Journal of Science, Technology, Mathematics, and Education (JOSTMED), 2009, 6(2), 124 – 135

Measurements of Prevalence of Noxious Gases in Some Parts of Kontagora, Niger State, Nigeria

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Abstract

Every year, thousands of people worldwide lose their lives to ailments that can be traced to environmental pollution arising principally from the release of toxic effluents into the atmosphere and surrounding ecosystems. This study was undertaken in order that the prevalence of gases that harmful or injurious to human health in some parts of Kontagora town could be determined. Sheets 11, 13, and 21 of the Kontagora cadastral map were earmarked for survey. On each of these sheets, neighbourhoods and point locations that were prone to air pollution from stationary sources were identified; the GPS-referenced signature of each of the point source was recorded. The gas meters were employed to determine three different readings of the various gases of interest at each of those GPS-referenced points. The result of Sheet 11 agrees with the general trends and patterns of air pollution from fuel burning sources. The high amount of H_2S released by the diesel generator is most likely due to the high sulphur content of diesel fuel and most of the emissions from the diesel generator and the firewood hearth exceed the safe threshold. The comparative high amount of the CO gas released by the majority of the sources is expected because combustion in all cases involves burning of carbon compounds (hydrocarbon for the liquid fuels and cellulose for the wood fuel). The overwhelmingly dominance of the SO_2 gas from the petrol generator and the CO gas from the firewood hearths (of Sheet 13) must be due to high sulphur content in the former and of course the innate matter of the latter. On Sheet 21 the noxious gases posing greater risk to health from the diesel generators (with respect to the threshold) are the SO_2, CO, HCN, NO_2, and H_2S gases, from the petrol generators these are the SO_2, Cl_2, and HCN gases. From the firewood hearth the noxipus gases occurring in greater than acceptable amounts are the CO, Cl_2, HCN, NO_2, NH_3, and H_2S, and for the vulcaniser's pump these are the SO_2, CO, Cl_2, and the NH_3 gases.

Keywords: Noxious gases, air pollution, generators, firewood hearths, respiratory diseases

INTRODUCTION

Every year, thousands of people worldwide lose their lives to ailments that can be traced to environmental pollution arising principally from the release of toxic effluents into the atmosphere and surrounding ecosystems. The trend towards urbanization in Nigeria means that it becomes of academic interest to quantify and describe the levels and prevalence of urban “environmental pollution”. Environmental pollution is the contamination of the earth’s environment with materials that interfere with human health, the quality of life, or the natural functioning of the ecosystem (living organisms and their physical surroundings). Whilst some environmental pollution is a result of natural causes (such as volcanic eruptions), most are caused by human activities. Environmental pollution has been classified into different categories that include air pollution, water pollution, solid pollution, hazardous pollution, and noise pollution (Encarta, 2007). Pollution, is in its different forms, degrades the environment and affects the quality of life of the organisms that depend on this environment for survival; this especially holds true for the interaction of man and his environment. As humans become more skilful and adept at exploiting their environment, it becomes obvious that certain practices are quite detrimental to the “health” of the environment. It is with these facts in mind that this study was undertaken in order that the prevalence of noxious gases in some part of Kontagora town could be determined.

Problem Statement

At present, there exists no database on noxious gases pollution patterns of Kontagora town, so it is hoped that this study would serve as a pointer or “roadmap” in this regard.

Aim of Study

The aim of this study is to determine the prevalence of noxious gases in some parts of Kontagora with a view to establishing air pollution trends in this town.

Scope of Study

Three cadastral sheets of Kontagora town were considered for this survey. Measurements were taken from over forty GPS-referenced points on each of the cadastral sheets. The principal sources of noxious effluents considered for this study are the diesel generators or petrol generators (herein considered under the broad category of “vehicular emitters”) and the firewood hearths.

Ingredients and Associated Risk of some Airborne Pollutants

- **Ozone (O_3):** The primary ingredients in urban smog, ozone is created when hydrocarbons and nitrogen oxides (NO_x), both of which are chemicals released by automobile fuel combustion, react with sunlight. Though beneficial in the upper atmosphere, at the ground level ozone can irritate the respiratory system, causing coughing, chocked and reduced lung capacity.
- **Particulate Matter:** These particles of soot, metals and pollen give smog its murky color. Among vehicular pollution, fine particles (those less than one-tenth the diameter of a human hair) pose the most serious threat to human health by penetrating deep into lungs. In addition to direct emissions of fine particles, automobiles release nitrogen oxides, hydrocarbons, and sulphur dioxide, which generate additional fine particles as secondary pollution.
- **Nitrogen Oxides (NO_x):** These vehicular pollutants can cause lung irritation and weaken the body's defences against respiratory infection such as pneumonia and influenza. In addition, they assist in the formation of ozone and particulate matter. In many cities, NO_x pollution accounts for one-third of the fine particulate pollution in the air.
- **Carbon monoxide (CO):** This odourless, colourless gas is formed by the combustion of fossil fuels such as petrol. Cars and lorries are the source of nearly two-thirds of this pollutant. When inhaled, carbon monoxide blocks the transport of oxygen to the brain, heart, and other vital organs in the human body. Newborn children and people with chronic illness are especially susceptible to the effects of carbon monoxide.
- **Sulphur Dioxide (SO_2):** Motor vehicles create this pollutant by burning sulphur-containing fuels, especially diesel. It can react in the atmosphere to form fine particles and can pose a health risk to young children and asthmatics.
- **Hazardous Air Pollutants (Toxics):** These chemical compounds, which are emitted by cars, heavy duty vehicles, refineries, gas pumps, and related sources have been linked to birth defect, cancer, and other serious illnesses.

Literature Review

The Wikipedia (www.wikipedia.org) states that air pollution is the human introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or damages the natural environment, into the atmosphere (www.merriam-webster.com). Air pollution causes deaths (www.americanheart.org) and respiratory disease (www.who.int). Air pollution is often identified with major stationary sources, but the greatest source of emissions is mobile sources, mainly automobiles (National Research Council, 2004).

In his study of vehicular emission, environmental and health implications, Enemari (2001) pointed out that vehicular emissions in typical urban centres constitute over 60% of the total pollutant emission compared to what anyone will naturally hope, think or assumed. He recommended for proper servicing of vehicles for optimal performance and this should be encouraged. Also, he recommended that the refineries in the country should be fully evaluated with the aim of redesigning them to produce entirely unleaded petrol in the very near future. Furthermore, the use of catalytic converters in vehicles that uses unleaded petrol to control photochemical seeding was recommended. Bishop and Stedman (1996) have pioneered and developed an instrument to remotely measure vehicle emissions. In several studies it has been found that about 10% of the fleet generates more than 50% of total emissions of carbon monoxide (CO). Most cars are clean but a small number of malfunctioning or tampered with vehicles produce a major amount of regulated and un-regulated emissions. Kai-Jen et al (2007) researched the question of whether biological mechanisms linking air pollution to cardiovascular events can occur concurrently in human subjects exposed to urban air pollutants. Measurements were made in each of the participating subject of high-sensitivity C-reactive protein (hs-CRP), 8-hydroxy-2'-deoxyguanosine (8-OHdG), plasminogen activator fibrinogen inhibitor-1 (PAI-1), tissue-type plasminogen activator (tPA) in plasma, and heart rate variability (HRV). Their study found that urban air pollution is associated with inflammation, oxidative stress, blood coagulation and autonomic dysfunction simultaneously in healthy young humans with sulphate and ozone (O_3) as two major traffic-related pollutants contributing to such effects. A World Bank report on urban air pollution (www.worldbank.org) stated that particulate matter is made up of airborne smoke, soot, dust, and liquid droplets from fuel combustion. The amount of suspended particulate matter, usually measured in micrograms per cubic metre of air, is one of the most important indicators of the quality of the air that people breathe. According to the World Health Organisation's air quality standards, the concentration of suspended particles should be less than 90 micrograms per cubic metre (www.worldbank.org). High concentrations of suspended particulates adversely affect human health, provoking a wide range of respiratory diseases and exacerbating heart disease and other conditions. Worldwide, in 1995 the il health caused by such pollution resulted in at least 500,000 premature deaths and 4 to 5 million new cases of chronic bronchitis (www.worldbank.org). The report pointed out further that fuel combustion by motor vehicles is another major source of suspended particulate emissions in urban areas. These emissions are particularly detrimental to human health because pollutants are emitted at ground level. Motor vehicles in developing countries cause serious air pollution because they are concentrated in a few large cities, many are in poor mechanical condition, and few emission standards exist.

FIELD EQUIPMENT

Various gas meters specific to the measurements of gas types like sulphur dioxide (SO_2), carbon monoxide (CO), chlorine (Cl_2), hydrogen cyanide (HCN), nitrogen dioxide (NO_2), ammonia (NH_3), and hydrogen sulphide (H_2S) were used for this project work.

DESCRIPTION OF DATA COLLECTION SEQUENCES

Sheets 11, 13, and 21 of the Kontagora cadastral map were earmarked for survey. On each of these sheets, neighbourhoods and point locations that were prone to air pollution from stationary sources were identified; the GPS-referenced signature of each of the point source was recorded. The gas meters were employed to determine three different readings of the various gases of interest at each of those GPS-referenced points.

RESULTS AND DATA ANALYSIS

Tables 1 and 2 present the results of Sheet 11 of Kontagora town. Figs 1 and 2 show the bar chart representations corresponding to Tables 1 and 2.

