

## Assessments of the volume and disposal methods of spent engine oil generated in Nekede mechanic village, Owerri, Nigeria

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**Abstract:** Studies were carried out to investigate the volume and disposal methods of spent automobile engine oil generated at Nekede Mechanic Village in Owerri, Imo State Nigeria, between February and June 2008, in order to establish the presence pollution problem as result of inappropriate disposal of spent engine oil in the study area. The study utilized structured questionnaire, personal interviews and field observations generate relevant data on the Mechanic village. Results obtained showed that over 1.4 million liters of spent engine oil was produced annually in the village. About 60% of the mechanics disposed spent engine oil on the soil, within their immediate environment, while others used it for other purposes, such as pest control, sharpening of blades and reuse in heavy trucks among others. Another 88.3% of mechanics were ignorant of environmental impact of inappropriate spent engine oil disposal. The study concluded that there is poor spent engine oil disposal attitudes of among the automobile mechanics and that such a practice may lead to serious hydrocarbon pollution at the Nekede mechanic village.

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### 1. Introduction

In Nigeria, automobile mechanic workshops are located or concentrated in areas known as mechanic villages. These places are officially designated for repairs and servicing of motor vehicles. They are also used for other purposes such as recreational, residential and agricultural purposes (Nwoko et al., 2007). The waste generated by automobile mechanics in these villages may include gasoline (petrol), diesel, spent engine oil and paints among others (Nwachukwu et al., 2010). These categories of wastes are generated and dumped by individuals, who may not know the potential human risks of exposure to such pollutants. They therefore dump them in the vicinity, where there is no further treatment and causes environmental risk to humans, animals and plants. This is probably because automobile mechanic activities in Nigeria are currently under the control of semi-literate individuals (Oguzie, 2001).

Omokhodiori (1999) specifically, indicated that the pollution effects of mechanic village activities in Nigeria have received limited attention even though these activities have been shown to produce petroleum based wastes (Nwachukwu et al., 2010). There is therefore the need to continually assess their nature, volume, direct harmful effects and current methods of

disposal as well as potential impacts on the environment. This is critical since human activities such as automechanic works generate hydrocarbon pollutants, which may disperse throughout the environment, leading to serious pollution problems (Thouand et al., 1999). Some of the substances dispersed may remain highly recalcitrant to biodegradation processes (EeLuiAng and Jeffrey, 2004).

Excessive accumulation of heavy metal from petroleum and other related human activities have been documented in soils (Kabata and Pendias, 1989) and have been shown to pose major environmental and human health problems (Thouand et al., 1999; EeLuiAng and Jeffrey, 2004). In addition, high metal concentration in contaminated soil results to decreased soil microbial activity, soil fertility and increased yield losses (McGrath et al., 1995). The metals they contain are frequently bio-accumulated by agricultural crops and may through them be consumed by humans and animals of economic importance (Anoliefo and Edegbai, 2000; Odjegba and Sadiq, 2002)

This study assessed the volume and disposal methods of spent engine oil generated in Nekede mechanic village in Owerri Imo state, Nigeria.

## 2. Materials and methods

**2.1 Study area:** The mechanic village sited in Nekede, Owerri West Local Government Area of Imo State, provides a dramatic example of environmental impact due to anthropogenic activities. The automobile mechanic site was set up in the year 1983 for the purpose of repairing and maintaining automobile vehicles used in the transportation of humans, animal and goods. The village is sited in an agricultural community, approximately one-kilometer distance from Owerri, the major state capital city of Imo State.

Nekede mechanic village falls under the geographical coordinates of longitude 7.04 – 7.06°W and latitude 5.24 – 5.27°N. It lies on an area of flat agricultural land converted to mechanic workshops, shops and homes, where some of the mechanic and their families live. This makes the area very busy with human activities. The topography is relatively a level ground but towards the Otamiri River side that borders it to the west, it is strongly degraded. Its landscape has been sculpted by erosion forming deep gullies with elevations ranging between 71.5 and 44.1 meters in the north—west and central section and to about 65 meters on the east and south. The climate falls under type A W in the Kopper –Geiger classification of wet and dry climate and zone B of the Nigeria's eco-climatologically zones (Oformata, 1976). Given the close relationship between climate and vegetation, the location of the study area coincides with the rain-forest belt.

The geology of the area consists of plain soil, which is about 0.05 – 2.0 mm in size. This type of soil has good drainage and is well aerated, causing it to dry out quickly (Onweremadu and Duruigbo, 2007). In addition, the agricultural land has humus soil showing a good area for agricultural practice. They study area also shows a moderate to high population density, with average population density being about 104 people per 1km. This population density could be as a result of the activities of these labor force and their relatives (NPC, 2006).

