

Emission and Pollution Control Needs in the Automobile Mechanic Workshop in Benue State, Nigeria

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Abstract

The research study determined the emission and pollution control needs in the automobile mechanic workshop in Benue State, Nigeria. The study was a survey research in which data was collected through a 30 items questionnaire on a population of 150 respondents conveniently sampled from Makurdi, Gboko and Otukpo towns. The data were analyzed using Mean and Standard Deviation on a 5-point scale. Findings of the study revealed among others that several activities and practices in the automobile workshop serves as major sources of environmental contaminants in the automobile mechanic workshop environment; as a result soil, plants animals and human health are adversely affected. The study recommended among others: that there should be regular orientation of auto mechanics on the dangers of their poor sanitary practices on the environment; provision of proper sanitary facilities and proper waste management plan in the automobile workshop; and proper disposal of solid and liquid automobile waste around the workshop environment.

Introduction

Automobiles constitute one of the major modes of transportation for conveying people and goods in any nation of the world. The usefulness of this mode of transportation is not without cost. The major cost is pollution and emission of different magnitude. Operationally automobile pollution and emission are two related activities that involve releasing harmful hydrocarbon and chemical substances into the atmosphere or environment leading to the contamination of the air, water, soil and other natural environmental resources. Akoto, Ephraim and Darko (2008) classified the pollution cost of automobile transportation into two main groups such as operational and the maintenance cost. The operational cost of automobile transportation occurs when vehicles are driven from one place to the other while the maintenance dimension occurs during vehicle repairs. Robinson & Robinson (1999) observed that 48% of total atmospheric pollution comes from these two forms of automobile activities. Their major gaseous pollutants are sulphur dioxide, nitrogen oxide, ozone, carbon monoxide and hydrocarbons. International forum such as Earth Summit focused more attention on the reduction of operational cost of automobile pollution by recommending the use of ethanol and hydrogen as alternative fuel for powering automobiles, removal of lead from gasoline, use of electric trains for inner city transportation, among others.

Most of these suggestions have been implemented in some developed countries while some have been interpreted into local contents of some developing countries waiting for implementation (Earth summit, 2002). However, less attention is paid to pollution caused by the maintenance dimension of automobile transportation (auto mechanic activities). Auto mechanic activities are actually producing comparable amount of pollutants due to their intensive operations (Sax, 2001). Chemicals such as refrigerator gases used in vehicle air conditioners are made up of chlorofluorocarbons which when allowed to escape in larger quantities into the atmosphere can deplete the ozone layer and cause a green house effect and consequently leading to global warming (Bassuer, 1997). This situation can not be allowed to continue especially with the current changes in climate within the region as shown by Iwegbue (2007) study. The use of chemical solvents and fumes may cause lower ground ozone/smog formation and global warming (Anthony, Lagowski and Johnson 2003)). Acid rain arising from the chemical reactions between atmospheric gasses and rain water can corrode zinc, paintings, monuments and buildings, thus destroying the aesthetic quality of the environment, leading to accelerated slum formation (Weiss, 1990).

To buttress this, Abdulahi (2008) in analyzing budgetary allocations and selected sectors' contribution to economic development in Nigeria, highlighted transport sector as central to economic activities and therefore paramount that this sector be given more attention than the government is currently doing. While an automobile engine is running, the motor oil collects particles of heavy metals such as Lead, Cadmium, Chromium, Iron, Zinc and copper. Used engine oil or transmission fluid poured on the ground therefore enriches the soil with heavy metals, which can drain into both surface waterways and groundwater. Spilling waste automobile fluids on the ground, and the processes of metal corrosion will therefore enrich the soil with heavy metals. There are several common sources of soil contaminants in a mechanic village. Perhaps the most serious occupational hazard of mechanics is spraying and painting, as mechanics performing this task gets exposed to paint dust and fumes capable of causing respiratory and pulmonary diseases. Fine particles of metal and paint become aerosol, eventually returning to the soil through rain or as settling dust.