Table 1: Gas density distribution of the Lagos/Kaduna Road neighbourhood with respect to sources (Sheet 11)

Neighborhood	Sources of Pollution	Pollutants (Gas Samples)	Average Values ($\mu g/m^3$)
Lagos/Kaduna Road	Diesel Generator	SO_2	258480
		CO	68000
		CL_2	36000
		HCN	182800
		NO_2	157080
		NH_3	18000
		H_2S	2678000
	Petrol Generator	SO_2	65566
		CO	16700
		CL_2	272233
		HCN	437733
		NO_2	17533
		NH_3	14267
		H_2S	34167
	Firewood Hearth	SO_2	151138
		CO	227000
		CL_2	190000
		HCN	120000
		NO_2	101600
		NH_3	876250
		H_2S	130425
	Vulcanizer’s pump	SO_2	8330
		CO	1053300
		CL_2	270000

		HCN	2600
		NO_2	18460
		NH_3	40000
		H_2S	7400

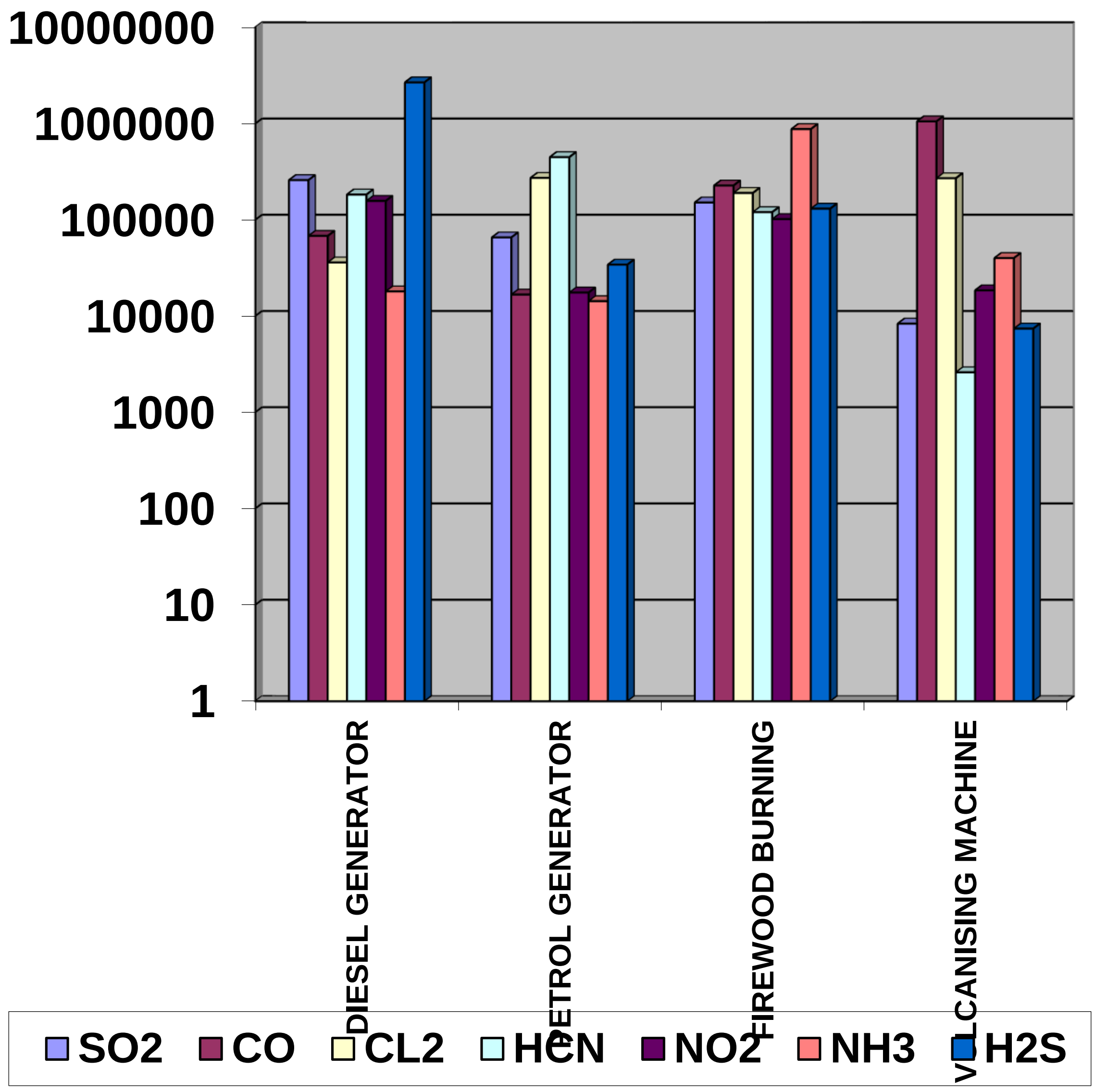

Fig.1: Bar chart representation corresponding to Table 1 (vertical scale in µg/m^3)

Table 2: Gas density distribution of the Old Sabon Gari Road neighbourhood with respect to sources (Sheet 11)

Neighborhood	Sources of Pollution	Pollutants (Gas Samples)	Average Values ($\mu g/m^3$)
Old Sabon Gari Road	Diesel Generator	SO_2	8100
		CO	40000
		CL_2	30000
		HCN	1000
		NO_2	3100
		NH_3	10000
		H_2S	2100
	Petrol Generator	SO_2	46112
		CO	24550
		CL_2	134350
		HCN	123380
		NO_2	10970
		NH_3	15950
		H_2S	7150000
	Firewood Hearth	SO_2	1300
		CO	4000000
		CL_2	160000
		HCN	130000
		NO_2	2400
		NH_3	1000000
		H_2S	6200
	Vulcanizer's pump	SO_2	8330
		CO	1053300

		CL_2	270000
		HCN	2600
		NO_2	18460
		NH_3	40000
		H_2S	7400

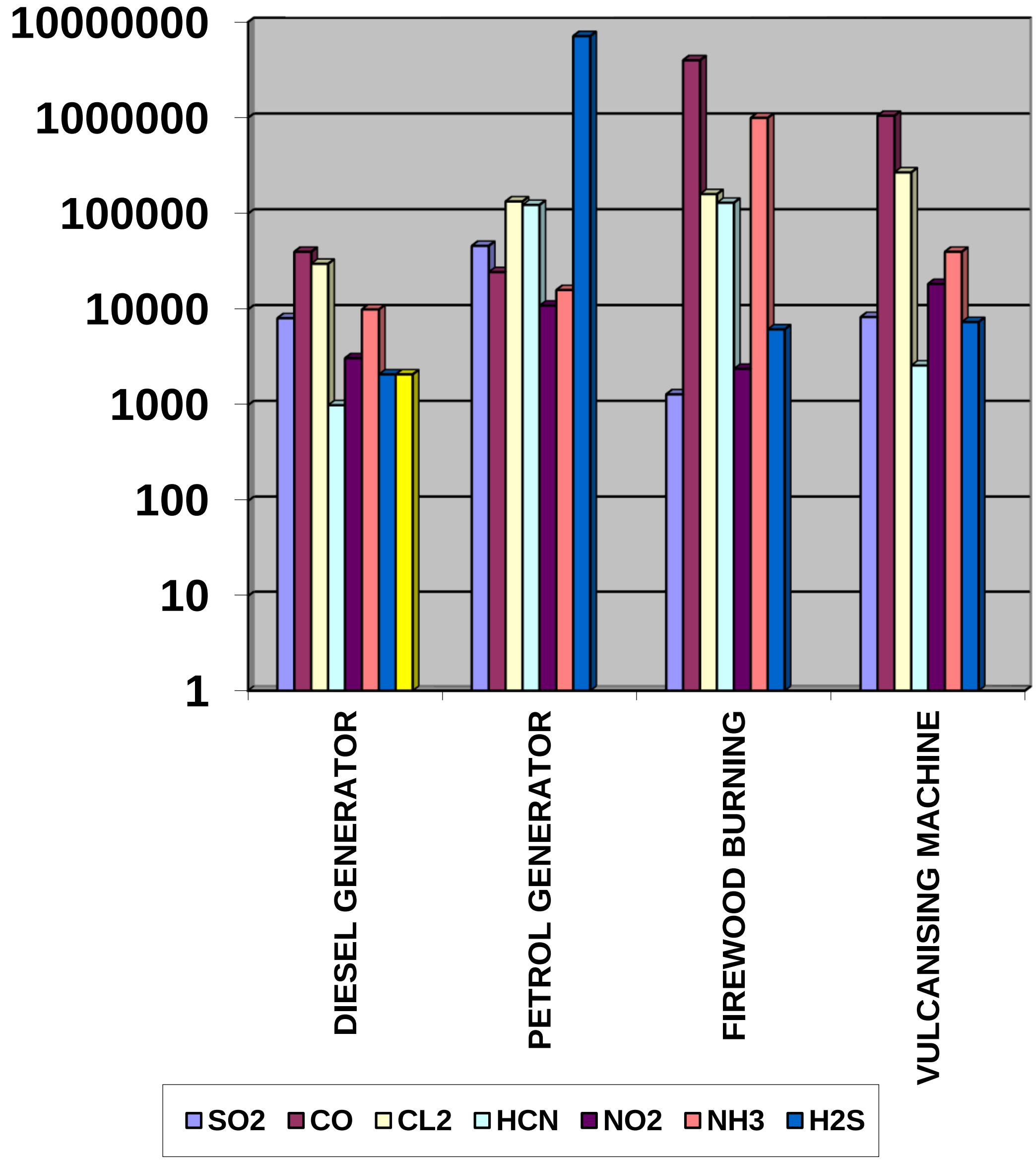

Fig.2: Bar chart representation corresponding to Table 2 (vertical scale in μg/m^3)

Table 3 presents position co-ordinates, gas type, and values for Sheet 13 of Kontagora town. The corresponding bar chart representation with respect to the various sources of pollution is shown in Fig. 3.

