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Impact of urban informal enterprises on air pollution in Ibadan, Nigeria

Olajoke Abolade *, A.T. Adeboyejo

Department of URP LAUTECH, Ogbomoso, Nigeria

Abstract

Contrary to generally held believe of contributions of Urban Informal Enterprises (UIE) to urban economy, this paper provides empirical evidence for environmental negativities associated with the informal sector in a pre-colonial African city, Ibadan, Nigeria. The paper measures varying levels of concentration of four gaseous pollutants: SO_2, NO_2, VO and NH4 generated by twenty (20) UIEs in fifty two (52) locations within four randomly selected LGAs in Ibadan. The gaseous pollutants were measured using Triple plus scientific microprocessor. The concentrations of pollutant were mapped to reveal the spatial pattern. The results show that SO_2, VO, and NO_2 generated from most of UIEs were significantly high and above the permissible recommended (FEPA and USEPA) level. The study recommends among others, that location of urban informal enterprises particularly in spaces that are incongruous to other land uses should be strictly discouraged. This can be achieved through implementation of development control measures as well as formulations of new policies and legislations that will accommodate and regulate the operations of UIEs with negative impact on the environment. This will irrefutably promote sustainable environment.

Keywords: Urban Informal Enterprises, Environment, Pollutant, Sustainability, Spatial Pattern

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* Corresponding author. *E-mail address:* robjoke2001@yahoo.com

1. Introduction

There exist voluminous literature and myriads of information on informal enterprises (Sethuraman 1976, Perera et al. 1996; Harts, 1973; Oni, 2001; Ijaiya, 2002; Menyah, 2009; Onyechere, 2011). However, most studies on urban informal enterprises have focused on its contributions to growth of urban economy especially its contribution to poverty alleviation among low income earners (Akerele, 2000; Ijaiya, 2002; Umar, 2004; Igbenedor, 1987; Olokesusi 1999). Some studies examined either the employment prospects of informal sector trainees as in South Western Nigeria (Oni, 2001; Harts, 1973), or the impact of forced population relocation on urban informal sector (Olokesusi, 1999). Attempts have also been used to examine the physical planning implications of UIEs , particularly the incidence of informal sector enterprises in the urban residential zone; (Onyebueke, 2000; Adeyinka 2006); urban land use planning and land use classification and informal sector syndrome (Okeke, 2000; Jelili and Adedibu, 2005); the urban informal sector; concepts, measurements and policy (Sethuraman, 1976); among others. It is however observed that past studies offer preliminary tool for the development of this type of framework and none has explicitly employed the experimental field investigation and laboratory analysis of the environmental negativities associated with increasing proliferation of UIEs in the country. This is the major preoccupation of this paper.

The sporadic location and ubiquitous distribution of informal enterprises coupled with its haphazard development is undoubtedly a significant factor contributing to the deplorable condition of the urban environment. Environmental degradation arising from indiscriminate disposal of waste, amorphous development of informal enterprises among others is a major characteristic of metropolitan cities in the world particularly the developing nations, where population growth, as well as the rate of urbanization is very rapid and alarming.

Most of man induced activities has led to changes or alteration in the bio-physical components of the environment. This is often caused by introduction of potentially harmful substances, impurities and unwanted materials in large volume than what the environment can accommodate (Umeh and Uchegbu, 1997). According to Faniran and Adeboyejo (1999) Nigerian environment is 'threatened" both as a result of uncontrolled or uncontrollable urban development and by operational procedures of different man's activities like industrialization, mining, agriculture, economic activities both formal and informal. Consequently, city environment especially in developing countries have incessantly been confronted by a plethora of problems which make them less conducive to healthy living (Afon, 2006). Amongst these problems, is the accelerating growth of municipal waste disposal emanating from various human activities, particularly waste from informal enterprises. According to Onyenchere (2011), waste generation and disposal, most especially from informal enterprises, is now one of the most conspicuous environmental problems of Africa's urban areas. The generation of wastes from discarded pure water bottles and sachets by hawkers/vendors coupled with gaseous and related pollutants from operational procedures and use of biogas fuel from informal enterprises is growing steadily and causing threat to the environment. This increase is not only in terms of quantity but also in its varieties, components and level of concentration. These also include its changing biodegradability and toxicity. The complexity of this problem is hinged on

unorganized and indiscriminate location of informal enterprises which often pose a great difficulty and stress to the entire environment.

Against this background of unrecognized problem but very important environmental upheaval, this paper investigate empirically, the contributions of UIEs to air pollution in a cosmopolitan city in Africa that is witnessing unprecedented increase in the proliferation of urban informal enterprise.

2. Literature Background

Attention to and information on environmental impact of informal enterprises seems to be minimal in both old and current research works. Even though Onibokun (1995) remarked that the entire research conducted in Nigeria as at 1990 on informal sector accounts for only 1.1 percent of publications on urban affairs in the country. Today, studies on this subject are still scanty and deficient in adequate empirical information particularly its environmental effect (Onyechere 2011; Onibokun et al., 1995). Most studies (Perera and Amin, 1996; Lubell, 1991; Mubvani, 1992) have been concerned with the environment and management nexus and consequently conducted studies on incorporating informal enterprises as a strategy for environmental management. According to Onyebueke (2000) much more research is needed on the subject in order to expand its usefulness in urban planning and policy formulation.