**2.2 Description of anthropogenic activities in the study area:** Nekede mechanic village is divided into 12 roads, namely; Road 1, Road 1 extension, Road 2, 3, 4, 5, Road 5 extension, Road 6, 7, 12, church road, and Aba road. The roads are occupied by various categories of artisans practicing their various areas of specialization. All the roads in the research area were visited during the course of the study, in order to become familiar with the automechanic activities in the study area. Mechanics working on each of these roads formed

themselves into associations with reliable membership lists.

**2.3 Determination of population of automobile mechanics used:** Population of mechanics was determined based on their anthropogenic activities. This involved assessing the membership list of each association in the different roads. The data obtained from this list was further validated by direct physical count of mechanics at the workshops.

**2.4 Engine oil generated in Nekede mechanic village, Owerri:** This was based on a survey work involving structured questionnaire, personal interviews, observations and subsequent estimation of the population size of automobile mechanics, number of vehicle serviced the quantity of spent engine oil generated, the current disposal methods and the other uses of spent engine oil in the area.

**2.5 Estimation of the quantity of spent engine oil generated in the village:** Direct field observation was used to determine the volume of spent engine oil generated annually. For this part of study, three sampling sites were selected for the study based on the conclusions of an earlier study in the mechanic village by Mbrepadiaha (2005). These included heavily patronized workshops (those that service 10 – 15 vehicles daily), moderately patronized (service 5 – 10 vehicles daily) and slightly patronized (service 1 – 5 vehicles daily).

Servicing in this case included both changing of engine oil, overhauling of the engine and other minor jobs done in the engine area of the vehicle. Thus, the mean number of vehicles serviced per week by each mechanic, which was estimated using a simple structured questioner was obtained. Using this data, the number of vehicles serviced in the village per day, week and per annum was determined. These figures were further used to estimate the daily, weekly and annual spent engine oil generated in the village.

**2.6 Knowledge of environmental risks and disposal methods of spent engine oil:** Information on these was generated using a structured questionnaire distributed to 36 respondents in the mechanic village. There respondents were chosen from all the roads studied, based on willingness to participate in the study.

**2.7 Data analysis:** Data generated from the study were subjected to simple descriptive statistics such as means, frequency distribution and percentages.

## 3. Results

**3.1 Population of mechanics in Nekede mechanic village:** Table 1 showed that 1664 mechanics were working in the Nekede mechanic village and that these were spread across 12 roads in the study area. The number of mechanics that registered as

members and own workshops were adopted from their records. The apprentices amongst them (those training under them) were not included in data obtained.

Road 5 extension had the highest number of mechanics (328 automobile mechanics), and was followed by Aba road, which had 292 mechanics. The least number of mechanics was recorded at Road 6, which had 18 mechanics.

**Number of vehicles serviced by mechanics:** The frequency and percentage distribution of mechanics according to the number of vehicles serviced per week was shown in table 2. The result showed that 26.7% of mechanics serviced five vehicles weekly, while 20% serviced 3 – 4 vehicles weekly. Fewer mechanics on the other hand serviced two or seven vehicles (10% each)

Table 1: The population of mechanics in Nekede mechanic village

Name of roads in Nekede mechanic village	Number of mechanics interviewed from each road	Number of mechanic working in each road
Road One	3	195
Road One Extension	3	180
Road Two	2	90
Road Three	2	133
Road Four	1	56
Road Five	2	115
Road Five Extension	5	328
Road Six	1	18
Road Seven	2	29
Road Twelve	2	104
Church Road	3	124
Aba Road	4	292
12 Roads	30	1664 Mechanics

Table 2: Distribution of mechanics according to the number of vehicles serviced per week.

Number of vehicles serviced	Frequency	Percentage (%)
1	0	0
2	3	10
3	6	20
4	6	20
5	8	26.7
6	4	13.3
7	3	10

**3.2 Annual volume of spent engine oil:** The volume of spent engine oil removed from a vehicle after service and the weekly, monthly and annual computations were presented in table 3. The total annual volume of spent engine oil produced stood at 1,469,678.08 liters or 7348.39 drums of oil. Further multiplication of this with the number of years of existence of Nekede mechanic village

would show that there could be serious spent oil pollution of the soils of the village.

**3.3 Knowledge of environmental impact of spent engine oil:** The mechanic's knowledge of the environmental impact of spent engine oil was also determine and as shown in table 4, 88.3% of them did not have any such knowledge, while 16.7% described it as a chemical, which could exert deleterious effects on humans.