In Nigeria, soil pollution problems associated with automobile wastes has been reported by Onianwa , Jaiyeola, and Egekenze, 2001; Ipeaiyeda, Dawodu and Akande, 2007; Iwegbue, 2007; Adie and Osibanjo, 2009) in their study of metal fractionation in soil profiles at

automobile mechanic waste dumps around Port harcourt, and observed that the metals present were relatively mobile, but more in the surface than in the subsurface. They also lamented on the numerous adverse effects these automobile waste have on the environmental plant, animal and human health. This study therefore strive to investigate the emission and pollution control needs in the automobile mechanic workshop in Benue State, Nigeria.

Statement of Problems

The menaces of automobile mechanic activities have been a serious concern to governments, stakeholders and non-governmental organizations all over the world. Presently though efforts are made in most developed countries to create a sustainable environment by imposing strict environmental regulations for auto mechanic workshops. Provision of environmental review that covers servicing, mechanical repairs in premises, sound environmental management system of waste generated and in extreme cases citing of these workshops are lacking in Nigeria. In Benue State especially in Makurdi, Gboko and Otukpo towns, automobile maintenance and repair activities carried out by auto mechanic operators, artisans, craftsmen and technicians does not comply with any of the standards set by international organizations or the Federal Ministry of Environment standards. There is indiscriminate citing of mechanic workshops and disposal of hazardous wastes such as brake fluid, greases, spent oil, radiator coolant, soot, fuel, metal scraps, chemicals and other volatile compounds into the air and the surrounding environment (Iwegbue, 2007). These chemicals are not biodegradable and therefore persist in the environment. They have numerous adverse effects on the plants, animals and human health. The aim of this study, therefore, is to assess the emission and pollution control needs in the automobile mechanic workshop in Benue State, Nigeria.

Purpose of the Study

The purpose of the study was to conduct a research on the emission and pollution control needs in the automobile mechanic workshop in Benue State, Nigeria.

Specifically, the study:

1. Identified the major sources of environmental contaminants in the automobile mechanic workshop area.
2. Determined the effects of automobile emissions and pollution in the automobile workshop environment.

3. Identified the emissions and pollution control needs in the automobile mechanic workshop.

Research Questions

The following research questions were formulated to guide the study:

1. What are the major sources of environmental contaminants in the automobile mechanic workshop?
2. What are the effects of automobile emissions and pollution in the automobile workshop environment?
3. What are the emissions and pollution control needs in the automobile mechanic workshop?

Research Hypotheses

The following null hypotheses guided the study:

H₀₁ : There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the major sources of environmental contaminants in the automobile mechanic workshop .

H₀₂ : There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the effects of automobile emissions and pollution in the automobile workshop environment.

H₀₃ : There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the emissions and pollution control needs in the automobile mechanic workshop.

Research Methodology

The study adopted survey research design to carry out research on the emission and pollution control needs in the automobile mechanic workshops in Benue State, Nigeria. The study was carried out in Makurdi, Gboko and Otukpo towns. The population of the study was 150 respondents comprising of 50 Industry-based automobile mechanics and 100 master automobile mechanics having workshop in mechanic villages. Makurdi, Gboko and Otukpo towns were used for the study because they form the major cities in Benue State, Nigeria where there are high influx of motor vehicle usage as well as maintenance and repair activities. A 30 item questionnaire structured on a 5-point scale response option was used to collect data from the respondents to indicate the degree to which respondents agree to each item as strongly agree (SA)-5 points ,agree(A)-4 points, undecided(UD) -3 points, disagree (D) -2 points and strongly disagree(SD) -1 points. The questionnaire was validated by three experts from Mechanical Engineering Department in the Federal University of Agriculture, Makurdi and a Peugeot maintenance service unit in Makurdi town. The reliability of the validated questionnaire was found to be 0.87 using Cronbach Alpha statistics. Corrections were made appropriately before it was administered. The Mean and Standard Deviation (SD) were used to answer the research questions. Therefore items with mean score below 3.00 (cut off mark) were regarded as disagreed while those with mean score of 3.00 and above were regarded as agreed. The t-test statistics was used to test the hypotheses at 0.05 level of significance. The t-critical value for accepting or rejecting the null hypothesis was ± 1.98 .