The infiltration of informal sector has turned out to be an environmental tragedy and its land use implications present a considerable challenge to urban land use planning in Nigeria, even though it contributes to poverty alleviation (Okeke, 2000). He argues further that the operation of informal enterprises has defied urban land use planning and consequently defaced the urban landscape. This often results to health hazards, environmental pollution and filthy or unsanitary condition of the environment, and sometimes contributes to outbreak of diseases thus constituting serious threat to human life. This occurrence is predominant in urban environment of less developed countries. Akin to this, Onyechere (2011) vehemently maintained that despite the contribution of the sector to job creation , and to the boosting of the nation economy, more importantly there is need to ascertain the possibility of eventual saturation of the sector and to determine the rate of its accompanying degradation on the environment. He argued further that there is need not only to fathom which subsector degrades the environment most but to determine which component is most degraded vis- a vis land, water, and air. This is one of the major concerns of this paper. Again, most of the structures housing urban informal enterprises either obstruct or confuse the original plan of the environment where it exit and thus constitute an eyesore to the environment. This is particularly true of urban areas such as Ibadan metropolis the context of this study.

3. Materials and Methods

The study utilized primary data. The primary data adopted was actual measurement of gaseous pollutants emitted during the operational procedures of selected Urban Informal Enterprises in the study area. This

comprises of four different gaseous pollutants: Sulphur dioxide (SO_2), Nitrogen Dioxide (NO_2), Volatile Organics (VO) and Ammonia (NH_3) measured in ambient environment from four randomly selected LGAs. Global Position System (GPS) was used to determine the sampling locations as presented in Figure 1. A total of fifteen locations representing at least five urban informal enterprises in category of commercial /petty trading, tertiary services and cottage industry in each of the four selected local government areas totaling sixty locations were considered for sampling. This was considered adequate because of the exorbitant price of survey equipment as well as uncooperative attitudes of operators since majority of the operators were hostile to taking measurement and samples from their workshops. This was premised on fear of insecurity of business due to African culture. However, a total of fifty two (52) locations were successfully sampled. This represents 86.7% of the sample size. The concentrations of Sulphur (IV) Oxide (SO_2) Nitrogen (IV) Oxide (NO_2), Volatile Organics (VO), Ammonia (NH_3) were determined with the use of Triple Plus + Multigas Detector. It is a microprocessor controlled portable multigas detector (Plate 1). It is designed to monitor four types of gas simultaneously and provide warning of hazardous levels. The instrument was placed at the point of discharge of fumes from each selected Urban Informal Enterprises particularly those that emit gaseous pollutants for short Term Weighted Average (TWA) i.e. 15-30 minutes. The instantaneous read out concentrations of the monitored gasses were displayed on the screen with unit of measurement as part per million (ppm). The short term limit was employed for this study to capture the actual concentration of pollutant emitted by the various categories of Urban Informal Enterprises before diffusion. This duration is acceptable since the instrument is designed to capture Short Term Weighted Average.

Plate 1. Triple Plus + Multigas Detector (Authors' Field Survey, 2011)

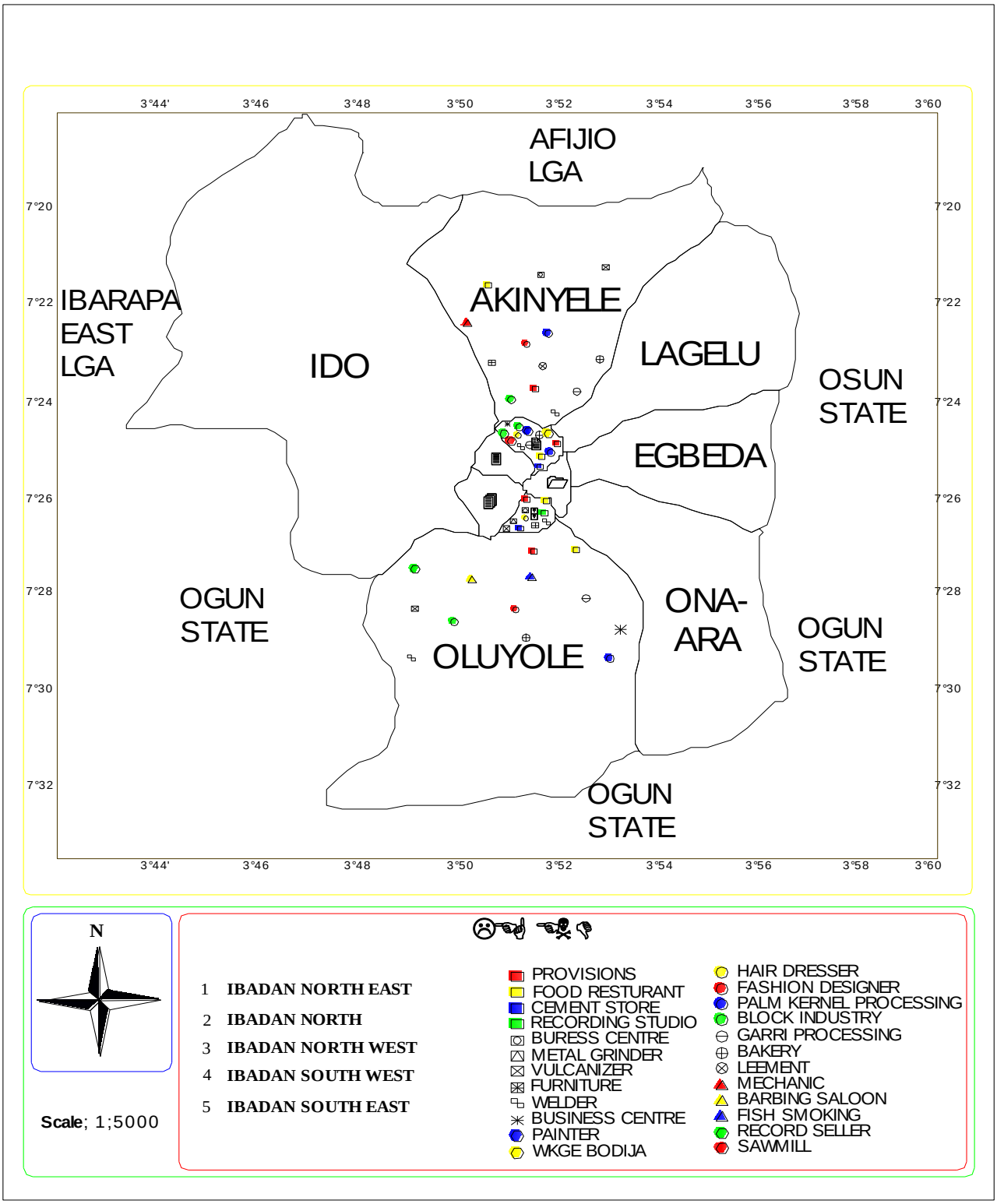

Figure 1. Sampling Locations of Urban Informal Enterprises (Authors' Field Survey, 2011)