Table 3: Station location and values of the different gas types measured in Sheet 13

	GPS VALUES		Pollutants		
1	UTM values	Local co-ordinates	Gas Samples	Av. values in ppm	Av. values in μg/m^3
	X= 0771337 Y=1151183	N=10.4053213 E=5.4781622	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
2	X=0771339 Y=1151190	N=10.4053844 E=5.478181	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
3	X=0769937 Y=1150877	N=10.4026547 E=5.4653623	SO_2	0.032	32000
			CO	0.035	35000
			CL_2	0.03	30000
			HCN	0.001	1000
			NO_2	0.003	3000
			NH_3	0.01	10000
			H_2S	0.0014	1400

4	X=0770209 Y=1150891	N=10.402762 E=5.4648450	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
5	X=0771525 Y=1151170	N=10.4051905 E=5.4798772	SO_2	0.008	8000
			CO	0.02	20000
			CL_2	0.04	40000
			HCN	0.008	8000
			NO_2	0.023	23000
			NH_3	0.013	13000
			H_2S	0.003	3000
6	X=0770130 Y=1150885	N=10.4027134 E=5.4671244	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
7	X=0770137 Y=1150888	N=10.40274 E=5.4671885	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000

			H_2S	0.01	10000
8	X=0770133 Y=1151209	N=10.4056411 E=5.4671784	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
9	X=0770731 Y=1150460	N=10.3988305 E=5.4725797	SO_2	0.032	32000
			CO	0.035	35000
			CL_2	0.03	30000
			HCN	0.001	1000
			NO_2	0.003	3000
			NH_3	0.01	10000
			H_2S	0.0014	1400
10	X=0771540 Y=1151121	N=10.4047466 E=5.4800106	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000

11	X=0772113	N=10.4090256	SO_2	0.008	8000
	Y=1151599	E=5.482747	CO	0.02	20000
			CL_2	0.04	40000
			HCN	0.008	8000
			NO_2	0.023	23000
			NH_3	0.013	13000
			H_2S	0.003	3000
12	X=0771520	N=10.4051457	SO_2	0.013	13000
	Y=1151165	E=5.4798312	CO	0.21	210000
			CL_2	0.00	0.000000
			HCN	0.003	2000
			NO_2	0.07	72000
			NH_3	0.013	13000
			H_2S	0.01	10000
13	X=0771500	N=10.4050115	SO_2	1.2	1200000
	Y=1151150	E=5.4796476	CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
14	X=0771495	N=10.4049757	SO_2	1.2	1200000
	Y=1151146	E=5.4796017	CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000

			H_2S	0.007	7000
15	X=0770220 Y=1150899	N=10.4028336 E=5.4679469	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
16	X=0771488 Y=1151257	N=10.4059793 E=5.479545	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
17	X=0769591 Y=1150880	N=10.4027061 E=5.4622045	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
18	X=0769735 Y=1150880	N=10.402696 E=5.4635188	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000

			H_2S	0.007	7000
19	X=0771830 Y=1151418	N=10.40741 E=5.4826787	SO_2	0.008	8000
			CO	0.02	20000
			CL_2	0.04	40000
			HCN	0.008	8000
			NO_2	0.023	23000
			NH_3	0.013	13000
			H_2S	0.003	3000
20	X=0769665 Y=1150881	N=10.4027099 E=5.46288	SO_2	0.04	40000
			CO	1.05	1050000
			CL_2	0.3	30000
			HCN	0.004	4000
			NO_2	0.010	10000
			NH_3	0.013	13000
			H_2S	0.003	3000
21	X=0769780 Y=1150882	N=10.4027109 E=5.4639297	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
22	X=0771508 Y=1151251	N=10.4059237 E=5.4797278	SO_2	0.032	32000
			CO	0.035	35000
			CL_2	0.03	30000
			HCN	0.001	1000
			NO_2	0.003	3000
			NH_3	0.01	10000

			H_2S	0.0014	1400
23	X=0769933 Y=1150888	N=10.4027543 E=5.4653266	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
24	X=0771859 Y=1151430	N=10.4075164 E=5.4829443	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
25	X=0769629 Y=1150872	N=10.4026311 E=5.4625508	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
26	X=0769781 Y=1150878	N=10.4026746 E=5.4639385	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000

			H_2S	0.01	10000
27	X=0771520	N=10.4051457	SO_2	0.04	40000
	Y=1151165	E=5.4798312	CO	1.05	1050000
			CL_2	0.3	30000
			HCN	0.004	4000
			NO_2	0.010	10000
			NH_3	0.013	13000
			H_2S	0.003	3000
28	X=0769786	N=10.4026924	SO_2	0.032	32000
	Y=1150880	E=5.4639843	CO	0.035	35000
			CL_2	0.03	30000
			HCN	0.001	1000
			NO_2	0.003	3000
			NH_3	0.01	10000
			H_2S	0.0014	1400
29	X=0770010	N=10.4026947	SO_2	0.013	13000
	Y=1150882	E=5.466029	CO	0.21	210000
			CL_2	0.00	0.000000
			HCN	0.002	2000
			NO_2	0.072	72000
			NH_3	0.013	13000
			H_2S	0.01	10000

30	X=0771500 Y=1150815	N=10.4019843 E=5.4796237	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
31	X=0770899 Y=1150512	N=10.3992886 E=5.4741167	SO_2	0.008	8000
			CO	0.02	20000
			CL_2	0.04	40000
			HCN	0.008	8000
			NO_2	0.023	23000
			NH_3	0.013	13000
			H_2S	0.003	3000
32	X=0771519 Y=1150795	N=10.4018022 E=5.4797957	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000

33	X=0770899 Y=1150512	N=10.3992886 E=5.4741167	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
34	X=0770591 Y=1150470	N=10.3989307 E=5.4713026	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
35	X=0770784 Y=1150343	N=10.3977695 E=5.4725797	SO_2	1.2	1200000
			CO	1.54	1540000
			CL_2	0.40	400000
			HCN	0.05	50000
			NO_2	0.53	530000
			NH_3	0.007	7000
			H_2S	0.007	7000
36	X=0770010 Y=1150882	N=10.4026947 E= 5.466029	SO_2	0.013	13000
			CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000

37	X=0772078	N=10.4084859	SO_2	0.013	13000
	Y=1151539	E= 5.484951	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
38	X=0771919	N=10.4077832	SO_2	0.013	13000
	Y=1151460	E= 5.4834941	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
39	X=0771075	N=10.3997732	SO_2	0.013	13000
	Y=1150567	E=5..475727	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000

40	X=0770974	N=10.3995273	SO_2	0.013	13000
	Y=1150539	E=5.4748032	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
41	X=0770731	N=10.3988305	SO_2	0.013	13000
	Y=1150460	E=5.4725797	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000
42	X=0771535	N=10.404738	SO_2	0.013	13000
	Y=1151120	E=5.4799649	CO	0.21	210000
			CL_2	0.00	000000
			HCN	0.003	3000
			NO_2	0.07	70000
			NH_3	0.013	13000
			H_2S	0.01	10000

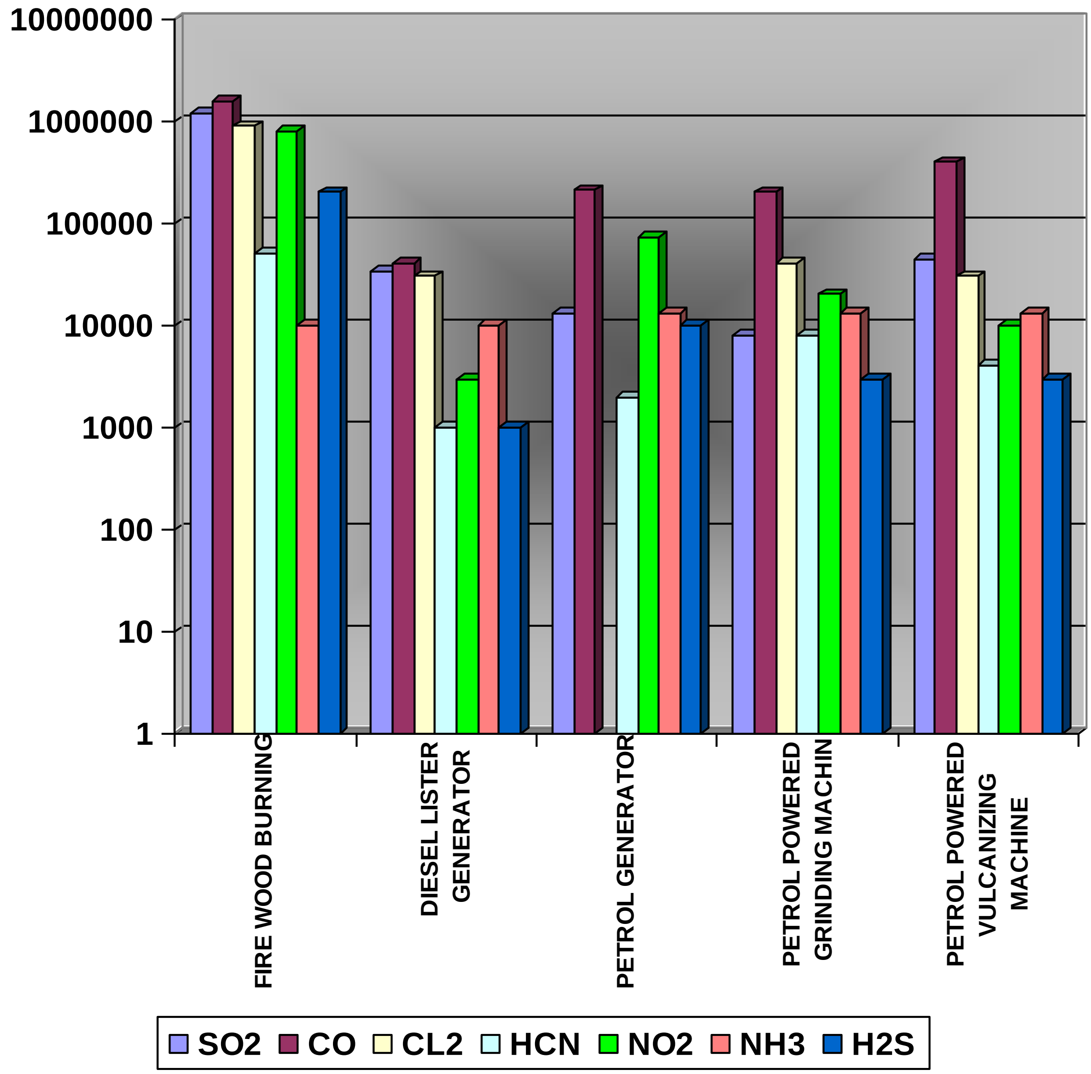

Fig.3: Bar chart representation corresponding to Table 3 (vertical scale in μg/m^3)

Table 4 presents position co-ordinates, gas type, and values for Sheet 21 of Kontagora town. Table 5 shows correlations with the different sources of pollution.