Table 3: Annual volume of spent engine oil produced at Nekede mechanic village Owerri

Volume of spent engine oil removed from a serviced vehicle	4 liters
Number of mechanics in Nekede mechanic village	1664
Mean number of vehicles serviced per mechanics per week	4.3 vehicles
Mean volume of spent engine oil generated per vehicle	3.95 liters
Number of vehicles serviced per week: (1664x4.3)	7155.2
Number of vehicles serviced per day (7155.2 ÷ 6)	1192.5

Number of vehicles serviced per annum (52 weeks x 7155.2)	372,070.40
Volume of spent engine oil (SEO) generated per day: (1192.53 x 3.95)	4710.49litres
Volume of spent engine oil generated per week (7155.2 x 3.95)	28263.04
Volume of spent engine oil generated per annum (372,070.40 x 3.95)	1,469,678.08 liters

Source: Field data 2008

Table 4: Response on environmental knowledge of spent engine oil by automobile mechanics (n = 30)

Response	Number of mechanics	Percentage
Yes	5	16.7
No	25	83.3

Source: Field data 2008

### 3.4 Uses and disposal methods of spent engine oil in the mechanic village:

The different methods of disposal of spent engine oil by the mechanics were assessed, and as shown in table 5, a high proportion of the mechanics (60%) disposed the oil on ground in their immediate vicinity. Another 46.7% sold some of the spent engine oil to people for other uses. However, these other users were not

investigated. About 43% of the mechanics claimed that spent engine oil could be used to control insects pests such as termites, cockroaches and other nuisance flies. A low 10% used spent engine oil to fuel generators and big trucks. It was also gathered that carpenters use spent engine oil for sharpening saw blades.

Table 5: Disposal method and uses of spent engine oil by automobile mechanics

Methods of disposal of spent engine oil	Frequency	Percentage (%)
Dispose within immediate Environment	18	60
Sold to other users	14	46.7
Used as polish	7	23.3
Pest control	13	43.3
Sharpening of blades	8	26.7
Used as fuel in other trucks	3	10

Source: Field data 2008

## 4. Discussion

The present study showed that Nekede mechanic village was set up in 1983 for repairing and maintaining automobile vehicles used in the transportation of humans, animal and goods. The village has thus existed for more than 25 years. During the study period, 1664 automobile mechanics were found working at the site on a land area of more than 20 hectares (Udebuani personal communication, 2008) divided into 12 roads for easy access.

Road 5-extension and Aba Road, which are directly on the major access roads to the site had the highest population of mechanics. This could be because of the strategic nature of these two road, since every mechanic wants to locate his workshop at an economically strategic place. This has made these roads to become congested indicating that the volume of engine oil produced at these sites will be more.

The study showed that majority the mechanics service between 5 and 7 vehicles per week. This implies among other things removal of

spent engine oil from a vehicle and replacing it with new engine oil. The estimated 1.4 million liters or 7348.39 drums annual volume of spent engine oil produced at the site is quite large, especially when the fact that the village has been in existence for more than 25 years is considered. This agrees with the reports of Nwachukwu et al. (2010) that the major wastes generated by automobile mechanics in these villages include gasoline (petrol), diesel, spent engine oil and paints among others. There are however no available published information on the volume of spent oil produced at the village or any other in Nigeria. Such studies are important since these places even though officially designated for repairs and servicing of motor vehicles also serve other purposes such as recreational, residential and agricultural purposes (Nwoko et al., 2007).

It was also observed that a very high proportion all the mechanics disposed spent engine oil removed from serviced motor vehicle within the surrounding vicinity. This is in agreement with an earlier report by Nwoko et al. (2007). According to

Nwachukwu et al. (2010), these categories of wastes are generated and dumped by individuals, who may not fully appreciate the potential human risks of exposure to such pollutants. For example, the present study showed that more than 80% of the studied mechanics are ignorant of the environmental impact of spent engine oil.

From all indications, no measures have been taken to check the amount of spent engine oil deposited or clean up the ones already discharged into the environment since the creation of Nekede mechanic village in 1983. This again is probably because automobile mechanic activities in Nigeria are currently under the control of semi-literate individuals (Oguzie, 2001). Omokliodon (1999) had earlier reported that in Ibadan, southwest Nigeria, this lack of knowledge of the environmental consequences of automobile mechanics activities is linked to poor educational background of stakeholders.

Generally, petroleum based activities such as oil prospecting, processing, distribution and author mechanic works have been shown to generate hydrocarbon pollutants, which may disperse throughout the environment, leading to serious pollution problems (Thouand et al., 1999). Some of the substances remain highly recalcitrant to biodegradation processes (EeLuiAng and Jeffrey, 2004). Global concerns about these have heightened the need for novel remediation techniques that are cheap and affordable to effectively remove these pollutants from contaminated sites, water, soil and sediment (Romantschuk et al., 2000; Duran and Esposito, 2000).

It is interesting to note that spent engine oil has many other useful applications in the study area. For example, the study revealed that it is used for sharpening blades, pest control and as polish among others. Since about 60% of the spent oil produced at the site is currently thrown away, it is assumed that the remaining 40% utilized for other purposes are obtained free from the mechanics. There is therefore the need to develop these technologies that utilize spent oil as raw material in other for the auto mechanics to create additional income from their sales. This might be the most effective deterrent from inappropriate disposal of the waste and its environmental implication.

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