4. Results and Discussion

The overall average of concentration of Sulphur (1V) Oxide ($S0_2$) for monitored Urban Informal Enterprises varied across selected LGAs considered for survey. This also varied among sampling locations and days considered for sampling (i.e weekday and weekend). The highest calculated overall average concentration was recorded for Ibadan South East (8.98mg/m3) while the minimum was recorded for Ibadan North (0.37mg/m^3). Similarly, it was observed that few Urban Informal Enterprises during the weekday recorded extremely high concentration of SO_2. This varied across space and types of activities. For instance in Ibadan South East, hair dressing (94.2mg/m^3), metal grinding (54.72mg/m^3), vulcanizing (2.62mg/m^3) recorded very high concentration of SO_2 when compared with permissible level of 0.52mg/m^3. The result also shows that those engaged in business center, fashion designing, welding and cassava processing recorded same concentration of 2.6 mg/m^3 in Akinyele LGA. Again, in Oluyole and Ibadan North some UIEs (furniture, cassava processing and Vulcanizing) recorded very high concentration that is higher than the permissible level of ambient air quality. This concentration is in line with expectation because of the combustion process involved during operation which involves use of fuel (like charcoal, diesel or petroleum) generates SO_2 that contains sulphur. It has been argued that sulphur dioxide affects respiratory system and aggravates cardiovascular disease (Khitoliya, 2004) and that it can cause acid rain which can harm humans and vegetation as well as erode buildings.

Nitrogen (IV) Oxide (NO_2) contributes significantly to air pollution and ambient air quality Khitoliya (2004). The result of the concentration of gaseous pollutant as obtained in the field survey within the four Local Government Areas is summarized in Table 2. The value of overall average concentration reveals high concentration when compared with permissible tolerance limits of (0.0085mg/m3). It observed that the concentration of Nitrogen (IV) Oxides (NO_2) for all the categories of informal enterprise in Akinyele LGA ranges from 0 to 3.8 mg/m^3. The highest concentration (3.8 mg/m^3) was recorded for block industry and furniture workshop. This is followed by high concentration (3.0 mg/m^3) observed for provision store, cement store and mechanic workshop. The high concentration recorded for cement and block making industry is justified since waste generated from these sources is mostly dust which is a major source of NO_2.

Similarly, the results of gaseous pollutants monitored in Ibadan North as summarized in the Table 2 reveals that the concentration of Nitrogen (IV) Oxide (NO_2) ranges from 0 mg/m^3 -4.9 mg/m^3. The highest concentration was observed for recording studio (4.9 mg/m^3) and mechanic workshop (3.6mg/m^3).This is followed by sawmill, welding block industry (3.4 mg/m^3) each and provision store, food restaurant, cement store business centre with concentration of 3.0 mg/m^3 each. Others are cassava processing (3.2 mg/m^3), bakery (3.2 mg/m^3) and palm kernel (2.8mg/m^3). This concentration is high when compared with permissible tolerance limits of (0.00085mg/m^3). Consequently, the air quality index shows that the air quality of the sampling locations is poor because of the presence of NO_2. The high concentration of this pollutant is because most operators employ fairly used machines for their operations. Most of the generating plants are “tokunbo” (imported fairly used) this are relatively old and smoky machines which in most cases not properly maintained. It was also observed that dust generated from the cement store is a major source of this gaseous pollutant.

Table 1. Spatial Variation in Concentration of Sulphur (IV) Oxide

S/N	Sampling Areas	UIEs	SO_2(ppmmg/m^3)							
			WKD	WKED	WKD	WKED	WKD	WKED	WKD	WKED
			Ibadan South East		Akinyele		Ibadan North		Oluyole	
1	SP_1	Provision Store	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
2	SP_2	Food Rest	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	10(26.2)	2(5.3)
3	Sp_3	Fish Smoking	Nil	Nil	Nil	Nil	Nil	Nil	10(26.2)	4(10.5)
4	SP_4	Cement Store	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	Nil	Nil
5	SP_5	Recorded Studio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2(5.2)	1(02.6)
6	SP_6	Business Center	0(0)	0(0)	1(2.6)	0(0)	0(0)	0(0)	1(2.6)	0(0)
7	SP_7	Mechanic	Nil	Nil	0(0)	0(0)	1.0(2.6)	0(0)	Nil	Nil
8	SP_8	Painting	Nil	Nil	Nil	Nil	0(0)	0(0)	Nil	Nil
9	SP_9	Sawmill	Nil	Nil	Nil	Nil	0(0)	0(0)	Nil	Nil
10	SP_{10}	Fashion designing	Nil	Nil	1(2.6)	0(0)	Nil	Nil	0(0)	0(0)
11	SP_{11}	Metal Grinding	20.9 (54,7)	Nil	Nil	Nil	Nil	Nil	Nil	Nil
12	Sp_{12}	Vulcanizing	1(2.6)	0(0)	1(2.6)	2(5.2)	Nil	Nil	0(0)	0(0)
13	SP_{13}	Furniture	0(0)	0(0)	0(0)	0(0)	Nil	Nil	2(5.2)	1(2.6)
14	Sp_{14}	Welding	0(0)	0(0)	1(2.6)	0(0)	0(0)	0(0)	0(0)	0(0)
15	Sp_{15}	Barbing Saloon	Nil	Nil	Nil	Nil	Nil	Nil	0(0)	0(0)
16	Sp_{16}	Hair Dressing	36(94.2)	11(28.8)	Nil	Nil	1.0(2.6)	0(0)	Nil	Nil
17	Sp_{17}	Cassava processing	Nil	Nil	1(2.6)	0(0)	0(0)	0(0)	1(2.6)	0(0)
18	Sp_{18}	Block Industry	Nil	Nil	0(0)	0(0)	0(0)	0(0)	0(0) 0(0)	0(0)
19	Sp_{19}	Palm Kernel	Nil	Nil	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
20	Sp_{20}	Bakery	Nil	Nil	Nil	Nil	0(0)	0(0)	0(0)	0(0)
			5.79(15.5)	1.18(2.8)	0.38(1.0)	0.15(0.4)	0.14(0.7)	0.0(0.0)	1.86(4.)	0.57(1.0)
Overall Average (OVA)			3.49 (8.98)		0.22 (0.7)		0.14 (0.37)		1.22 (3.18)	

