000	0,0016	0,17	33	70,8-76,7	
6	06.10.1999	Air Quality at Bratang Terminal	0,0188	4,74	0,0125	0,0010	0,660	0,0021	0,0002	0,0032	0,13	29	68,2-76,2	
7	06.10.1999	Air Quality at cross section Rungkut SIER	0,0269	2,68	0,0124	0,0005	0,193	0,0016	0,0009	0,0054	0,05	30,5	65,4-75,6	
8	06.10.1999	Air Quality at Purabaya Terminal	0,0236	8,42	0,0223	0,0018	0,873	0,0030	0,0000	0,0074	0,16	31	72,2-77,6	
9	06.10.1999	Air Quality at Mayangkara fly over	0,0228	12,58	0,0225	0,0021	0,740	0,0041	0,0006	0,0077	0,25	32,5	73,6-84,2	
10	06.10.1999	Air Quality at Joyoboyo Terminal	0,0218	6,51	0,0231	0,0024	0,467	0,0030	0,0006	0,0153	0,10	33	66,1-75,6	

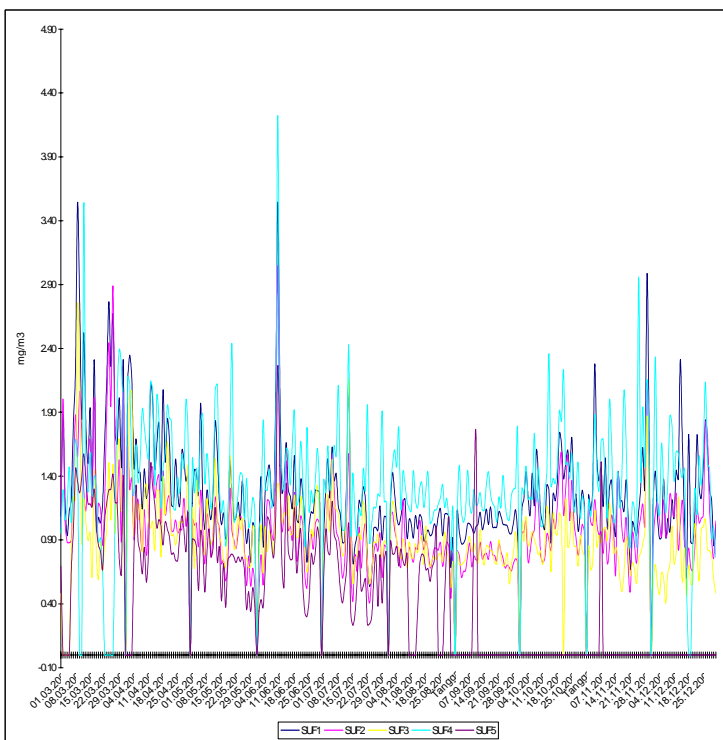
Ambient Air Quality in Surabaya 2001



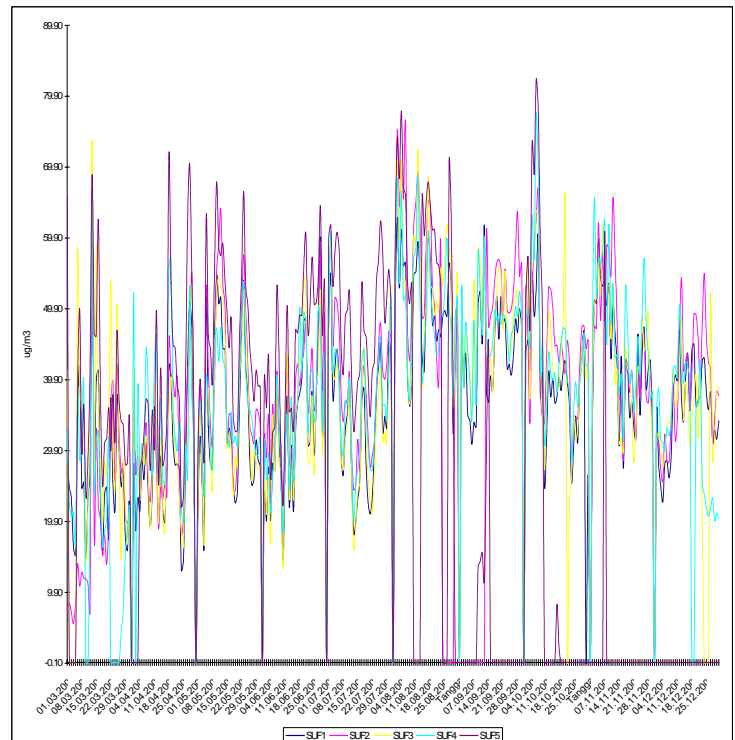
Picture 1. Assess measurement for the PM10 Of Year 2001