Table 4: Station location and values of the different gas types measured in Sheet 21

	GPS VALUES		Gas Samples/Mean Gas Values		
	UTM	Local Coordinates	Gas Samples	Values in ppm	Values in mg/m^3
1	X=768159.5	N=10 24.023	SO_2	0.0013	1.3
	Y=1151276.45	E=005 26.957	CO	005	5000
			CL_2	0.16	160
			HCN	0.001	1
			NO_2	0.0024	2.4
			NH_3	001	1000
			H_2S	0.0062	6.2
2	X=768191.59	N=10 24.016	SO_2	0.0013	1.3
	Y=1151061.53	E=005 26.958	CO	005	5000
			CL_2	0.16	160
			HCN	0.001	1
			NO_2	0.0024	2.4
			NH_3	001	1000
			H_2S	0.0062	6.2
3	X=768039.67	N=10 24.015	SO_2	1.25	1250
	Y=1151029.62	E=005 26.953	CO	0.25	250
			CL_2	0.40	400
			HCN	0.50	500

			NO_2	0.82	820
			NH_3	1.00	1000
			H_2S	1.50	1500
4	X=767368.76	N=10 24.021	SO_2	0.013	13
	Y=1151208.87	E=005 26.931	CO	0.21	210
			CL_2	0.00	0
			HCN	0.002	2
			NO_2	0.072	72
			NH_3	0.013	13
			H_2S	0.01	10
5	X=767336.43	N=10 24.029	SO_2	0.0081	8.1
	Y=1151454.53	E=005 26.930	CO	0.007	7
			CL_2	0.003	3
			HCN	0.0013	1.3
			NO_2	0.0031	3.1
			NH_3	0.015	15
			H_2S	0.0022	2.2
6	X=767212.1	N=10 24.040	SO_2	0.0081	8.1
	Y=1151791.69	E=005 26.926	CO	0.007	7
			CL_2	0.003	3
			HCN	0.0013	1.3
			NO_2	0.0031	3.1
			NH_3	0.015	15
			H_2S	0.0022	2.2
7	X=767545.66	N=10 24.045	SO_2	1.2	1200
	Y=1151947.96	E=005 26.937	CO	1.54	1540
			CL_2	0.43	430
			HCN	0.05	50

			NO_2	0.769	769
			NH_3	0.01	10
			H_2S	001	1000
8	X=768004.25	N=10 24.036	SO_2	0.0013	1.3
	Y=1151674.85	E=005 26.952	CO	005	5000
			CL_2	0.16	160
			HCN	0.001	1
			NO_2	0.0024	2.4
			NH_3	001	1000
			H_2S	0.0062	6.2
9	X=767575.61	N=10 24.047	SO_2	0.072	72
	Y=1152009.66	E=005 26.938	CO	0.51	510
			CL_2	0.02	20
			HCN	0.00	0
			NO_2	0.0081	8.1
			NH_3	0.01	10
			H_2S	0.065	65
10	X=767585.8	N=10 24.062	SO_2	1.30	1300
	Y=1150688	E=005 26.965	CO	0.067	67
			CL_2	0.022	22
			HCN	0.910	910
			NO_2	0.773	773
			NH_3	0.01	10
			H_2S	0.07	70
11	X=796519.47	N=10 24.041	SO_2	1.25	1250
	Y=1152060.56	E=005 26.989	CO	0.25	250
			CL_2	0.40	400
			HCN	0.50	500

			NO_2	0.82	820
			NH_3	1.00	1000
			H_2S	1.50	1500
12	X=768226.7 Y=1150614.25	N=10 24.024 E=005 26.984	SO_2	1.2	1200
			CO	1.54	1540
			CL_2	0.43	430
			HCN	0.05	50
			NO_2	0.769	769
			NH_3	0.01	10
			H_2S	001	1000
13	X=768219.44 Y=1150608.66	N=10 24.021 E=005 26.980	SO_2	0.072	72
			CO	0.51	510
			CL_2	0.02	20
			HCN	0.00	0
			NO_2	0.0081	8.1
			NH_3	0.01	10
			H_2S	0.065	65
14	X=768281.05 Y=1150670	N=10 24.054 E=005 27.014	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
15	X=768317.62 Y=1150662.9	N=10 24.050 E=005 27.034	SO_2	0.0081	8.1
			CO	0.007	7
			CL_2	0.03	30
			HCN	0.001	1

			NO_2	0.0032	3.2
			NH_3	0.01	10
			H_2S	0.0021	2.1
16	Y=768308.83 Y=1150618.57	N=10 24.026 E=005 27.029	SO_2	0.218	218
			CO	1.540	1540
			CL_2	0.080	80
			HCN		
			NO_2	0.0245	24.5
			NH_3	0.040	40
			H_2S	0.285	285
17	X=768361.34 Y=1150676.15	N=10 24.057 E=005 27.058	SO_2	0.0073233	7.32
			CO	0.03333	33.33
			CL_2	0.2	200
			HCN	0.006667	6.667
			NO_2	0.03837	38.37
			NH_3	0.00	0
			H_2S	0.00	0
18	X=768347.84 Y=1150770.11	N=10 24.108 E=005 27.051	SO_2	0.218	218
			CO	1.540	1540
			CL_2	0.080	80
			HCN		
			NO_2	0.0245	24.5
			NH_3	0.040	40
			H_2S	0.285	285
19	X=768394.18 Y=1150680.09	N=10 24.059 E=005 27.076	SO_2	0.0081	8.1
			CO	0.04	7
			CL_2	0.03	30
			HCN	0.001	1

			NO_2	0.0032	3.2
			NH_3	0.01	10
			H_2S	0.0021	2.1
20	X=768392.74 Y=1150630.29	N=10 24.032 E=005 27.075	SO_2	0.0073233	7.32
			CO	0.03333	33.33
			CL_2	0.2	200
			HCN	0.006667	6.667
			NO_2	0.03837	38.37
			NH_3	0.00	0
			H_2S	0.00	0
21	X=768454.38 Y=1150687.94	N=10 24.063 E=005 27.109	SO_2	0.072	72
			CO	0.51	510
			CL_2	0.02	20
			HCN	0.00	0
			NO_2	0.0081	8.1
			NH_3	0.01	10
			H_2S	0.065	65
22	X=768518.13 Y=1150708.72	N=10 24.074 E=005 27.144	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
23	X=768518.29 Y=1150688.43	N=10 24.063 E=005 27.144	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4

			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
24	X=768540.28 Y=1150677.53	N=10 24.057 E=005 27.156	SO_2	1.2	1200
			CO	1.54	1540
			CL_2	0.43	430
			HCN	0.05	50
			NO_2	0.769	769
			NH_3	0.01	10
			H_2S	001	1000
25	X=768556.69 Y=1150681.35	N=10 24.059 E=005 27.165	SO_2	0.013	13
			CO	003	3000
			CL_2	0.00	0
			HCN	0.002	2
			NO_2	0.072	72
			NH_3	0.02	20
			H_2S	0.21	210
26	X=768580.3 Y=1150698.13	N=10 24.068 E=005 27.178	SO_2	1.30	1300
			CO	0.067	67
			CL_2	0.022	22
			HCN	0.910	910
			NO_2	0.773	773
			NH_3	0.01	10
			H_2S	0.07	70
27	X=768624.02 Y=1150711.38	N=10 24.075 E=005 27.202	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4

			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
28	X=768686.03 Y=1150721.08	N=10 24.080 E=005 27.236	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
29	X=768769.96 Y=1150729.11	N=10 24.084 E=005 27.282	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
30	X=768800.89 Y=1150744.1	N=10 24.092 E=005 27.299	SO_2	1.30	1300
			CO	0.067	67
			CL_2	0.022	22
			HCN	0.910	910
			NO_2	0.773	773
			NH_3	0.01	10
			H_2S	0.07	70
31	X=768819.12 Y=1150747.93	N=10 24.094 E=005 27.309	SO_2	0.043	43
			CO	0.0074	7.4
			CL_2	0.300	300
			HCN	0.0027	2.7

			NO_2	0.0053	5.3
			NH_3	0.0007	0.7
			H_2S	0.0027	2.7
32	X=768861.1 Y=1150750.1	N=10 24.095 E=005 27.332	SO_2	1.57	1570
			CO	0.094	94
			CL_2	0.031	31
			HCN	0.984	984
			NO_2	0.820	820
			NH_3		
			H_2S	1.30	1300
33	X=768888.45 Y=1150755.85	N=10 24.098 E=005 27.347	SO_2	0.067	67
			CO	0.022	22
			CL_2	0.910	910
			HCN	0.773	773
			NO_2	0.01	10
			NH_3	0.07	70
			H_2S	1.30	1300
34	X=768915.84 Y=1150756.06	N=10 24.098 E=005 27.362	SO_2	0.0077	7.7
			CO	11.000	11000
			CL_2	0.0030	3.0
			HCN	0.0033	3.3
			NO_2	0.0034	3.4
			NH_3	2.330	2330
			H_2S	0.002	2
35	X=768944.46 Y=1150597.67	N=10 24.012 E=005 27.377	SO_2	0.013	13
			CO	3.333	3333
			CL_2	0.00	0
			HCN	0.002	2

			NO_2	0.288	288
			NH_3	0.020	20
			H_2S	0.210	210
36	X=768979.43 Y=1150797.13	N=10 24.120 E=005 27.397	SO_2	0.0013	1.3
			CO	005	5000
			CL_2	0.16	160
			HCN	0.001	1
			NO_2	0.0024	2.4
			NH_3	001	1000
			H_2S	0.0062	6.2
37	X=769038.09 Y=1150768.07	N=10 24.104 E=005 27.429	SO_2	1.60	1600
			CO	0.094	94
			CL_2	0.031	31
			HCN	0.984	984
			NO_2	0.825	825
			NH_3	0.03	30
			H_2S	1.27	1270
38	X=769045.41 Y=1150766.28	N=10 24.103 E=005 27.433	SO_2	1.2	1200
			CO	1.54	1540
			CL_2	0.43	430
			HCN	0.05	50
			NO_2	0.769	769
			NH_3	0.01	10
			H_2S	001	1000
39	X=769094.69 Y=1150768.51	N=10 24.104 E=005 27.460	SO_2	1.60	1600
			CO	0.094	94
			CL_2	0.031	31
			HCN	0.984	984