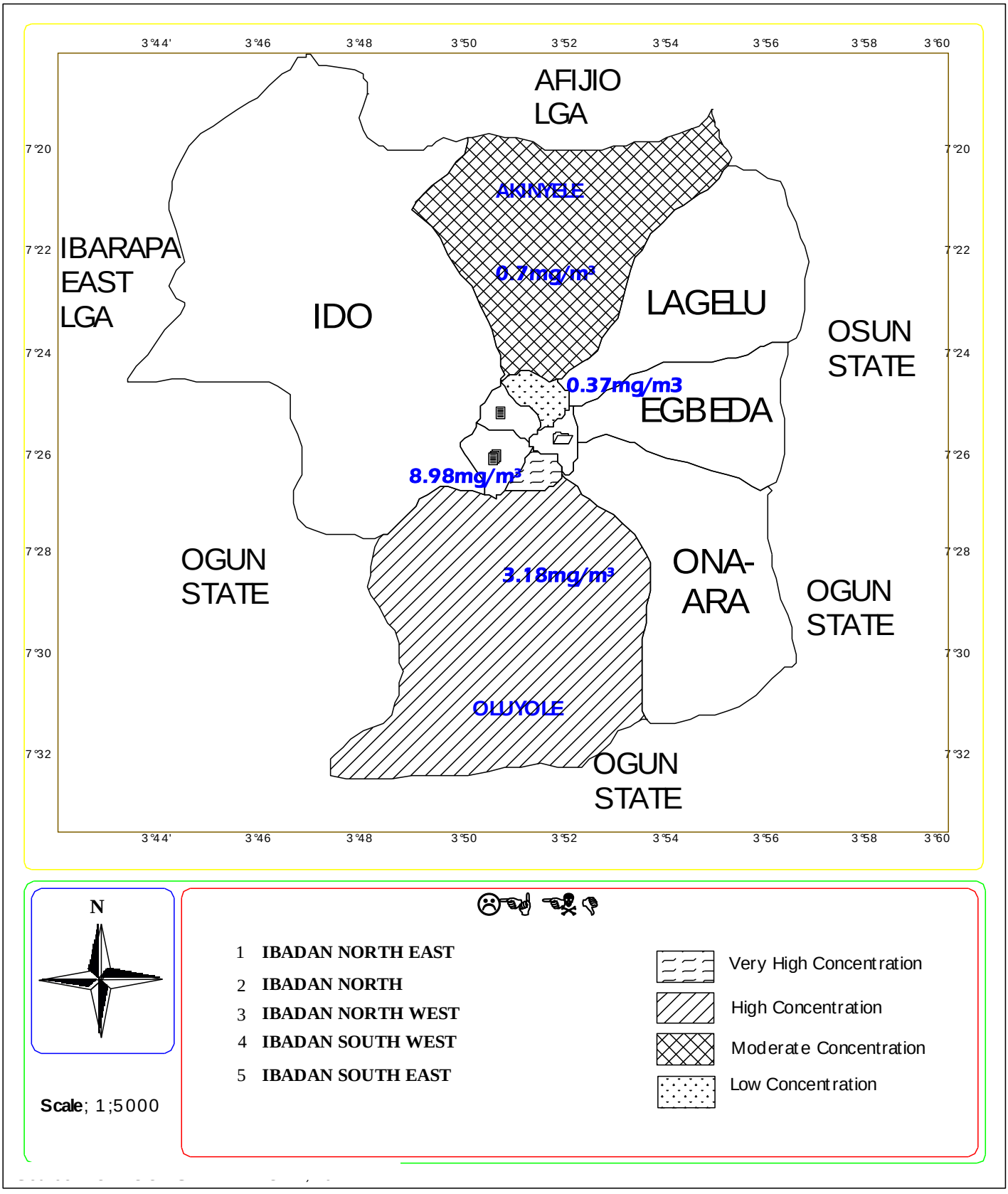

Figure 2. Spatial variation in concentration of Sulphur Dioxide (Authors' Field Survey, 2011)

