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VALUATION OF NIGERGAS COMPANY, EMENE, ENUGU, NIGERIA USING THE ENVIRONMENTAL FACTOR (E-FACTOR) MODEL

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ABSTRACT: *Industries in Nigeria are heavy sources of Environmental pollution. However, before now there was no realistic valuation model for valuation of the environmental damage caused by these industries. Advocates of environmental protection in Nigeria then tasked the Estate Surveyors and Valuers to develop valuation models that would consider the extent of damages caused by industries to the environment while interpreting the value of such industries and other facilities generating waste in Nigeria. The E-factor model was then developed. This paper tries to value NIGERGAS Company Enugu, using the E-factor model. The company was valued using the Conventional Cost Approach to Valuation and thereafter the E-factor model. The results indicated a loss of value of about ₦16,266,020 representing 14.54%. This loss of value is attributable to the inability of NIGERGAS Company to meet up with world best practices in terms of environmental protection standards. The paper then recommends that the E-factor model be accepted by the Nigerian Institution of Estate Surveyors and Valuers (NIESV) as a veritable valuation tool for valuation of industries and other facilities generating wastes in Nigeria.*

Keywords: *Environmental Factor, Industries, Model, NIGERGAS Company, Pollution, Valuation, Waste.*

1.0 Background of the Study

Deane, Gray and Steel (1986) pointed out that valuation is a professionally derived estimate of value, which is based on supportable conclusions arrived at through a thorough and logical analysis of facts and data at a particular time. The Estate Surveyor and Valuer is the professional that is bestowed with the responsibility of interpreting the values of different categories of properties both fixed and movable in Nigeria. Exercising this valuation duty has not been easy since the valuer in practice in Nigeria still depends on models developed many years ago by scholars in Europe. Gross lack of data has also made it extremely difficult for them to use the highly academic models that are currently emerging.

Again, Baum and Mackmin (1989) opined that the Estate Surveyors and Valuers concept of value is from a strictly economic perspective based on the premise that legal interest in landed properties are usually exchanged with money and are therefore regarded as scarce resources. In this sense, valuers see open market value as price struck between a willing and well informed buyer and seller under conditions approximating to that of a perfect competition. When viewed from another prospective, the Estate Surveyors and Valuers see value as the Replacement Cost (New) of the improvements on the property. This concept of value has been widely criticized.

With the worlds' recent focus on environment (OECD, 1989) brings to limelight the concept of Total Economic Value (TEV) which is very important in the valuation natural and man-made environment. TEV provides various perspectives on different kinds of benefit that accrue from environmental preservation and improvement. Ogunba (1999) opined that TEV covers the use value, the option value and the non-use value. According to Bishop (1982) the use value has a striking relationship with the existing use value, exchange value and alternative use value as practised by Estate Surveyors and Valuers. He however pointed out that the non-use value has been seriously neglected by majority of Estate Surveyors and Valuers in practice during their valuation exercise. This according to Aina (1992) has resulted in gross over-valuation of environmentally unsound properties. Proponents of TEV in Nigeria, have therefore called on Estate Surveyors and Valuers in Nigeria (both academicians and practitioners) to develop more generally accepted Environmental valuation models that can handle serious cases of environmental damage and by implication take care of the non-use value. In tandem with this called, the Environmental Factor (E-factor) adjusted cost approach to valuation was developed by Aniagolu (2009). This work therefore tries to apply the model to the valuation of NIGERGAS Company Limited, Emene, Enugu, Nigeria.

2.0 Statement of the Problem

Aniagolu (2009) developed the E-factor model. This is an extension of the Cost Approach to valuation which is derived from the Cost Theory of value. E-factor simply measure the rate of compliance of industries or other facilities generating waste / pollution in Nigeria to Environmental Standards as contained in the National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Waste) Regulation of 1991. The model is designed in such a way that valuers are expected to inspect pollution abatement facilities in industries and other facilities generating waste in addition to their usual inspection of Land & Buildings, Equipment and Hand tools, Plant & Machinery, Motor Vehicle, Furniture and Fittings, etc.

Aniagolu, Iloeje and Emoh (2015) had earlier demonstrated the use of the model in terms of data collection, data collating and data analysis. Also Aniagolu, Iloeje and Okwu-Delunzu (2015) had also applied the model to the valuation of Anambra Motor Manufacturing Company (ANAMMCO), Emene, Enugu, Nigeria: a company with international repute and affiliation. This paper therefore tries to apply the model also to NIGERGAS Company Nigeria Limited: a local company that is indigenous to Nigeria.