Results

Research Question 1

What are the major sources of environmental contaminants in the automobile mechanic workshop?

Hypothesis One (H_{01})

There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the major sources of environmental contaminants in the automobile mechanic workshop.

Table 1: t-test analysis of mean responses of respondents on the major sources of environmental contaminants in the automobile mechanic workshop.

S/N	ITEM STATEMENT	\bar{X}_1	SD_1	\bar{X}_2	SD_2	t-cal	REMARK
1	Spilling of used electrolyte from battery charging activities.	4.33	0.60	3.82	0.40	0.34	NS
2	Spilling of paints from spray painting on the workshop floor.	4.68	0.30	4.05	0.10	0.88	NS
3	Indiscriminate dumping of carbides by panel beaters.	4.34	1.20	3.47	0.30	0.62	NS
4	Pouring of washery fluid and human excrement around the workshop area.	4.00	0.36	4.06	0.70	1.25	NS
5	Discarding lead plates on auto mechanic shop site.	4.01	1.21	4.75	0.65	1.21	NS
6	Pouring of dirty engine oil on the workshop environment.	4.10	0.83	3.71	1.27	0.60	NS
7	Tailpipe emissions releasing exhaust gases and soot.	4.20	0.32	4.01	0.81	0.50	NS
8	Wrong disposal of metallic waste from used spare parts during repair activity.	4.71	1.00	4.36	0.72	0.59	NS
9	Indiscriminate citing of mechanic workshops.	4.56	1.39	4.70	0.63	0.50	NS
10	Poor handling of hazardous chemical from vehicle air conditioning refrigerant.	4.71	1.29	4.45	0.74	0.21	NS

The presentation on table 1 shows that all the items presented had their weighted mean values ranged from 3.47-4.75. This values are above the cut off mark of 3.00 which signifies that the

respondents agreed to the items as the major sources of environmental contaminants in the automobile mechanic workshop environment.

The t-test analysis revealed that all the items had their t-calculated values less than the t-table value of ± 1.98 . This implies that there was no significant (NS) difference in the mean ratings of the responses of the respondents on the major sources of environmental contaminants in the automobile mechanic workshop.

Research Question 2

What are the effects of automobile emissions and pollution in the automobile workshop environment?

Hypothesis Two (H_{02})

There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the effects of automobile emissions and pollution in the automobile workshop environment.

Table 2: t-test analysis of mean responses of respondents on the effects of automobile emissions and pollution in the automobile workshop environment.

S/N	ITEM STATEMENT	\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	t-cal	REMARK
11	Depletion of ozone layer causing green house effect.	4.24	0.81	3.67	0.84	0.46	NS
12	Lowering of soil smog formation causing global warming..	4.56	0.13	3.11	0.48	0.89	NS
13	Acid rain causing corrosion of zinc, paintings, monument and buildings.	4.53	0.81	4.81	0.59	0.78	NS
14	Contamination of underground water.	4.46	0.54	4.21	0.58	1.43	NS
15	Poor plant quality and crop yield within contaminated workshop surrounding.	4.65	0.59	4.43	0.70	1.23	NS
16	Automobile workshop pollution causing eye, throat and lung irritation.	4.41	0.92	3.97	1.01	0.64	NS
17	Cancer and breathing difficulty among auto mechanics.	3.55	0.88	3.06	0.81	0.56	NS
18	High metal concentration in contaminated soil in the workshop area.	3.40	1.77	3.23	0.74	0.55	NS
19	Increase in cough and pulmonary disorder among mechanics.	3.51	0.73	3.20	1.07	0.54	NS
20	Pollution leads to asthma and lung diseases among mechanics.	3.57	0.73	3.03	0.90	0.35	NS

The data analysis in table 2 revealed that all the items had their mean values ranged from 3.06-4.81. Since the values are above the cut off mark of 3.00, it indicates that the respondents agreed

to all the items as effects of automobile emissions and pollution in the automobile workshop environment. The t-test analysis also revealed that all the items had their t-calculated values less than the t-table value of ± 1.98 . This implies that there was no significant (NS) difference in the mean ratings of the responses of the respondents on the effects of automobile emissions and pollution in the automobile workshop environment. Hence we uphold the null hypothesis.