Table 2. Spatial variation in concentration of Nitrogen (IV) Oxide

S/N	Sampling Area	UIEs	NO_2(ppm,mg/m^3)							
			WKD	WKED	WKD	WKED	WKD	WKED	WKD	WKED
			Ibadan South East		Akinyele		Ibadan North		Oluyole	
1	SP_1	Prov/Store	0(0)	0(0)	1.6(3.0)	1(1.9)	1.6(3.0)	1.6(3.)	0(0)	0(0)
2	P_2	Food Rest	1(1.9)	0(0)	0(0)	0(0)	1.6(3.0)	0(0)	1.3(2.4)	1.3(2.4
3	Sp_3	Fish Smoking	Nil	Nil	Nil	Nil	Nil	Nil	1(1.8)	1(1.8)
4	SP_4	Cement Store	2(3.8)	1(1.9)	1.6(3.0)	0(0)	1.6(3.0)	1.6(3.)	Nil	Nil
5	SP_5	Recorded Studio	2(3.8)	1(1.9)	0(0)	0(0)	2.6(4.9)	1.6(3.)	0(0)	0(0)
6	SP_6	Business Center	2(3.8)	1(1.9)	1.3(2.4)	0(0)	1.6(3.0)	1.6(3.)	1.3(2.4)	1.3(2.4)
7	SP_7	Mechanic	Nil	Nil	1.6(3.0)	0(0)	1.9(3.6)	0(0)	Nil	Nil
8	SP_8	Painting	Nil	Nil	Nil	Nil	0(0)	0(0)	Nil	Nil
9	SP_9	Sawmill	Nil	Nil	Nil	Nil	1.8(3.4	0(0)	Nil	Nil
10	SP_{10}	Fashion/design	Nil	Nil	1.3(2.4)	0(0)	Nil	Nil	0(0)	0(0)
11	SP_{11}	Metal Grinding	1(1.9)	0(0)	Nil	Nil	Nil	Nil	Nil	Nil
12	Sp_{12}	Vulcanizing	1(1.9)	0(0)	1(1.9)	1.3(2.4)	Nil	Nil	1(0)	0(0)
13	SP_{13}	Furniture	0(0)	0(0)	2(3.8)	0(0)	Nil	Nil	0(0)	0(0)
14	Sp_{14}	Welding	1(1.9)	0(0)	1.3(2.4)	0(0)	1.8(3.4)	0(0)	0(0)	0(0)
15	Sp_{15}	Barbing Saloon	Nil	Nil	Nil	Nil	Nil	Nil	0(0)	0(0)
16	Sp_{16}	Hair Dressing	0(0)	0(0)	Nil	Nil	1.6(3.0)	0(0)	Nil	Nil
17	Sp_{17}	Cassava processg	Nil	Nil	3(2.4)	1.3(2.4)	1.7(3.2)	1(1.9)	1.3(2.4)	1.3(2.4)
18	Sp_{18}	Block Industry	Nil	Nil	2(3.8)	0(0)	1.8(3.4)	1(1.9)	1.6 (3.0)	0(0)
19	Sp_{19}	Palm Kernel	Nil	Nil	3(2.4)	2(3.8)	1.5(2.8)	1(1.9)	1.6 (3.0)	0(0)
20	Sp_{20}	Bakery	Nil	Nil	Nil	Nil	1.7(3.2)	0(0)	1.6 (3.0)	1.3(2.4)
Overall Average (OVA)			1.0(1.9)	0.3(0.5)	1.5(2.3)	0.807.4	1.74(3.3)	0.67(1.3)	0.69(1.29)	0.44(0.81)
			0.65(1.22)		1.15 (4.85)		1.21 (2.27)		0.57(1.05)	

Source: Author's Field Survey (2011)