3.0 Aim and Objectives of the Study

This study aims at applying the E-factor model to the valuation of NIGERGAS Company Limited, Emene, Enugu, Nigeria. To achieve this aim, this study will first of all describe NIGERGAS Ltd to the reader so that a visual impression of the company could be attempted by the reader. Secondly, an attempt will be made to value NIGERGAS Ltd using the Cost Approach to Valuation as adopted by valuers in Nigeria. Thirdly, NIGERGAS Ltd would be valued with the E-factor model. Finally the result from the two valuation processes would be compared and inferences drawn.

4.0 Research Methodology

The E-factor model makes extensive use of the experimentation and survey research methods. According to Odoziobodo and Amam (2007), Experimentation research is the manipulation of experimental variables to ascertain that one is related to or has any effect on the other. Also Anyadike (2009) described survey research as one that tends to cover a large population of people by taking and studying samples from the population.

5.0 NIGERGAS Company Limited, Emene, Enugu, Nigeria

5.1 Ownership:

NIGERGAS Limited started in May 1962 as a partnership business between the former Eastern Nigerian Government and Siad Machine Impianti Italy who supplied the plant and managed the company until the Nigerian/Biafra Civil War broke out in 1967. After the Biafran war, as states were being created and assets were shared, Enugu State Government retained ownership of the company. Hence the company is 100% owned by Enugu State Government (NIGERGAS, 1980).

5.2 Range of Products:

The Company's products are welding and processing Oxygen, Medical Oxygen, Nitrogen, Acetylene and waste-lime which can be used in paint production, production of fillers and production of chalk (NIGERGAS, 1980). The products of the company and their installed capacity are presented in table 1.

Table 1: Product Range of NIGERGAS and Their Installed Capacity.

S/N	Product	Installed Capacity	Purity
1.	Welding/Process Oxygen	620M3/HR	97 – 98%
2.	Medical Oxygen	620M3/HR	99.9%
3.	Nitrogen	620M3/HR	-
4.	Acetylene	32M3/HR	-

Source: Aniagolu (2009)

Products of NIGERGAS, until recently were used nationwide and are marketed through their distributors' and agents.

5.3 Raw Material Requirements

For the production of Acetylene, NIGERGAS imported Calcium Carbide (CaO_2) from Europe. The calcium carbide came in drums of 100kg. Each production process requires 10 drums. Hence, the major raw material for production of acetylene was imported.

For the production of Oxygen and Nitrogen gases, no raw material was required since production is from atmospheric air which is required to be free from pollutants. As at 2009 when field work for this study was carried out, only the acetylene plant was working.

5.4 Production Processes

NIGERGAS operates two production processes with two separate production plants. The first production plant produces Oxygen and Nitrogen alternately (i.e the plant can only produce one of the gases at a time) while the second production plant produces acetylene. Details of the two production lines are as follows:

5.4.1 Oxygen Plant:

The oxygen plant is a 1973 model oxygen plant with the capacity of filling 100 (one hundred) cylinders at a time. The plant as originally installed is fully automated and operates with cryogenic technology (technology of very low temperature). To manufacture Oxygen or Nitrogen, atmospheric air is sucked-in from the intake point by an aspirator which is fitted with filters to remove impurities. The air so sucked-in then moves through pipes to the compressor. As the name implies, the compressor compresses the air giving it additional pressure and very high velocity. The high velocity air then moves from the compressor to the Freon coolers in a 4 (four) stage compression and cooling process. The Freon cooler reduces the temperature of the air to a very low negative point. From there, the air moves to the preliminary heat exchange where the air is further cooled. The air then moves to the molecular adsorber units where other impurities (carbodioxide, hydrocarbons, moisture, etc) are removed. From the adsorbers, the air moves to the Expansion Turbine where the air is liquefied. In the Expansion Turbine the liquefied air is between – 192^{oC} and – 194^{oC}. The liquefied air is then sent to the fractionating column. This comprises the lower column and upper column. Between the two columns are two sub-coolers which further reduce the temperature of the liquefied air. At this very low temperature, the liquefied air is then separated into its components: Oxygen and Nitrogen (NIGERGAS, 1980).

The gas desired at each point in time is collected and sent to the condenser/evaporator from where it is transferred to the ramp for filling of the cylinders. The undesired gas is evaporated through a valve back into the atmosphere. As at the time of this work this plant is not working.

5.4.2 Acetylene Plant:

The acetylene plant is fully automated too. Acetylene is produced by a wet process. The plant is installed to produce pure acetylene gas with the use of calcium carbide (CaO_2) as a major source of raw material. It has a filling capacity of 120 (one hundred and twenty) cylinders at a time.