Picture 2. Assess measurement for the SO2 Of Year 2001

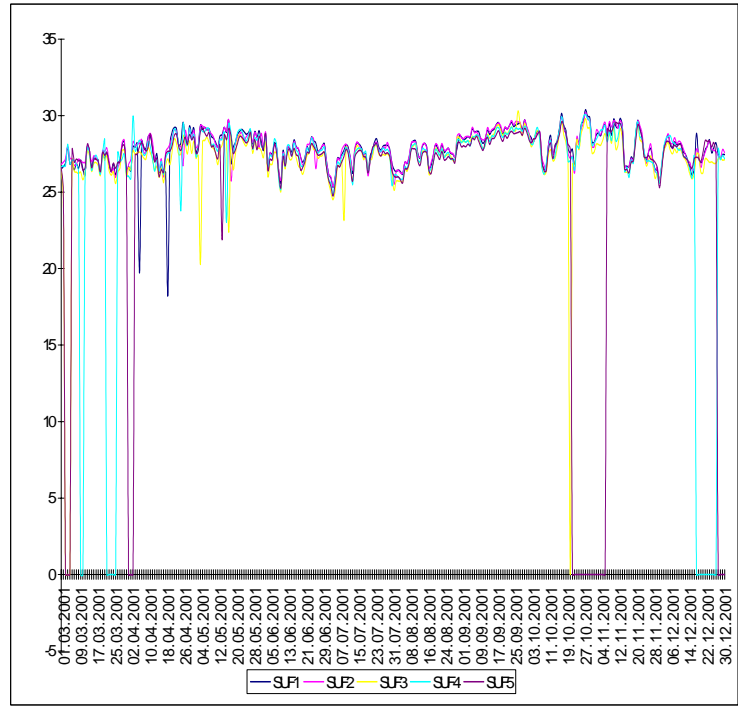
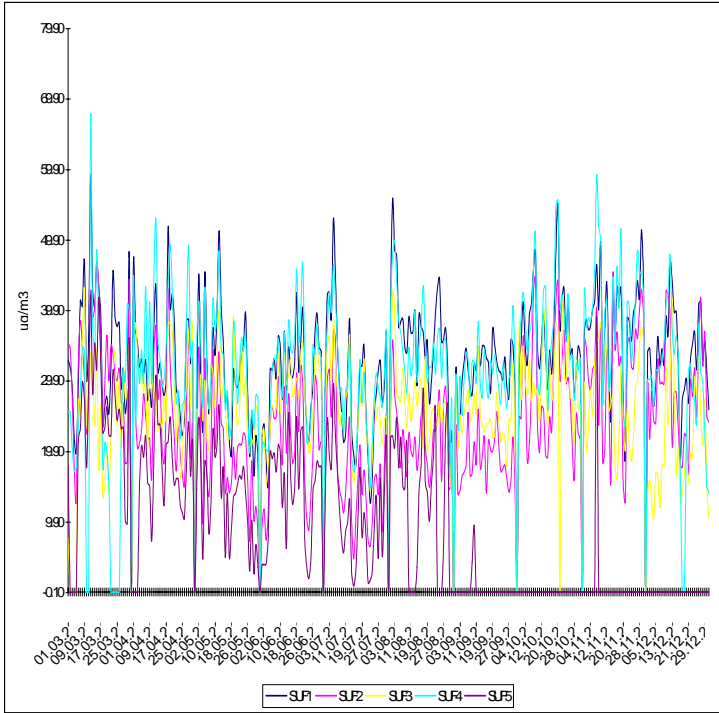