			NO_2	0.825	825
			NH_3	0.03	30
			H_2S	1.27	1270
40	X=769107.29	N=10 24.117	SO_2	0.0727	72.7
	Y=1150792.58	E=005 27.467	CO	0.0051	5.1
			CL_2	0.0167	16.7
			HCN	0.079	79
			NO_2	0.0081	8.1
			NH_3	0.0133	13.3
			H_2S	0.095	95
41	X=769103.57	N=10 24.122	SO_2	0.0727	72.7
	Y=1150801.78	E=005 27.465	CO	0.0051	5.1
			CL_2	0.0167	16.7
			HCN	0.079	79
			NO_2	0.0081	8.1
			NH_3	0.0133	13.3
			H_2S	0.095	95
42	X=769101.62	N=10 24.130	SO_2	0.008	8
	Y=1150816.52	E=005 27.464	CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
43	X=769095.9	N=10 24.147	SO_2	0.0081	8.1
	Y=1150847.82	E=005 27.461	CO	0.007	7
			CL_2	0.003	30
			HCN	0.0013	1

			NO_2	0.0031	3.2
			NH_3	0.015	10
			H_2S	1.60	2.1
44	X=769094.18 Y=1150834.9	N=10 24.140 E=005 27.460	SO_2	0.094	94
			CO	0.031	31
			CL_2	0.984	984
			HCN	0.825	825
			NO_2	0.03	30
			NH_3	1.27	1270
			H_2S	1.60	1600
45	X=769097.97 Y=1150816.49	N=10 24.130 E=005 27.462	SO_2	0.008	8
			CO	0.03	30
			CL_2	0.40	400
			HCN	0.0084	8.4
			NO_2	0.02	20
			NH_3	0.02	20
			H_2S	0.01	10
46	X=769138.46 Y=1150776.23	N=10 24.108 E=005 27.484	SO_2	1.2	1200
			CO	1.54	1540
			CL_2	0.43	430
			HCN	0.05	50
			NO_2	0.769	769
			NH_3	0.01	10
			H_2S	001	1000
47	X=769143.92 Y=1150778.11	N=10 24.109 E=005 27.487	SO_2	0.0727	72.7
			CO	0.0051	5.1
			CL_2	0.0167	16.7
			HCN	0.079	79

			NO_2	0.0081	8.1
			NH_3	0.0133	13.3
			H_2S	0.095	95
48	X=769145.78 Y=1150774.44	N=10 24.107 E=005 27.488	SO_2	1.60	1600
			CO	0.094	94
			CL_2	0.031	31
			HCN	0.984	984
			NO_2	0.825	825
			NH_3	0.03	30
			H_2S	1.27	1270
49	X=769132.72 Y=1150809.38	N=10 24.126 E=005 27.481	SO_2	1.30	1300
			CO	0.072	67
			CL_2	0.51	22
			HCN	0.02	910
			NO_2	0.00	773
			NH_3	0.0081	10
			H_2S	0.001	70

Table 5: Sources of pollution, types of pollution, and their mean values in $\mu g/m^3$

Neighbourhoods	Sources of Gas	Pollutants (Gas Samples)	Average Values ($\mu g/m^3$)
Lagos Road	Diesel Generator	SO_2	257480
		CO	68500
		CL_2	36700
		HCN	184800
		NO_2	153080

		NH_3	18500
		H_2S	2678550
	Petrol Generator	SO_2	65588
		CO	17889
		CL_2	256533
		HCN	436689
		NO_2	17577
		NH_3	14289
		H_2S	34200
	Firewood Hearth	SO_2	151138
		CO	227000
		CL_2	190000
		HCN	120000
		NO_2	101600
		NH_3	876250
		H_2S	130425
	Vulcanizer's pump	SO_2	833879
		CO	1053323
		CL_2	277654
		HCN	45903
		NO_2	18460
		NH_3	467233
		H_2S	78123

DISCUSSION

Four principal sources of pollution were identified in the neighbouhoods of Sheet 11 of Kontagora, viz: the diesel generator, the petrol generator, the firewood hearth, and the vulcaniser's pump. Each of these sources emit all of the gases under measurements, i.e. SO_2, CO, Cl_2, HCN, NO_2, NH_3, and H_2S. Along the Lagos/Kaduna Road neighbourhood the diesel generator was observed to release the largest amount of H_2S, while the firewood hearth and vulcaniser's pump released a comparatively high amount of the CO gas. Along the Old Sabon Gari Road neighbourhood, all of the major sources of pollution belched out a comparatively high amount of the CO gas; however, the petrol generator gave off the highest amount of the H_2S gas while the firewood hearth gave off the highest amount of the NH_3 gas. The Cl_2 gas was also released in high amounts by all of the sources under condition.

On Sheet 13, the principal sources of pollution identified were the hearth, diesel generator, petrol generator, petrol engine milling machine, and the vulcanizer's pump powered by petrol engine. In all of the cases, the CO gas was released by each of the aforementioned sources in the largest amount. The SO_2 gas was observed in comparatively large amounts, too. Of all the gases, the diesel generator released the fewest quantities of each.

Sheet 21 comprises, predominantly, the Lagos Road neighbourhood. The diesel generator was observed to release the largest amount of the H_2S gas. The vulcaniser's pump released the highest amount of the CO gas and the least amount of the HCN gas. All the sources of pollution, except the diesel generator, were observed to belch out significant amount of the Cl_2 gas.

CONCLUSION

The result of Sheet 11 agrees with the general trends and patterns of air pollution from fuel burning sources. The high amount of H_2S released by the diesel generator is most likely due to the high sulphur content of diesel fuel. Technical literature points out that exposure to gas concentration above 50 mg/m^3 or 50,000 µg/m^3 over a short period of time is injurious to health (personal communication); it follows from Fig. 1 that most of the emissions from the diesel generator and the firewood hearth exceed the safe threshold. The comparative high amount of the CO gas released by the majority of the sources is expected because combustion in all cases involves burning of carbon compounds (hydrocarbon for the liquid fuels and cellulose for the wood fuel).

It is not a surprise that the CO gas was released in comparative large amounts by all the sources identified in Sheet 13; as was pointed out early, all fuels are, after all, carbon-based. As per the threshold of 50, 000 μg/m^3, most of the effluents for the diesel generators are well below this mark. The values of the NO_2, Cl_2, NH_3, and HCN gases from the firewood hearth exceed the safe threshold. There is also the prevalence of the Cl_2 gas in all of the sources observed. The overwhelmingly dominance of the SO_2 gas from the petrol generators and the CO gas from the firewood hearths must be due to high sulphur content in the former and of course the innate matter of the latter.

On Sheet 21 the noxious gases posing greater risk to health from the diesel generators (with respect to the threshold) are the $SO_{2,}$ CO, HCN, NO_2, and H_2S gases, from the petrol generators these are the SO_2, Cl_2, and HCN gases. From the firewood hearth the noxipus gases occurring in greater than acceptable amounts are the CO, Cl_2, HCN, NO_2, NH_3, and H_2S, and for the vulcaniser's pump these are the SO_2, CO, Cl_2, and the NH_3 gases.

It is seen from this study that all of the primary stationary sources of pollution emit noxious gases in different degrees into the atmosphere and the ambient environment about any source is constantly inundated with all of the seven gases identified in this survey.

RECOMMENDATION

In addition to a suggestion for constant monitoring and evaluation of the amount of different noxious gases present in the ambient environment, it is recommended that:

- For the short-term, householders should be encouraged to convert to pressurized kerosene cookers instead of the heavy reliance on woodstoves and open hearth charcoal stoves that are a common sight in many kitchens in Nigeria today. The long-term solution would obviously involve the implementation of an effective nationwide domestic gas-piping policy whence most homes would be linked to a national gas distribution grid.

- To reduce the incidence of the high occurrences of the SO_2 and the H_2S gases, petrol that are less in their sulphur content should be used at all times as the primary fuel of combustion in particular engines.
- The use of generators of very high combustion capabilities should be encouraged at all times.
- To minimize exposure to harmful fumes exiting all the sources of pollution, proper ventilation procedures must be adhered to at all times; this could be in the form of smokestacks in kitchens and the safe and proper routing of exhaust fumes from all kinds of engines during their operations.