WKD=Weekend, WKED=Weekend

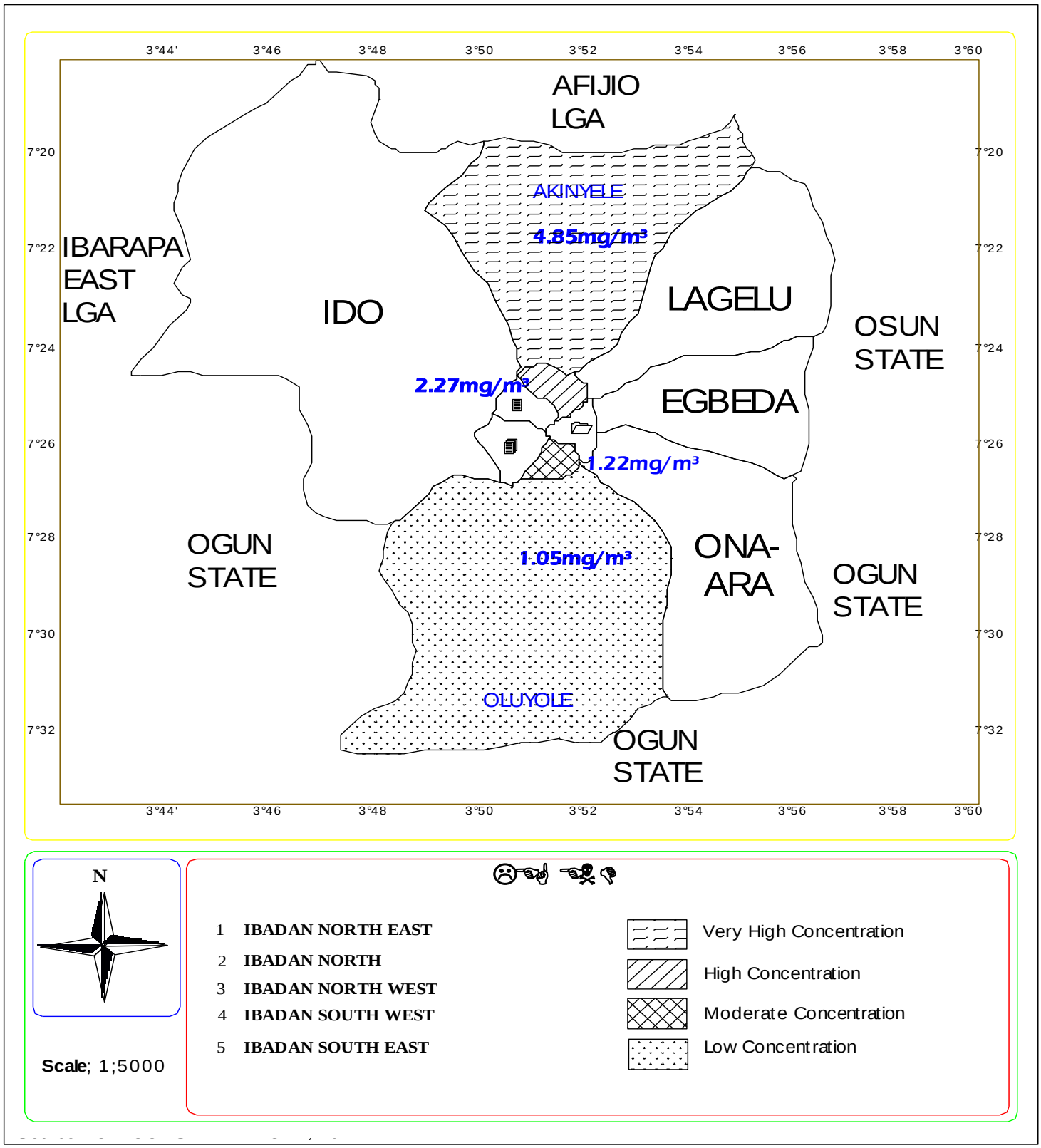

Figure 3. Spatial variation in concentration of Ammonia (Authors' Field Survey, 2011)

Volatile organic compound is of environmental concern because it is very injurious to human health when inhaled. The concentration of Volatile Organic (VO) for all the sampled urban informal enterprises was extremely high when compared with permissible hair quality standard of 1.9ppm. Comparison of the concentration spatially, also reveals varying level of high concentration in all the LGAs. The highest concentration was recorded for Oluyole LGA (132.32ppm), and the minimum was recorded for Ibadan North (89.32ppm) (Figure 4). With extremely high concentration of Volatile Organics, it is therefore apparent that ambient air quality of the respective locations is very poor. This will undoubtedly affect the inhabitants in these locations. The underlying factor responsible for very high concentration in Oluyole LGA is probably the agglomeration of industries such as which also attracted other informal enterprise. Generally, the most significant factor responsible for these is the unburned hydrocarbons from big plants or machine used in some of these industries coupled with exhaust of automobile vehicles as well as Urban Informal Enterprises that use, heavy appliances including generators of varying sizes and capacity that run on petroleum or diesel fuel. Much of this pollution results from the evaporation of gasoline from carburetors, generator heavy machines such as the one used for milling. With high concentration of Volatile Organic compounds in all the sampling locations, it is evident that all informal enterprises operators and residents particularly those that locate or reside along major roads and road interjections are susceptible to danger of being affected with cancer since they have direct contact with this pollutant .Those that patronize this affected locations are not exempted from this risk.

The concentration of Ammonia (NH_3) for most of the Urban Informal Enterprises sampled either for weekday or weekend is not significant. The overall average values for the four LGAs varied in concentration. These ranged between 0.025mg/m3-0.34mg/m3. It was however observed that only Akinyele LGAs recorded significant (0.34mg/m3) concentration that is above permissible tolerance limits (0.2mg/m3). The remaining three LGAs recorded a lower concentration. However, in Akinyele local government area, three Informal Enterprises sampled for cottage industry (i.e. palm kernel, block industry and cassava processing) recorded a very high concentration that breached the air quality standard. Similarly, the concentration of Ammonia associated with processing of palm kernel (0.7 mg/m3) in Ibadan North and cassava processing (2.8mg/m3) in Oluyole LGA was equally above the permissible level when compared with the ambient air quality standard and air quality index limit (0.2mg/m^3). The concentration recorded for Ammonia (NH_3) is expected since waste from palm kernel undergo decomposition processes that emits odour most especially when the sludge are left in the storage tank without proper disposal and treatment. Comparing the Overall Average Values with air quality standard and air quality index rating, only Akinyele LGA was observed to record poor air quality with respect to locations sampled as illustrated in Figure 5.

Table 3. Spatial Variation in Concentration of Volatile Gases

S/N	Sampl Areas	Samps	VO(ppm mg/m^3)							
			WKD	WKED	WKD	WKED	WKD	WKED	WKD	WKED
			Ibadan South East		Akinyele		Ibadan North		Oluyole	
1	SP_1	Provision/Store	137	137	137	2	137	137	137	137
2	SP_2	Food Rest	137	137	6	7	4	2	137	136
3	Sp_3	Fish Smoking	Nil	Nil	Nil	Nil	Nil	Nil	137	136
4	SP_4	Cement Store	137	137	137	137	137	137	Nil	Nil
5	SP_5	Recorded Studio	10	137	137	137	137	137	10	137
6	SP_6	Business Center	137	137	137	137	137	137	137	137
7	SP_7	Mechanic	Nil	Nil	137	2	137	9	Nil	Nil
8	SP_8	Painting	Nil	Nil	Nil	Nil	137	137	Nil	Nil
9	SP_9	Sawmill	Nil	Nil	Nil	Nil	137	137		
10	SP_{10}	Fashion designing	Nil	Nil	137	2	Nil	Nil	137	137
11	SP_{11}	Metal Grinding	137	137	Nil	Nil	Nil	Nil	Nil	Nil
12	Sp_{12}	Vulcanizing	137	137	137	137	Nil	Nil	137	137
13	SP_{13}	Furniture	137	137	137	1	Nil	Nil	137	135
14	Sp_{14}	Welding	137	137	137	5	5	1	137	137
15	Sp_{15}	Barbing Saloon	Nil	Nil	Nil	Nil	Nil	Nil	137	137
16	Sp_{16}	Hair Dressing	137	137	Nil	Nil	137	1	Nil	Nil
17	Sp_{17}	Cassava processing	Nil	Nil	137	5	137	137	137	137
18	Sp_{18}	Block Industry	Nil	Nil	137	137	5	3	137	137
19	Sp_{19}	Palm Kernel	Nil	Nil	137	10	137	137	137	137
20	Sp_{20}	Bakery	Nil	Nil	Nil	Nil	4	1	137	137
			124.3	137	129.9	55.3	79.2	79.5	127.92	136.71
21	Overall Average (OVA)		130.7		92.6		89.32		132.32	