Picture 3. Assess measurement for the CO Of Year 2001

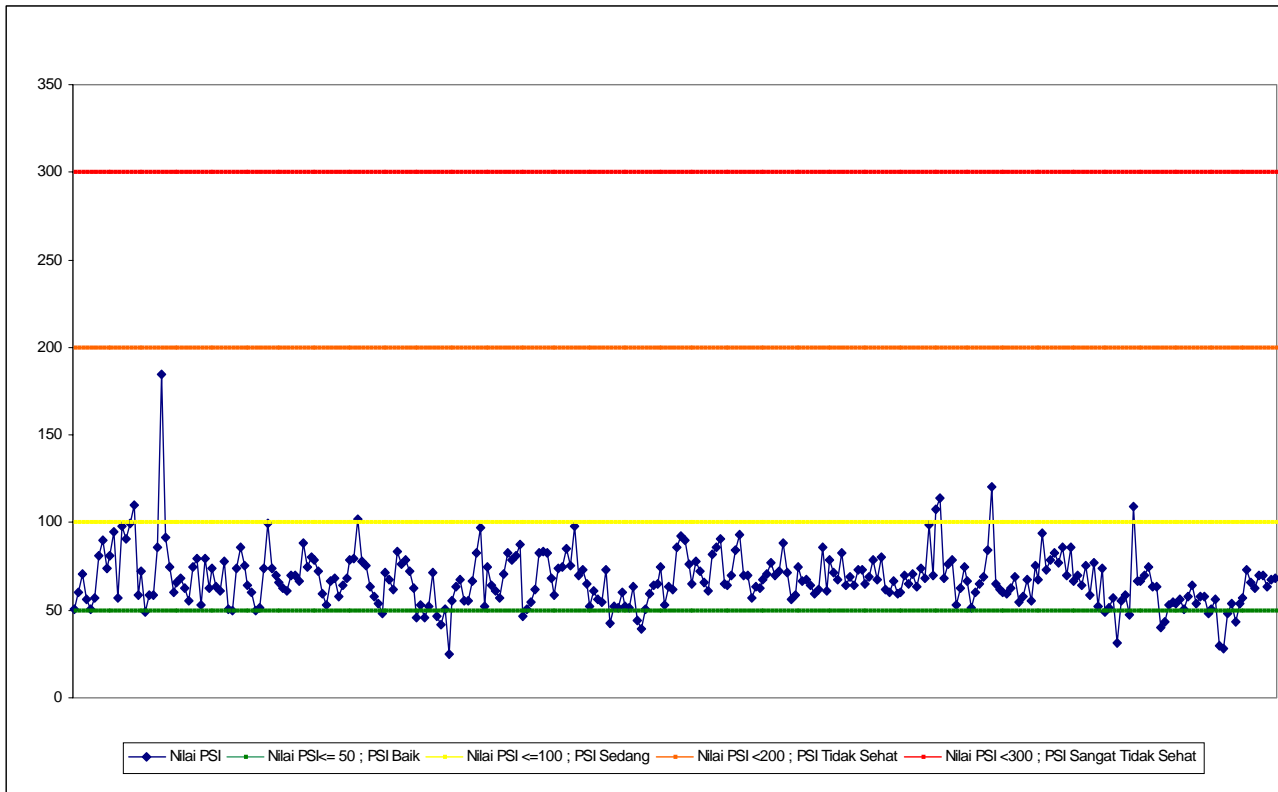


Picture 4. Assess measurement for the O3 of Year 2001