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APPENDIX: MORE NOXIOUS GASES DATASET FOR KONTAGORA TOWN

SHEET 18 OF KONTAGORA MAP

SOURCES OF GAS	GPS VALUES		VALUES (ppm)			
	UTM VALUES	LOCAL COORDINATE	1st Reading	2nd Reading	3rd Reading	Average Value
1. Bean cake seller	X-0772237	N-10.40906˚	1.2	1.2	1.2	1.2
	Y-1151708	E-005.48645˚	1.52	1.54	1.55	1.54
			1.1	0.03	0.08	0.43
			0.08	0.02	0.06	0.053
			0.792	0.800	0.00	0.53

			0.01	0.01	0.00	0.067
			0.02	0.00	0.00	0.0067
2. Fried yam seller	X-0772220 Y-1151742	N-10.40949˚ E-005.48630˚	0.0013	0.0012	0.0013	0.00127
			0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
3. Suzuki generator	X-0772203 Y-1151630	N-10.40836˚ E-005.48614˚	0.0000	0.120	0.013	0.043
			0.0071	0.0078	0.0073	0.0074
			0.200	0.300	0.400	0.300
			0.0035	0.0024	0.0021	0.0027
			0.0072	0.0042	0.0044	0.016
			0.0010	0.00	0.0010	0.0007
			0.0035	0.0024	0.0021	0.0026
4. Mei suya spot	X-0772153 Y-1151676	N-10.40878˚ E-005.5145˚	0.0089	0.0073	0.0068	0.0077
			10.00	11.00	12.00	11.00
			0.030	0.020	0.040	0.0030
			0.0032	0.0035	0.0032	0.0033
			0.0034	0.0037	0.0031	0.0034
			1.000	2.000	4.000	2.330
			0.0010	0.003	0.002	0.002
5. Restaurant	X-0772104 Y-1151695	N-10.40895˚ E-005.48524˚	0.0013	0.0012	0.0013	0.00127
			0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17

			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
6. Fried yam seller	X-0772045	N-10.2045˚	0.0013	0.0012	0.0013	0.00127
	Y-1151748	E-005.48470˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
7. Restaurant	X-0772083	N-10.40932˚	0.0013	0.0012	0.0013	0.00127
	Y-1151736	E-005.48505˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
8. Hemac generator	X-0772052	N-10.40972˚	0.073	0.071	0.072	0.072
	Y-1151780	E-005.48477˚	0.75	0.44	0.35	0.513
			0.03	0.01	0.01	0.017
			0.00	0.00	0.00	0.00
			0.0081	0.0083	0.0080	0.0082
			0.01	0.02	0.01	0.013
			0.098	0.093	0.004	0.064
9. Power master generator	X-0771897	N-10.41128˚	0.09	0.0080	0.0082	0.0354
	Y-1151887	E-005.48413˚	0.09	0.07	0.05	0.07
			0.02	0.04	0.03	0.03

			0.001	0.002	0.001	0.013
			0.0032	0.0030	0.0032	0.0032
			0.02	0.01	0.02	0.017
			0.0023	0.0021	0.000	0.0015
			0.0013	0.0012	0.0013	0.00127
			0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
10. Restaurant	X-0772129	N-10.40984˚	0.001	0.003	0.00	0.0013
	Y-1151638	E-005.48401˚	0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
11. Tiger generator	X-0772113	N-10.46844˚	0.075	0.071	0.074	0.073
	Y-1151638	E-005.48532˚	0.75	0.44	0.35	0.51
			0.03	0.01	0.01	0.017
			0.00	0.00	0.00	0.000
			0.0081	0.0083	0.0080	0.00813
			0.001	0.002	.001	0.043
			0.098	0.093	0.094	0.095
12. Mei suya	X-0772073	N-1040818˚	0.0089	0.0073	0.0068	0.0077
	Y-1151609	E-00548495˚	10.00	11.00	12.00	11.00
			0.030	0.020	0.040	0.0030
			0.0032	0.0035	0.0032	0.0033
			0.0034	0.0037	0.0031	0.0034
			1.000	2.000	4.000	2.330
			0.0010	0.003	0.002	0.002
13. Central generator	X-0772096	N-10.40805˚	0.09	0.0080	0.0082	0.0354
	Y-1151595	E-005.48516˚	0.09	0.07	0.05	0.07
			0.02	0.04	0.03	0.03

			0.001	0.002	0.001	0.013
			0.0032	0.0030	0.0032	0.0032
			0.02	0.01	0.02	0.017
			0.0023	0.0021	0.000	0.0015
14. Mei suya	X-0772063	N-10.40796˚	0.0089	0.0073	0.0068	0.0077
	Y-1151585	E-005.48487˚	10.00	11.00	12.00	11.00
			0.030	0.020	0.040	0.0030
			0.0032	0.0035	0.0032	0.0033
			0.0034	0.0037	0.0031	0.0034
			1.000	2.000	4.000	2.330
			0.0010	0.003	0.002	0.002
15. Nulux generator	X-0772050	N-10.40787˚	0.073	0.071	0.072	0.072
	Y-1151575	E-005.48474˚	0.75	0.44	0.35	0.513
			0.03	0.01	0.01	0.017
			0.00	0.00	0.00	0.00
			0.0081	0.0083	0.0080	0.0082
			0.01	0.02	0.01	0.013
			0.098	0.093	0.004	0.064
16. Restaurant	X-0771776	N-10.40659˚	0.0013	0.0012	0.0013	0.00127
	Y-1151427	E-005.47766˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.013
			0.0024	0.0080	0.0082	0.0062
	X-0771768	N-10.40668˚	0.073	0.071	0.074	0.073

17. Sumel firima generator	Y-1151427	E-005.48215˚	0.075	0.44	0.35	0.513
			0.04	0.02	0.02	0087
			0.00	0.00	0.00	0.000
			0.0082	0.0084	0.0079	0.0082
			0.01	0.02	0.01	0.013
			0.098	0.094	0.093	0.095
18. Bean cake seller	X0771683	N-10.40715˚	1.30	1.20	0.0	0.83
	Y-1151402	E-005.48138˚	0.3	0.20	0.0	0.16
			0.50	0.30	0.0	0.26
			0.30	0.20	1.00	0.50
			0.83	0.82	0.81	0.82
			2.00	1.00	0.00	1.00
			2.00	1.00	0.00	1.00
19. Restaurant	X077656	N-10.40728˚	0.0013	0.0012	0.0013	0.00127
	Y-1151409	E-005.48296˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
20. Restaurant	X-0771633	N-10.40756˚	0.0013	0.0012	0.0013	0.00127
	Y-1151538	E-005.48093˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
	X0771590	N-10.40758˚	1.30	1.20	0.0	0.83
	Y-1151339	E-005.48034˚	0.3	0.20	0.0	0.16

21. Bean cake seller			0.50	0.30	0.0	0.26
			0.30	0.20	1.00	0.50
			0.83	0.82	0.81	0.82
			2.00	1.00	0.00	1.00
			2.00	1.00	0.00	1.00
22. Restaurant	X-0771587	N-10.40787˚	0.0013	0.0012	0.0013	0.00127
	Y-1151571	E-005.48051˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
26. Restaurant	X-0771998	N-10.40751˚	0.0013	0.0012	0.0013	0.00127
	Y-1151535	E-005.48426˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
27. Restaurant	X-0771910	N-10.40493˚	0.0013	0.0012	0.0013	0.00127
	Y-1151470	E-005.48345˚	0.06	0.05	0.03	0.047
			0.2	0.3	0.0	0.17
			0.001	0.003	0.00	0.0013
			0.0024	0.0023	0.0026	0.0024
			0.01	0.02	0.01	0.043
			0.0024	0.0080	0.0082	0.0062
28. Tiger generator	X-0771863	N-10.40682˚	0.075	0.071	0.074	0.073
	Y-1151508	E-005.48302˚	0.75	0.44	0.35	0.51

			0.03	0.01	0.01	0.017
			0.00	0.00	0.00	0.000
			0.0081	0.0083	0.0080	0.00813
			0.001	0.002	.001	0.043
			0.098	0.093	0.094	0.095
29. Tiger generator	X-0771831	N-10.40660˚	0.075	0.071	0.074	0.073
	Y-1151433	E-005.48273˚	0.75	0.44	0.35	0.51
			0.03	0.01	0.01	0.017
			0.00	0.00	0.00	0.000
			0.0081	0.0083	0.0080	0.00813
			0.001	0.002	.001	0.043
			0.098	0.093	0.094	0.095
30.Yaha ma Generator	X-0771790	N-10-40649˚	0.004	0.008	0.012	0.008
	Y-1151462	E-005.4235˚	0.04	0.03	0.02	0.003
			0.30	0.20	0.70	0.4
			0.0084	0.0083	0.0084	0.00836
			0.02	0.01	0.04	0.023
			0.02	0.03	0.02	0.023
			0.02	0.00	0.00	0.0067

SHEET 12 OF KONTAGORA MAP

	GPS VALUE		POLLUTANTS	VALUES (ppm)	VALUES (mg/m3)
	UTM VALUE	LOCAL COORDINATES	GAS SAMPLES	AVERAGE VALUES	AVERAGE VALUES
1	X= 0769615	N=10^0 24.057'	SO2	1.2	1200000
	Y=1150789	E=05^0 27.747'	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
2	X=0771609	N=10^0 24.051'	SO2	1.2	1200000
	Y=1153193	E=05^0 27.722'	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
3	X=0769047	N=10^0 23.913'	SO2	0.0081	8100
	Y=1150519	E=05^0 27.433'	CO	0.007	7000
			CL2	0.03	30000
			HCN	0.001	1000
			NO2	0.031	31000
			NH2	0.01	10000

			H2S	0.0021	2100
4	X=0769552 Y=1150787	N=10^0 24.055' E=05^0 27.715'	SO2	1.2	1200000
			CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
5	X=0769555 Y=1150841	N=10^0 24.085' E=05^0 27.715'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
6	X= 0769542 Y=1150876	N=10^0 24.105' E=05^0 27.706'	SO2	**0.00833**	8330
			CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
7	X=0769553 Y=1150868	N=10^0 24.098' E=05^0 27.714'	SO2	0.0727	72700
			CO	0.0051	5100
			CL2	0.0167	16700
			HCN	0.079	79000
			NO2	0.0081	8100
			NH2	0.0133	13300

			H2S	0.095	95000
8	X=0769251 Y=1150879	N=10^0 24.108' E=05^0 27.550'	SO2	**0.00833**	8330
			CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
9	X=0769587 Y=1150899	N=10^0 24.116' E=05^0 29.736'	SO2	0.0727	72700
			CO	0.0051	5100
			CL2	0.0167	16700
			HCN	0.079	79000
			NO2	0.0081	8100
			NH2	0.0133	13300
			H2S	0.095	95000
10	X=0769139 Y=1150877	N=10^0 24.105' E=05^0 27.487'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
11	X= 0772068 Y=1151749	N=10^0 24.565' E=05^0 29.095'	SO2	1.2	1200000
			CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000

			NH2	0.01	10000
			H2S	0.1	100000
12	X=0769348 Y=1150890	N=10^0 24.114' E=05^0 27.600'	SO2	0.0081	8100
			CO	0.007	40000
			CL2	0.03	30000
			HCN	0.001	1000
			NO2	0.031	3100
			NH2	0.01	10000
			H2S	0.0021	2100
13	X=0769385 Y=1150825	N=10^0 24.077' E=05^0 27.622'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
14	X=0769388 Y=1150675	N=10^0 23.995' E=05^0 27.625'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
15	X=0768619 Y=1150817	N=10^0 24.076' E=05^0 27.203'	SO2	**0.00833**	8330
			CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460