Source: Author's Field Survey (2011)

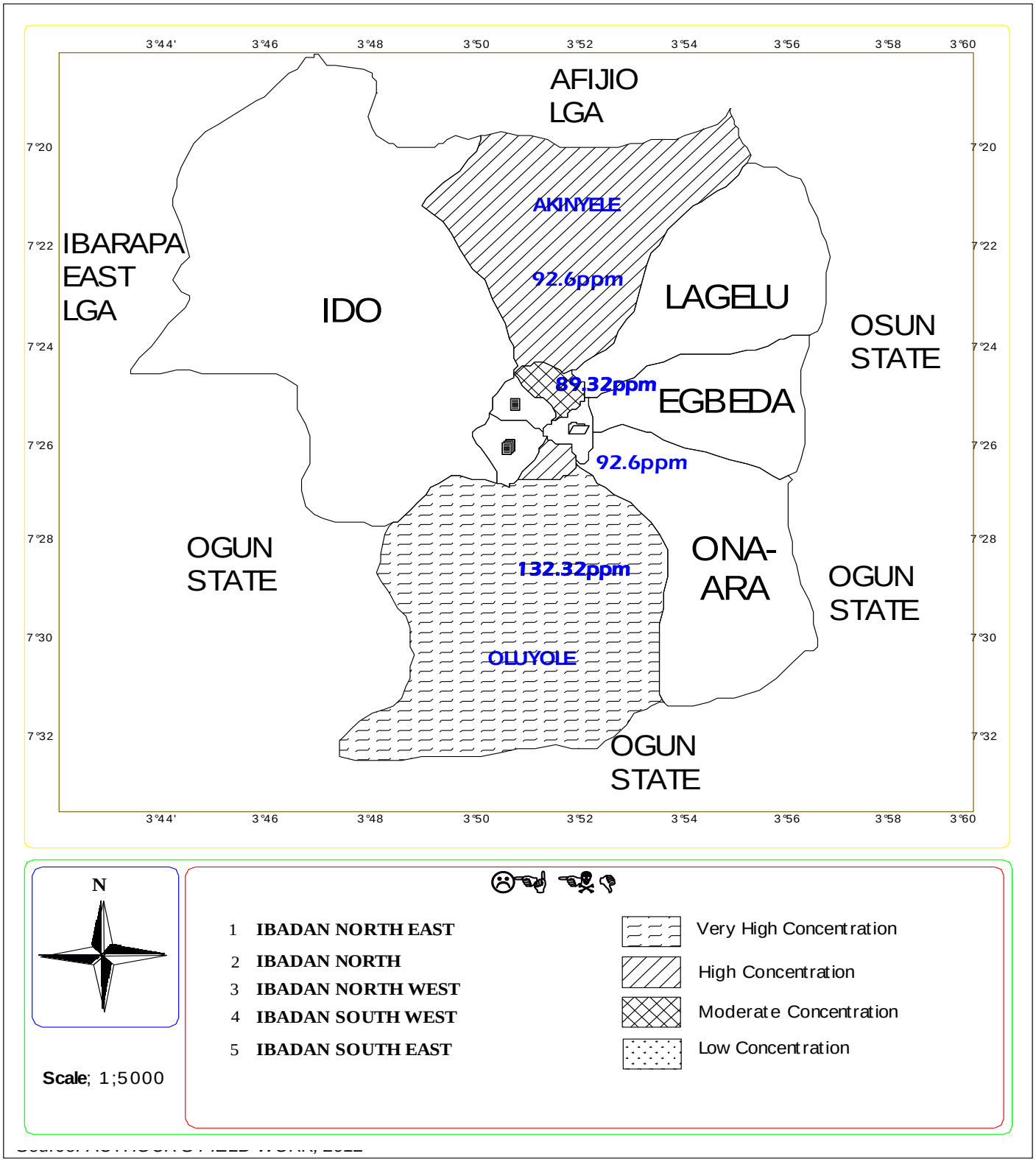

Figure 4. Spatial variation in concentration of Volatile Organics (Authors' Field Survey, 2011)

Table 4. Spatial variation in concentration of Ammonia

S/N	Sampling Area	UIEs	NH_3(ppm,mg/m^3							
			WKD	WKED	WKD	WKED	WKD	WKED	WKD	WKED
			Ibadan South East		Akinyele		Ibadan North		Oluyole	
1	SP_1	Provn/Store	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
2	SP_2	Food Rest	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
3	Sp_3	Fish Smoking	Nil	Nil	Nil	Nil	Nil	Nil	0(0)	0(0)
4	SP_4	Cement Store	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	Nil	Nil
5	SP_5	Record Studio	1(0.7)	1(0.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
6	SP_6	Busns/Center	1(0.7)	1(0.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
7	SP_7	Mechanic	Nil	Nil	0(0)	0(0)	0(0)	0(0)	Nil	Nil
8	SP_8	Painting	Nil	Nil	Nil	Nil	0(0)	0(0)	Nil	Nil
9	SP_9	Sawmill	Nil	Nil	Nil	Nil	0(0)	0(0)	Nil	Nil
10	SP_{10}	Fashion/desig	Nil	Nil	0(0)	0(0)	Nil	Nil	0(0)	0(0)
11	SP_{11}	Met/Grinding	0(0)	0(0)	Nil	Nil	Nil	Nil	Nil	Nil
12	Sp_{12}	Vulcanizing	0(0)	0(0)	0(0)	0(0)	Nil	Nil	0(0)	0(0)
13	SP_{13}	Furniture	0(0)	0(0)	0(0)	1(0.7)	Nil	Nil	0(0)	0(0)
14	Sp_{14}	Welding	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
15	Sp_{15}	BarbingSalon	Nil	Nil	Nil	Nil	Nil	Nil	0(0)	0(0)
16	Sp_{16}	Hair Dressing	0(0)	0(0)	Nil	Nil	0(0)	0(0)	Nil	Nil
17	Sp_{17}	Cassava/prog	Nil	Nil	4(2.8)	1.3(2.4)	0(0)	0(0)	4(2.8)	0(0)
18	Sp_{18}	Block Industry	Nil	Nil	2(1.4)	0(0)	0(0)	0(0)	0(0)	0(0)
19	Sp_{19}	Palm Kernel	Nil	Nil	2(1.4)	0(0)	1(0.7)	0(0)	0(0)	0(0)
20	Sp_{20}	Bakery	Nil	Nil	Nil	Nil	0(0)	0(0)	0(0)	0(0)
Overall Average (OVA)			0.2(0.14)	0.2(0.14)	0.6(0.43)	0.18(0.4)	0.07(0.05)	0.0(0.0)	0.28(0.2)	0.00.0
			0.2(0.14)		0.39(0.34)		0.13(0.025)		0.14(0.1)	