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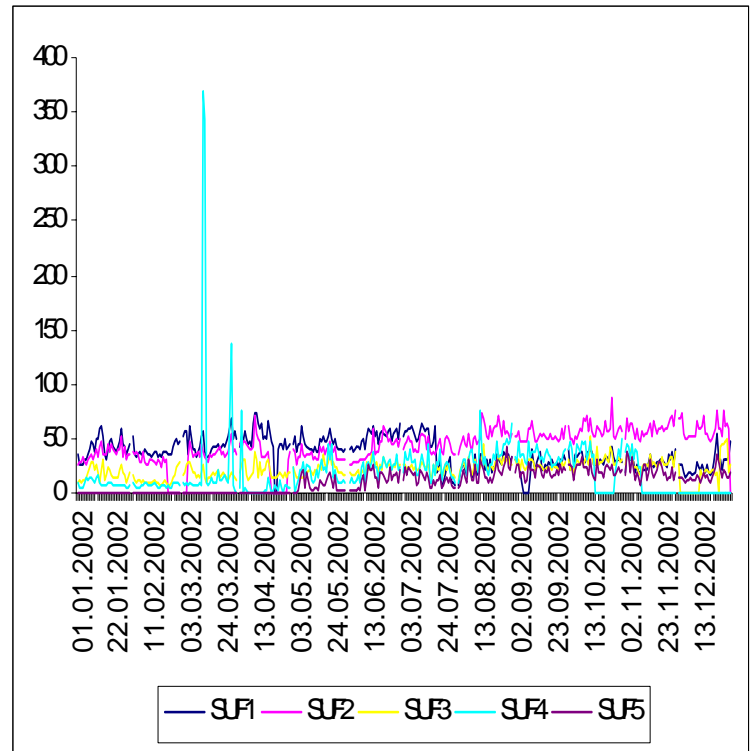
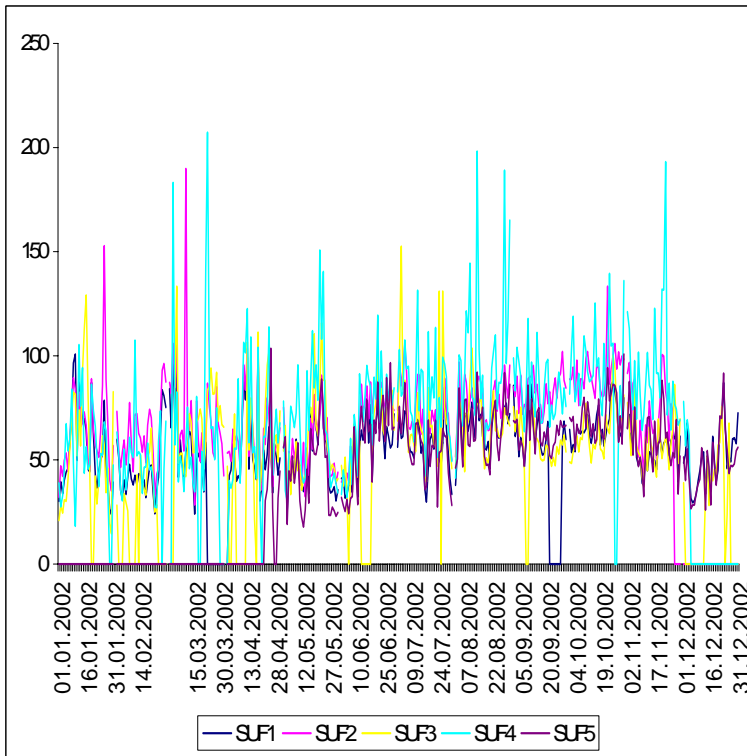