			NH2	**0.04**	40000
			H2S	**0.0074**	7400
16	X= 0768726	N=10^0 24.069'	SO2	0.0081	8100
	Y=1150806	E=05^0 27.259'	CO	0.007	7000
			CL2	0.03	30000
			HCN	0.001	1000
			NO2	0.031	31000
			NH2	0.01	10000
			H2S	0.0021	2100
17	X=0768801	N=10^0 24.084'	SO2	**0.00833**	8330
	Y=1150832	E=05^0 27.302'	CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
18	X=0768827	N=10^0 24.085'	SO2	**0.00833**	8330
	Y=1150838	E=05^0 27.316'	CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
19	X=0768828	N=10^0 24.146'	SO2	0.013	13000
	Y=1150947	E=05^0 27.317'	CO	0.21	210000
			CL2	0.00	0.00
			HCN	0.002	2000
			NO2	0.072	72000

			NH2	0.013	13000
			H2S	0.01	10000
20	X=0768895 Y=1150833	N=10^0 24.084' E=05^0 27.352'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
21	X= 076120 Y=1150461	N=10^0 23.881' E=05^0 27.476'	SO2	0.08	80000
			CO	0.02	20000
			CL2	0.40	400000
			HCN	0.82	820000
			NO2	0.023	23000
			NH2	0.013	13000
			H2S	0.003	3000
22	X=0769047 Y=1150519	N=10^0 23.913' E=05^0 27.433'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
23	X=0768975 Y=1150580	N=10^0 23.946' E=05^0 27.396'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000

			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
24	X=0768916	N=10^0 24.044'	SO2	0.00833	8330
	Y=1150761	E=05^0 27.365'	CO	1.0533	1053300
			CL2	0.27	270000
			HCN	0.0026	2600
			NO2	0.01846	18460
			NH2	0.04	40000
			H2S	0.0074	7400
25	X=0768941	N=10^0 23.996'	SO2	**0.0727**	72700
	Y=1150672	E=05^0 27.378'	CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
26	X= 0769153	N=10^0 23.480'	SO2	**0.0727**	72700
	Y=1150402	E=05^0 27.500'	CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
27	X=0769035	N=10^0 24.104'	SO2	1.2	1200000
	Y=1150872	E=05^0 27.430'	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000

			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
28	X=0769046	N=10^0 24.103’	SO2	**0.00833**	8330
	Y=1150870	E=05^0 27.436’	CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
29	X=0768911	N=10^0 24.097’	SO2	**0.00833**	8330
	Y=1150857	E=05^0 27.362’	CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
30	X=0768395	N=10^0 24.061’	SO2	**0.00833**	8330
	Y=1150787	E=05^0 27.080’	CO	**1.0533**	1053300
			CL2	**0.27**	270000
			HCN	**0.0026**	2600
			NO2	**0.01846**	18460
			NH2	**0.04**	40000
			H2S	**0.0074**	7400
31	X= 0768908	N=10^0 24.077’	SO2	1.2	1200000
	Y=1150820	E=05^0 27.360’	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000

			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
32	X=0768568	N=10^0 24.061’	SO2	1.2	1200000
	Y=1150789	E=05^0 27.173’	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
33	X=0769271	N=10^0 24.040’	SO2	0.0081	8100
	Y=1150756	E=05^0 27.559’	CO	0.007	7000
			CL2	0.03	30000
			HCN	0.001	1000
			NO2	0.031	31000
			NH2	0.01	10000
			H2S	0.0021	2100
34	X=076964	N=10^0 23.916’	SO2	1.2	1200000
	Y=1150530	E=05^0 27.761’	CO	1.52	1520000
			CL2	1.15	1150000
			HCN	0.05	50000
			NO2	0.800	800000
			NH2	0.01	10000
			H2S	0.1	100000
35	X=0769623	N=10^0 23.920’	SO2	**0.0727**	72700
	Y=1150540	E=05^0 27.751’	CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000

			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
36	X=0769591 Y=1150758	N=10^0 24.038' E=05^0 27.737'	SO2	0.013	13000
			CO	0.21	210000
			CL2	0.00	0.00
			HCN	0.002	2000
			NO2	0.072	72000
			NH2	0.013	13000
			H2S	0.01	10000
37	X= 0769652 Y=1150479	N=10^0 23.883' E=05^0 27.766'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
38	X= 0768438 Y=1150795	N=10^0 24.066' E=05^0 27.103'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
39	X=0769536 Y=1150277	N=10^0 23.778' E=05^0 27.702'	SO2	0.013	13000
			CO	0.21	210000
			CL2	0.00	0.00

			HCN	0.002	2000
			NO2	0.072	72000
			NH2	0.013	13000
			H2S	0.01	10000
40	X=0769271 Y=1150828	N=10^0 24.080' E=05^0 27.586'	SO2	0.0081	8100
			CO	0.007	7000
			CL2	0.03	30000
			HCN	0.001	1000
			NO2	0.031	31000
			NH2	0.01	10000
			H2S	0.0021	2100
41	X= 0768359 Y=1150782	N=10^0 24.058' E=05^0 27.062'	SO2	**0.0727**	72700
			CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000
42	X= 0768863 Y=1150993	N=10^0 24.170' E=05^0 27.336'	SO2	0.0727	72700
			CO	0.0051	5100
			CL2	0.0167	16700
			HCN	0.079	79000
			NO2	0.0081	8100
			NH2	0.0133	13300
			H2S	0.095	95000
43	X= 0768819 Y=1150962	N=10^0 24.154' E=05^0 27.313'	SO2	0.0727	72700
			CO	0.0051	5100
			CL2	0.0167	16700

			HCN	0.079	79000
			NO2	0.0081	8100
			NH2	0.0133	13300
			H2S	0.095	95000
44	X= 0769591	N=10^0 23.830’	SO2S	**0.0727**	72700
	Y=1150370	E=05^0 27.733’	CO	**0.0051**	5100
			CL2	**0.0167**	16700
			HCN	**0.079**	79000
			NO2	**0.0081**	8100
			NH2	**0.0133**	13300
			H2S	**0.095**	95000

STATIONS OF INTEREST AT KONTAGORA IDENTIFIED BY THE GPS POINTS

	SOURCES OF GAS	GPS VALUES			VALUES (ppm)			
		UTM VALUE	LOCAL COORD	GAS SAMPLES	1st VALUE	2ND VALUE	3RD VALUE	AVERAGE VALUE
1	ELEMAX GENERATOR SH2900DX	X-771135	N10.4058145	SO2	0.04	0.08	0.12	0.08
				CO	0.03	0.02	0.01	0.02
				CL2	0.30	0.20	0.70	0.40
		Y-1151236		HCN	0.82	0.83	0.82	0.82
			E005.4763223	NO2	0.020	0.010	0.040	0.023
				NH2	0.010	0.020	0.010	0.013
				H2S	0.010	0.000	0.000	0.003
2	WHITE VULCANISING MACHINE	X-771265	N10.4063113	SO2	0.00	0.12	0.00	0.04
				CO	0.38	0.33	0.41	0.5
		Y-1151292		CL2	0.20	0.30	0.30	0.26
				HCN	0.004	0.006	0.003	0.043
			E005.4775128	NO2	0.0075	0.0080	0.0069	0.074
				NH2	0.01	0.0069	0.00	0.01
				H2S	0.0069	0.0068	0.0069	0.068
3	TG2700 GENERATOR	X-771297	N10.4060018	SO2	0.073	0.071	0.074	0.072
				CO	0.75	0.44	0.35	0.51
				CL2	0.03	0.01	0.01	0.17
				HCN	0.00	0.00	0.00	0.00
		Y-1151258		NO2	0.0081	0.0083	0.0080	0.0081
			E005.4780295	NH2	0.001	0.002	0.001	0.010
				H2S	0.098	0.093	0.094	0.006

4	TG2700 GENERATOR	X-771330	N10.4053217	SO2	0.073	0.071	0.074	0.072
				CO	0.75	0.44	0.35	0.51
				CL2	0.03	0.01	0.01	0.17
		Y-1151208		HCN	0.00	0.00	0.00	0.00
			E005.4780983	NO2	0.0081	0.0083	0.0080	0.0081
				NH2	0.001	0.002	0.001	0.010
				H2S	0.098	0.093	0.094	0.006
5	JOHN HOLTS GENERATOR	X-771388	N10.405399	SO2	0.00731	0.00732	0.00734	0.00733
				CO	0.03	0.03	0.04	0.03333
				CL2	0.2	0.3	0.1	0.2
		Y-1151192	E005.4786283	HCN	0.00	0.001	0.001	0.006667
				NO2	0.038	0.0389	0.0382	0.03837
				NH2	0.00	0.00	0.00	0.00
				H2S	0.00	0.00	0.00	0.00
6	TIGER950	X-771454	N10.4052045	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.06
		Y-115118		CL2	0.02	0.04	0.03	0.03
			E005.4792292	HCN	0.001	0.002	0.001	0.001
				NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.01
				H2S	0.0023	0.0021	0.00000	0.0015
7	TIGER950	X-771524	N10.4054797	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.06
				CL2	0.02	0.04	0.03	0.03
				HCN	0.001	0.002	0.001	0.001
		Y-1151202		NO2	0.0032	0.0030	0.0032	0.0031
			E005.4798704	NH2	0.02	0.01		0.01
				H2S	0.0023	0.0021	0.00000	0.0015