Research Question 3

What are the emissions and pollution control needs in the automobile mechanic workshop?

Hypothesis Three (H₀₃)

There is no significant difference in the mean responses of auto-mechanics in mechanic villages and industrial auto-mechanics on the emissions and pollution control needs in the automobile mechanic workshop.

Table 3: t-test analysis of mean responses of respondents on the emissions and pollution control needs in the automobile mechanic workshop.

S/N	ITEM STATEMENT	\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	t-cal	REMARK
21	Proper disposal of harmful automobile solid waste such as soot and scrap metal.	4.09	0.68	3.90	0.70	0.44	NS
22	Efficient disposal of used automobile liquid waste such as brake fluid, engine and coolant.	3.77	0.48	3.75	0.71	0.83	NS
23	Recycling of metallic waste and developing of waste management plan in auto mechanic shops.	4.68	1.10	4.10	1.41	0.67	NS
24	Collection of used engine oil for reuse by other alternative users such as wood workers.	3.70	1.15	3.45	0.45	1.26	NS
25	Proper planning and sitting of auto mechanic workshop.	4.04	0.96	4.40	0.41	1.17	NS
26	Establishing a standard code of practice to control auto mechanics professional practices.	4.74	1.39	4.12	1.07	0.65	NS
27	Establishing strong linkage between auto mechanic workshop & training institutions.	4.68	0.36	3.40	0.69	0.53	NS
28	Provision of adequate sanitary facilities such as toilets, drainage and waste bin in strategic areas.	4.11	0.42	3.71	0.74	0.56	NS
29	Periodic orientation of auto mechanics on the dangers of their poor sanitary practices on the environment.	4.35	1.12	3.65	1.15	0.66	NS
30	Proper handling of automobile waste generated during repair activities.	4.34	0.78	4.05	0.67	0.23	NS

Table 3 shows that all the items presented had their weighted mean values ranged from 3.40-4.74. These values are above 3.00 indicating that the respondents agreed to the items as the emissions and pollution control needs in the automobile mechanic workshop.

The t-test analysis shows that all the items had their t-calculated values less than the t-table value of ± 1.98 . This implies that there was no significant (NS) difference in the mean ratings of the responses of the respondents on the emissions and pollution control needs in the automobile mechanic workshop.

Findings of the Study

On the major sources of environmental contaminants in the automobile mechanic workshop area, the study revealed among others the following as major sources:

1. Most of the environmental contaminants in the automobile mechanic workshop area results from spilling of automobile liquid waste (used engine oil, brake fluid, gear oil & coolant) and solid waste (soot and metal scrap) on the surrounding environment of the workshop.
2. Indiscriminate dumping of used automobile spare parts and human excrement.
3. Poor handling of hazardous chemical from vehicle air conditioning refrigerant and spray painting activities.
4. Improper planning and siting of automobile workshop.

Regarding the effects of automobile emissions and pollution in the automobile workshop environment, the study among others exposes the following effects:

1. Depletion of ozone layer causing green house effect, global warming, acid rain and corrosion of zinc and paintings on buildings.
2. Contamination of underground water leading to low plant and crop yield.
3. Pulmonary disorder, cancer and breathing difficulty among auto mechanics.
4. Soil contamination.

While on the emissions and pollution control needs in the automobile mechanic workshop, the study revealed among others the following:

1. Proper disposal of solid and liquid automobile waste around the workshop environment.
2. Provision of proper sanitary facilities and proper waste management plan in the automobile workshop.
3. Periodic orientation of auto mechanics on the dangers of their poor sanitary practices on the environment.

4. Establishing strong linkage between auto mechanics workshop & training institutions for availability of new information and retraining courses to upgrade technician's work skills.
5. Establishing a standard code of practice to control auto mechanics professional practices.