Picture 6. Assess measurement for the NO2 Of Year 2001 Picture 6. Assess measurement for the Temperature Of Ambient Air Year 2001



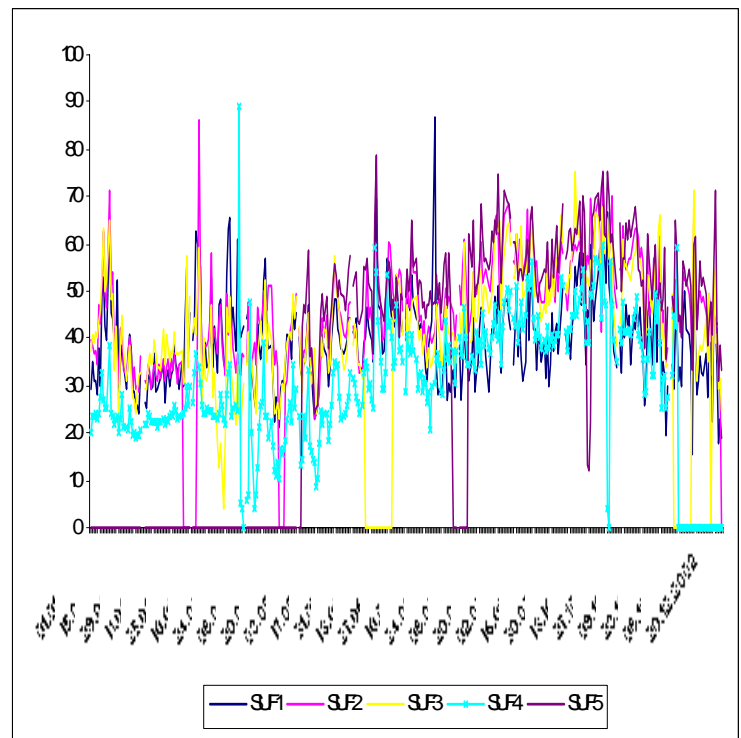
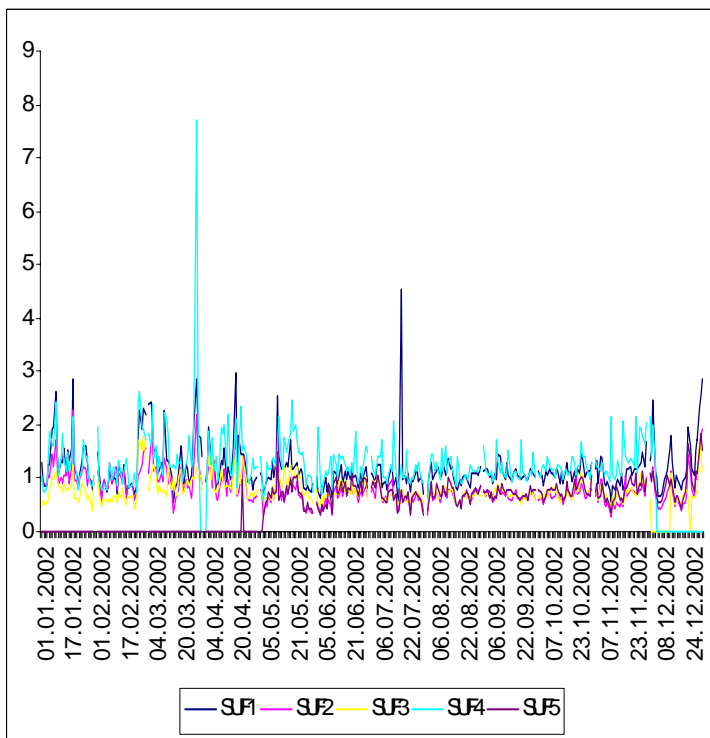
Picture . Value PSI/ISPU for the parameter of PM10, SO2, CO, O3 And NO2 Year 200