8	TIGER950	X-771508 Y-1151238	N-10.4058062 E005.4797269	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.06
				CL2	0.02	0.04	0.03	0.03
				HCN	0.001	0.002	0.001	0.001
				NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.01
				H2S	0.0023	0.0021	0.00000	0.0015
9	MIKANO GENERAROR	X-769157 Y-1150857	N10.4025286 E 005.4582415	SO2	0.0081	0.0082	0.0081	0.0081
				CO	0.620	0.710	0.430	0.586
				CL2	0.001	0.003	0.000	0.001
				HCN	0.0081	0.0083	0.0082	0.081
				NO2	0.035	0.034	0.030	0.033
				NH2	0.000	0.001	0.002	0.001
				H2S	0.020	0.020	0.000	0.013
10	DELIO REMY GENERATOR	X-767093 Y-1150838	N10.4025017 E005.439410	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.009	0.007	0.005	0.007
				CL2	0.02	0.04	0.003	0.003
				HCN	0.001	0.002	0.001	0.0013
				NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.015
				H2S	0.0023	0.0021	0.0021	0.0022
11	YAMAHA GENERATOR	X-768550 Y-1150690	N005.4394014	SO2	0.073	0.071	0.074	0.218
				CO	0.750.	0.440	0.350	1.540
				CL2	0.400	0.020	0.20	0.21
				HCN	0.00	0.00	0.00	0.00
				NO2	0.0082	0.0084	0.0079	0.0245

			E10.4025016	NH2	0.010	0.020	0.010	0.040
				H2S	0.098	0.094	0.093	0.285
12	TIGER 950 GENERATOR	X-768502	N10.4019238	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
		Y-1150785		HCN	0.001	0.002	0.001	0.0013
			E005.452258	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.01
				H2S	0.0023	0.0021	0.00000	0.0015
13	TIGER 950 GENERATOR	X-768790	N005.4548907	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
		Y-1150840		HCN	0.001	0.002	0.001	0.0013
			E10.4004007	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01		0.01
				H2S	0.0023	0.0021	0.00000	0.0015
14	GIBSON GENERATOR	X-768110	N10.4022675	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.009	0.007	0.005	0.007
				CL2	0.02	0.04	0.003	0.003
		Y-1150820		HCN	0.001	0.002	0.001	0.0013
			E005.4486827	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01		0.015
				H2S	0.0023	0.0021	0.0021	0.0022
15	MIKANO GENERATOR	X-768632	N10.4073922	SO2	0.0081	0.0082	0.0081	
				CO	0.620	0.710	0.430	
				CL2	0.001	0.003	0.000	
		Y-1150833		HCN	0.0081	0.0083	0.000	

			E005.47564 1	NO2	0.035	0.034	0.030	
				NH2	0.000	0.001		
				H2S	0.020	0.020	0.000	
16	TIGER 750 GENERA TOR	X-771072	N10.406279 3	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
		Y-1151286		HCN	0.001	0.002	0.001	0.0013
			E005.47464 64	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01		0.01
				H2S	0.0023	0.0021	0.00000	0.0015
17	TIGER 950 GENERA TOR	X-770935	N10.406271 4	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
		Y-1151285		CL2	0.02	0.04	0.03	0.033
				HCN	0.001	0.002	0.001	0.0013
			E005.47450 03	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01		0.01
				H2S	0.0023	0.0021	0.00000	0.0015
18	TIGER 950 GENERA TOR	X-770901	N10.406291 8	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
		Y-1151287		HCN	0.001	0.002	0.001	0.0013
			E005.47419 01	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.01
				H2S	0.0023	0.0021	0.00000	0.0015
19	JUMBO GENERA TOR	X-770874	N10.406230 5	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.009	0.007	0.005	0.007
				CL2	0.02	0.04	0.003	0.003

		Y-1151280	E005.4739432	HCN	0.001	0.002	0.001	0.0013
				NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.015
				H2S	0.0023	0.0021	0.0021	0.0022
20	LISTER GENERATOR	X-770839	N10.4013881	SO2	0.0083	0.0082	0.0083	0.0082
				CO	0.030	0.020	0.010	0.020
				CL2	0.100	0.030	0.040	0.056
				HCN	0.001	0.002	0.003	0.002
		Y-1151217		NO2	0.150	0.140	0.130	0.14
				NH2	0.010	0.0000	0.000	0.0033
			E005.4736193	H2S	0.040	0.003	0.020	0.003
21	TIGER 950 GENERATOR	X-770820	N10.4056650	SO2	0.0081	0.0080	0.0082	0.0081
				CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
		Y-1151217		HCN	0.001	0.002	0.001	0.0013
			E005.4734459	NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01		0.01
				H2S	0.0023	0.0021	0.00000	0.0015
22	WHITE VULCANISIG MACHINE	X-770538	N10.4014467	SO2	0.00	0.12	0.00	0.04
				CO	0.38	0.33	0.41	0.37
				CL2	0.20	0.30	0.30	0.266
		Y-1150748		HCN	0.004	0.006	0.003	0.0043
			E005.4708386	NO2	0.0075	0.0080	0.0069	0.0074
				NH2	0.01	0.0069	0.00	0.0056
				H2S	0.0069	0.00	0.00	0.0023
23		X-770632		SO2	0.0081	0.0080	0.0082	0.0081

	TIGER 950 GENERATOR	Y-1150745	N10.4014129 E005.4716963	CO	0.05	0.04	0.03	0.04
				CL2	0.02	0.04	0.03	0.033
				HCN	0.001	0.002	0.001	0.0013
				NO2	0.0032	0.0030	0.0032	0.0031
				NH2	0.02	0.01	0.00	0.01
				H2S	0.0023	0.0021	0.00000	0.0015
24	SUZUKI GENERATOR	X-770877 Y-1150789	N10.4013662 E-005.4739384	SO2	0.004	0.008	0.012	0.08
				CO	0.03	0.02	0.01	0.02
				CL2	0.30	0.20	0.70	0.4
				HCN	0.0082	0.0083	0.0082	0.0082
				NO2	0.02	0.01	0.04	0.02
				NH2	0.01	0.02	0.01	0.01
				H2S	0.01	0.0	0.0	0.0033
25	FUMES FROM COAL POT			SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
26	FUMES FROM CORN SELLER			SO2	0.0013	0.0012	0.0013	0.0012
				CO	0.06	0.05	0.03	0.0466
				CL2	0.2	0.3	0.0	0.166
				HCN	0.001	0.003	0.00	0.0013
				NO2	0.0024	0.0023	0.0026	0.0024
				NH2	0.01	0.02	0.01	0.0133
				H2S	0.0084	0.0080	0.0082	0.0082

27	FUMES FROM MAI-SUYA			SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
28	FUMES FROM MAI-TEA			SO2	0.0013	0.0012	0.0013	0.0012
				CO	0.06	0.05	0.03	0.0466
				CL2	0.2	0.3	0.0	0.166
				HCN	0.001	0.003	0.00	0.0013
				NO2	0.0024	0.0023	0.0026	0.0024
				NH2	0.01	0.02	0.01	0.0133
				H2S	0.0024	0.0080	0.0082	0.0082
29	FUMES FROM COAL POT			SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
30	FUMES FROM MAI-SUYA	X: 0828560 Y: 1006850	N: 11.9886941 E: 009.0970849	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330

				H2S	0.0010	0.003	0.002	0.002
31	FUMES FROM COAL POT	X: 0828617 Y: 1006851	N: 11.9892122 E: 009.0970896	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
32	FUMES FROM CORN SELLER	X: 0828656 Y: 1006879	N: 1.9895687 E: 009.0973397	SO2	1.2	1.2	1.2	1.2
				CO	1.52	1.54	1.55	1.536
				CL2	1.1	0.03	0.08	0.40
				HCN	0.08	0.02	0.06	0.05
				NO2	0.792	0.800	0.800	0.796
				NH2	0.01	0.01	0.01	0.01
				H2S	0.02	0.00	0.00	0.01
33	FLAMES/ FUMES FROM TOYOTA WORKSHOP	X: 0828683 Y: 1006907	N: 11.9898162 E: 009.0975906	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
34	FUMES FROM CORN SELLER	X: 0828696 Y: 1006882	N: 11.9899324 E: 009.0973638	SO2	1.2	1.2	1.2	1.2
				CO	1.52	1.54	1.55	1.536
				CL2	1.1	0.03	0.08	0.40
				HCN	0.08	0.02	0.06	0.05
				NO2	0.792	0.800	0.800	0.796

				NH2	0.01	0.01	0.01	0.01
				H2S	0.02	0.00	0.00	0.01
35	FUMES FROM WELDERS WORKSHOP	X: 0828739 Y: 1006853	N: 11.990321 E: 009.0970986	SO2	1.2	1.2	1.2	1.2
				CO	1.52	1.54	1.55	1.536
				CL2	1.1	0.03	0.08	0.40
				HCN	0.08	0.02	0.06	0.05
				NO2	0.792	0.800	0.800	0.796
				NH2	0.01	0.01	0.01	0.01
				H2S	0.02	0.00	0.00	0.01
36	STOVES	X: 0828628 Y: 1006858	N: 11.9893127 E: 009.097152	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
37	FUMES FROM CORN SELLER	X: 0828772 Y: 1006848	N: 11.9906206 E: 009.097051	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
38	FUMES FROM FIRE WOOD	X: 0828806 Y: 1006875	N: 11.9909302 E: 009.0971297	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033

	COOKING			NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002
39	FUMES FROM MAI-TEA	X: 0828849 Y: 1006838	N: 11.9913196 E: 009.0969549	SO2	0.0013	0.0012	0.0013	0.0012
				CO	0.06	0.05	0.03	0.0466
				CL2	0.2	0.3	0.0	0.166
				HCN	0.001	0.003	0.00	0.0013
				NO2	0.0024	0.0023	0.0026	0.0024
				NH2	0.01	0.02	0.01	0.0133
				H2S	0.0084	0.0080	0.0082	0.0082
40	FUMES FROM MAI SUYA.	X: 0828887 Y: 1006859	N: 11.9916665 E: 009.0971418	SO2	0.0089	0.0073	0.0077	0.0077
				CO	10.000	11.000	12.000	11.000
				CL2	0.0300	0.020	0.040	0.0030
				HCN	0.0035	0.0035	0.0032	0.0033
				NO2	0.0034	0.0037	0.0031	0.0034
				NH2	1.0000	2.000	4.000	2.330
				H2S	0.0010	0.003	0.002	0.002