Discussion

Analysis from table 1 showed that the respondents agreed with the 10 items to be among major sources of environmental contaminants in the automobile mechanic workshop area. For instance, the respondents opinion that most of the environmental contaminants in the automobile mechanic workshop environment results from spilling of automobile liquid waste (used engine oil, brake fluid, gear oil & coolant) and solid waste (soot and metal scrap) on the surrounding environment of the workshop., is in agreement with Iwegbue (2007) .Adie and Osibanjo (2009). studied metal fractionation in soil profiles at automobile mechanic waste dumps around Abuja, and observed that the metals present were relatively mobile, but more in the surface than in the subsurface due to spilling of used automobile engine oil, brake fluid, gear oil & coolant liquid ,soot and scrap spare parts. This was supported by Ipeaiyeda and Dawodu (2008) who investigating the heavy metals contamination of topsoil. He discovered that automobile waste dumps will consist predominantly of auto body scraps , pieces of mild steel , electrical components and wires .

The opinions of the respondents on item 8, 9 and 10 shows that auto mechanics rarely obey safety practices in the automobile workplace and this has always resulted to automobile accidents on highways and accidents in the workplace. The was supported by Jain (2010) who attributed the high rate of accidents to poor attitude of workers towards safety practices, poor attitudes of employers towards provision of safety awareness training courses and incomplete instructions on safe practices and technical know-how on the operation of tools, equipment and machines.

The acceptance of all the items on table 2 revealed that all the items are valid as regard to the effects of automobile emissions and pollution in the automobile workshop environment. The respondents identified among others : depletion of ozone layer, green house effect, global warming, acid rain, corrosion of zinc paintings on buildings, contamination of underground, low plant and crop yield, pulmonary disorder, cancer and breathing difficulty among auto mechanics

as major effects of automobile emissions and pollution in the automobile workshop environment. This was buttressed by Ajayi and Dosunmu (2002) that stated that while an automobile engine is running, the motor oil collects particles of heavy metals such as lead, cadmium, chromium, iron, zinc and copper. Used engine oil or transmission fluid poured on the ground therefore enriches the soil with heavy metals, which can drain into both surface waterways and groundwater. Spilling waste automobile fluids on the ground, and the processes of metal corrosion will therefore enrich the soil with heavy metals. Perhaps the most serious occupational hazard of mechanics is spraying and painting, as mechanics performing this task gets exposed to paint dust and fumes capable of causing respiratory and pulmonary diseases. Fine particles of metal and paint become aerosol, eventually returning to the soil through rain or as settling dust.

The acceptance of the 10 items in table 3 shows that the emissions and pollution control needs in the automobile mechanic workshop among others includes : safe disposal of solid and liquid automobile waste around the workshop environment, provision of proper sanitary facilities and proper waste management plan in the automobile workshop, periodic orientation of auto mechanics on the dangers of their poor sanitary practices on the environment, establishing strong linkage between auto mechanics workshop & training institutions for availability of new information and retraining courses to upgrade auto technician's work skills and establishing a standard code of practice to control auto mechanics professional practices. This is in line with Fakayode and Onianwa (2002) who lamented that the poor infrastructural development common in all the mechanic villages such as the lack of concrete floor workshops, lack of toilet and emission testing facilities, lack of engineered drainage system and storm water management facilities calls for immediate action of redevelopment and soil remediation in the mechanic villages.

Conclusion

Our environment is where we live and for intergenerational equity must be protected especially with the current climate change. Every activity carried out in it should be performed in a way that it does not deviate so much from its natural carrying capacity. Activities carried out on the environment should be done with high level of sustainability. This study has shown that auto mechanic activities are scattered all over the city with no proper land use plan separating them from other uses especially residential and vegetables gardens. The study assessed the emission and pollution control needs in selected automobile mechanic workshop in Wuse-

Abuja and Minna. The study revealed several major sources of environmental pollution and contaminants in the automobile mechanic workshop environment and their consequent effects on the contaminated soil and environment. Several emission and pollution control needs were also revealed by the respondents to help reduce emission and pollution on the auto mechanic workshop soil and environment.