Ambient Air Quality in Surabaya 2002



Picture 9. Assess measurement for the PM10 Of Year 2002

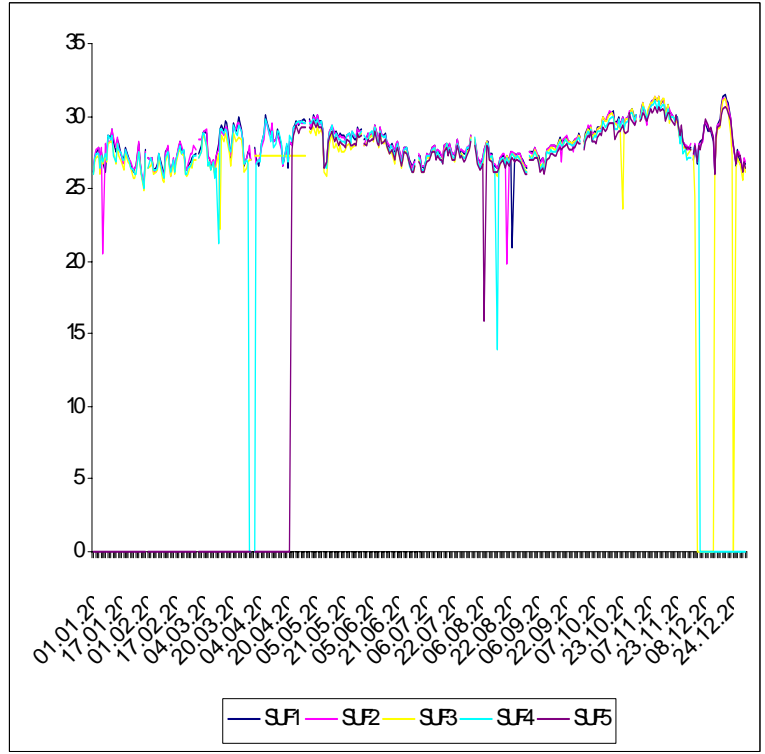
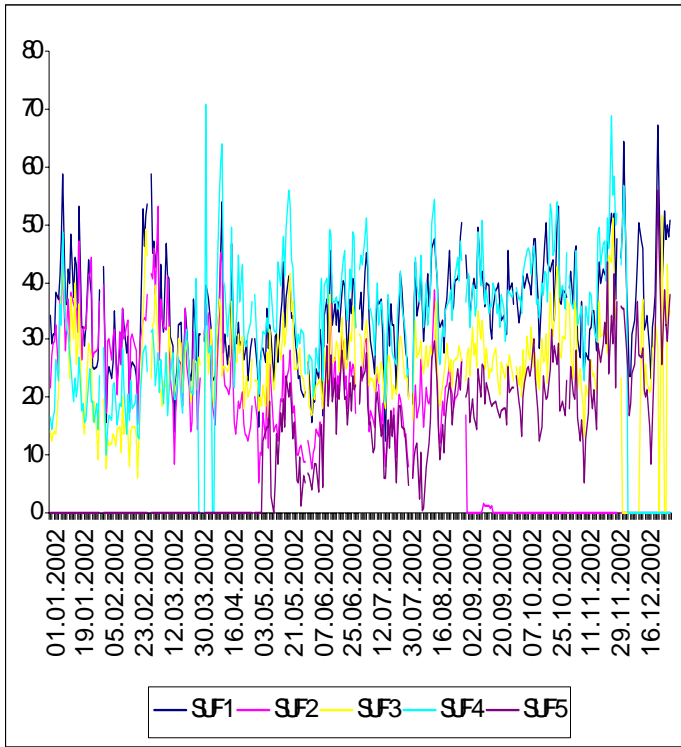
Picture 10. Assess measurement for the SO2 Of Year 2002