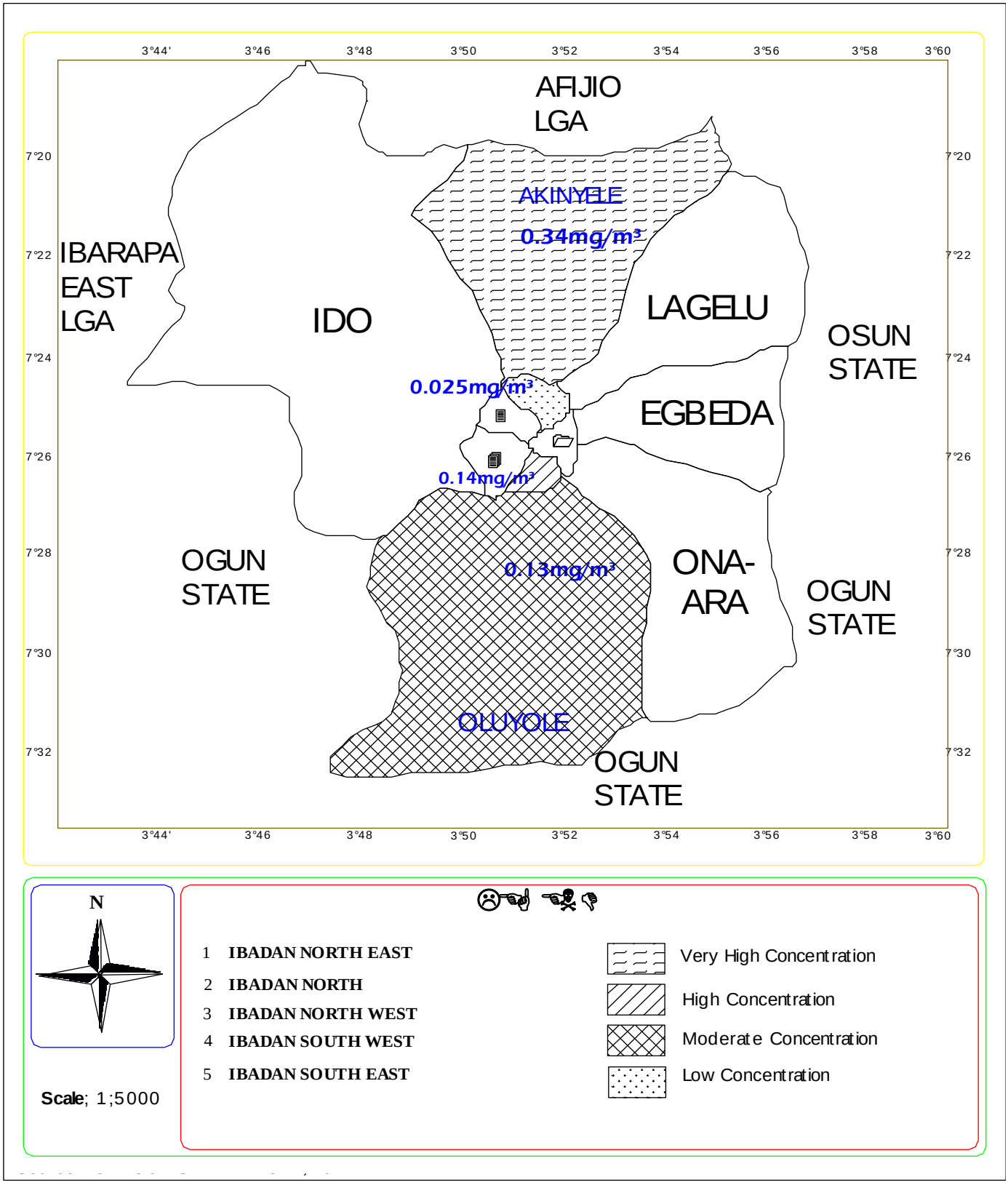

Figure 5. Spatial variation in concentration of Ammonia (Author's Field Survey, 2011)

5. Conclusion

It has been established from the above premise that operators of UIEs in the study area and by logical extension in similar and socio-political and cultural context are associated with harmful gaseous pollutants, such as SO_2, NO_2, VO and NH_4 with discharges exceeding permissible levels. Without prejudice to the popularly recorded and generally acknowledged contributions of UIEs to Urban Economy, the minimization of the negativities associated is the policy thrust of the paper. This is question of how to regulate the operations of the UIEs without violating their informal structure, is a major challenge for policy makers. The reorganization of the UIEs in well defined spatial units for the purpose of monitoring and control is suggested. Within the spatial units, different categories of UIEs should be empowered as groups or cooperatives to purchase new and environmentally friendly equipment. Conclusively, the study has established that informal enterprises do not contribute to urban economy alone but its associated environmental negativities are also appalling.

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