Recommendations

To achieve a clean environment free from pollution from automobile maintenance and repair activities , the study recommends the following:

1. There should be proper land use zoning where the activities of this vital sector are confined to specific locations for easy management of wastes generated by it.
2. Planting of local phyto-remediation plants should be encouraged in all the workshops to help in the reduction of the obnoxious gases through the process of photosynthesis thereby making the air environment of these premises fresh all year round.
3. Car painting should be done in enclosed areas with less spraying so as to reduce obnoxious gas production into the atmosphere.
4. Mechanic workshops should be cited in environmental non-sensitive areas and residential land uses should be discouraged from migrating to such areas.
5. Planning authorities should set up a regulatory body to ensure that all auto mechanic workshops established within the metropolis apply for and receive consent in line with the planning provisions. This will help enforce compliance to the provision of the draft 2008 master plan.
6. All obnoxious gases should be reduced at source through proper land use zoning to ensure a sustainable air environment in the face of growing climate.

References

- Abdulahi ,I.B. (2008). Budgetary allocations and selected sectors' contribution to economic development in Nigeria; *Pak. J. Social Sci.* 5 (9): 894-898.
- Adie ,G.U.& Osibanjo, O. (2009). Assessment of soil-pollution by slag from an automobile battery manufacturing plant in Nigeria; *Afr. J. Environ.Sci. Technol.* 3(9): 239-250.
- Akoto,O.,Ephraim ,J.H. & Darko, G.(2008). Heavy Metals pollution in surface soils in the vicinity of Abundant Railway servicing workshop in Kumasi, Ghana. *Int. J. Environ Res.*, 2(4): 359 –364.
- Ajayi, A.B.,& Dosunmu, O.O. (2002). Environmental hazards of importing used vehicles into Nigeria; *Proceedings of international symposium on environmental pollution control and waste management Tunis EPCOWM* p. 521-532.
- Anthony ,N.J., Lagowski, J.J.& Johnson, C .(2003). Analysis of Heavy Metals in Remediate Soil Using an Atomic Absorption Spectrometer (AAS); *Wekh summer scholar program, University of Texas.*
- Bassuer, G. (1997). The Endangered Ozone layer and New Theories of Ozone Depletion. *The Environment* 29 (1):20-27.
- Earth Summit (2002) 'Pollution caused by Transportation' In: *A new deal*, Felix Dods (ed) Earth scans publication, London pp86-90.
- Fakayode ,S.O., & Onianwa. P.C. (2002). Heavy metal contamination of soil, and bioaccumulation in Guineagrass (*Panicum maximum*) around Ikeja Industrial Estate, Lagos, Nigeria; *Environ. Geol.* 43: 145-150.
- Ipeaiyeda, A.R., Dawodu, M., & Akande,T.(2007). Heavy metals concentration of Topsoil and Dispersion in the vicinities of reclaimed auto-repair workshops in Iwo, Nigeria. *Research Journal of Applied science* ,2007,2(II): 1106-1115.
- Iwegbue, C. M. (2007) 'Metal fractionation in soil profiles at automobile mechanic waste dumps around Port Harcourt' *Waste Management resource* 25(6), 585-593.
- Jain, R.K. (2010). *Production Technology*. New Delhi: Khanna publishers.
- Onianwa, P. C.,Jaiyeola, O. M. & Egekenze, R. N., (2001). Heavy metal contamination of topsoil in the vicinities of auto-repair workshops, gas stations and motor parks in a Nigerian city .*Toxicol. Environ. Chem.*, 84 (1-4), 33-39.
- Robinson, E. and Robinson, B. B.(1990) Gaseous Nitrogenous Compounds. Pollutants from Urban and natural sources. *Journal of Air Pollution Contr. Association* 20, 303- 311.
- Sax, N.I. (2001). *Industrial Pollution*, 4th ed., Van Nost and Reinhold Ltd
- Weiss, M.A (1990). *The Origins and Legacy of Urban Renewal in Urban and Regional Planning*,New York Paragon Press Inc.

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