Picture 11. Assess measurement for the CO Of Year 2002

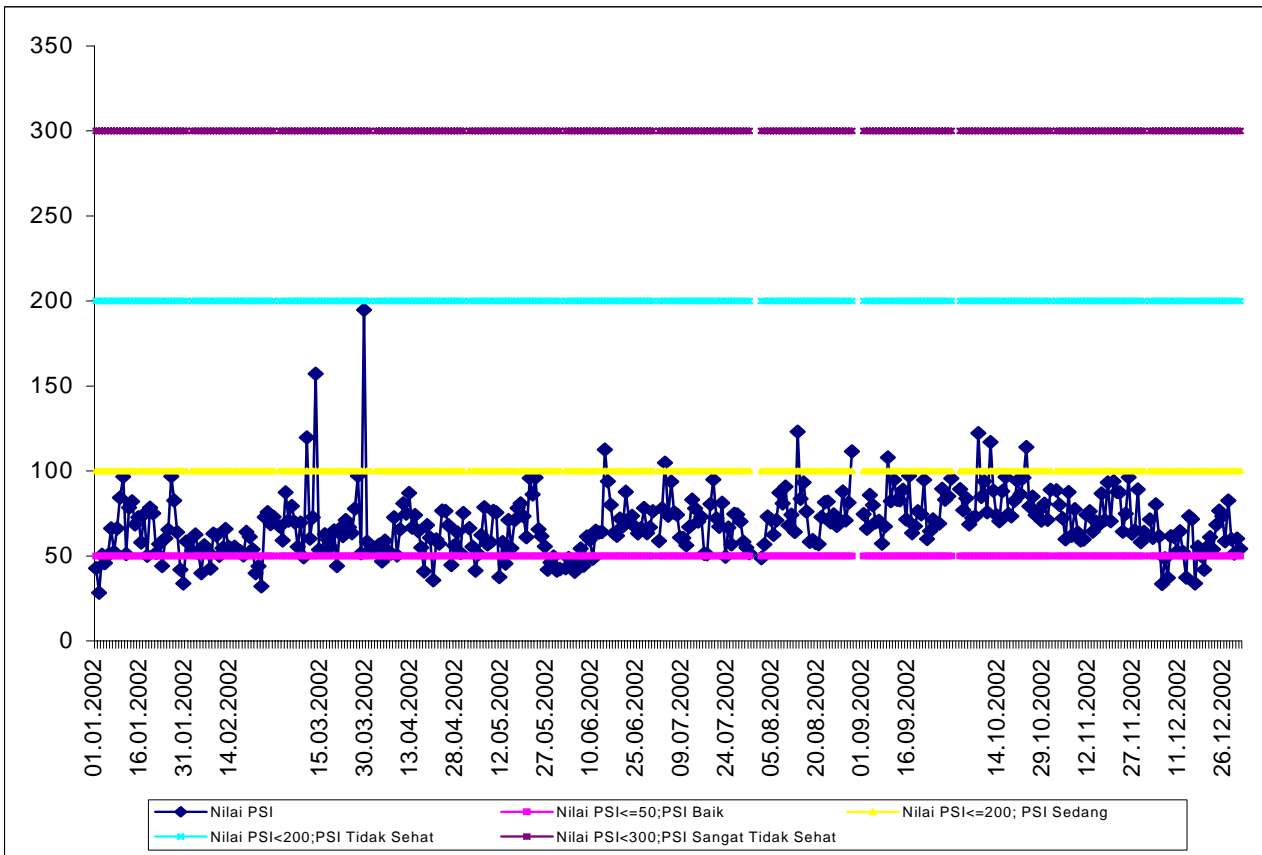
Picture 12. Assess measurement for the O3 of Year 2002

Continued



Picture 13. Assess measurement for the NO2 Of Year 2002

Picture 14. Assess measurement for the Temperature Of Ambient Air Year 2002



Picture 16. Value PSI/ISPU for the parameter of PM10, SO2, CO, O3 And NO2 Year 2002