For acetylene production, the movable hopper is lowered and loaded with 1000kg of calcium carbide. The hopper is then lifted by an air operated crane of about 1500kg capacity into the immovable hopper. The immovable hopper accepts the CaO_2 with the help of a media screw conveyor and introduces the CaO_2 into the generator which is half filled with water. The water then reacts with the CaO_2 to produce lime, heat and low purity Acetylene gas (LPAG). A paddle stir is installed in the generator to ensure maximum output. A cooling system is installed to circulate water into the generator to keep it cool. Since the generator is expected to operate at normal temperature. The waste carbide (lime) is purged from the generator periodically through a valve, while other gaseous impurities escape into hydraulic safety blow-out machine. The water inside the generator prevents the LPAG from escaping. Nitrogen is passed manually to separate or prevent oxygen from having contact with the acetylene to avoid explosion/accident. The LPAG then travels through a pipe to the gasometer or gas reservoir (which is filled with water to serve as a scalant) while carbide waste lime and water escape for processing at the recycling plant.

From the gasometer, the LPAG travels through pipes to two low pressure driers for purification. The low pressure drier removes moisture and lime particles. From there the LPAG passes through pipes to the purifier (mass filters) to eliminate the last lime particles and moisture before going through pipes again to the 3 (three) stages compressor. The compressor releases High Purity Acetylene Gas (HPAG) which again passes through pipes to 6 (six) high pressure driers for final purification before moving to the ramp via pipes for bottling in cylinders. As at the date of this work (2009) this plant is in a very good state of repairs and is functioning very efficiently.

Carbide waste (lime and water) is pumped through pipes from acetylene plant to the waste recycling plant. This plant comprises three mixers arranged in stages. The mixers mix the waste by-product very well before they are pumped into a sieving machine. From this machine, the waste by-product moves to the nomadic dryer before they are moved to the oven for baking. The backed products are then returned to the crusher from where they are bagged. The entire processes work manually. As at the date of our field work in 2009, this recycling plant broke down. An improvised waste recycling system was dug in the area. This consist of 4 (four) underground septic sedimentation tanks. The waste carbide passes through the four tanks and as they are doing so, the carbide settles under while the waste water collects at the last tank. The carbide sediments are collected manually and bagged while the water is piped back to the acetylene plant for further production.

5.5 Sources of Pollution from the Production Processes

The major sources of pollution from the production processes of NIGERGAS Limited would include but not limited to solid/sanitary wastes from various offices: waste carbide (lime and water) from production of acetylene gas, emissions from plants, vehicles and power generating sets, noise pollution from vehicles plant and power generation sets, waste water from acetylene processing plants.

5.6 Existing Pollution Abatement and Safety Measures in NIGERGAS

Our survey reveals the following waste management strategies in NIGERGAS

a. Waste Water

Waste water is generated from acetylene plant in the form of a mixture of lime and water. The installed waste treatment plant was not functional at the time of this study rather an improvised waste treatment process comprising four sedimentation / septic tanks which was dug in the premises. This by all standards is grossly inadequate.

b. Solid Waste:

The solid waste management system in NIGERGAS is very poor probably because of the low level of activities in the factory. Waste bins are located only inside administrative offices. The production area and the entire premises do not have waste bins. Open incineration system is used for disposal of the wastes.

c. Gaseous Emissions:

The acetylene plant generates a lot of CO_2. Result from the E-factor model attest to this. Unfortunately, the company has no gas masks or any other remedy to this problem. Factory workers were so surprised when they saw the readings from our gasometers.

d. Noise Pollution:

Noise pollution level is minimal. This may be attributed to the fact that the level of activities within the factory is quite low. Besides, power generating sets were not on as at the date of this work.

e. Industrial Health and Safety:

In the area of industrial Health and Safety, NIGERGAS has a lot to improve on. There is no clinic for workers, the first-aid boxes in the factory are not functional and firefighting materials are mostly sand buckets and fire extinguishers. The workers were not wearing safety devices and enforcement of such safety precautions are almost non-existent.

6.0 Valuation of NIGERGAS Using the Conventional Method

6.1 Method of Valuation Adopted:

The cost approach to valuation was adopted for the valuation of assets of NIGERGAS Company Limited, Emene, Enugu, Nigeria. The method can also be called the contractors method, the contractors taste, the replacement cost approach, the re-instatement cost method or the depreciated replacement cost (DRC) approach. According to Aniagolu (2009) the DRC approach is most preferred because it best describes what the valuer is doing.

6.2 Rationale for Using the Method.

The method is best used when the market approach is impracticable due to dearth of comparables and the investment method is inapplicable probably because there is no rent passing (Kalu, 2002). Hence, NIGERGAS has no comparable sales evidence in Enugu and there is no rent passing on the properties. Again, according to Aniagolu (2009) the method (i.e DRC method) is best used for special purpose industries, service properties such as schools, hospitals, churches, etc. (where comparable sale evidence is not available) and any other type of property where there is no rent passing and there is no comparable sales evidence.

6.3 Valuation of NIGERGAS Company, Emene, Enugu, Nigeria Using the Conventional Method

Messrs Frank Maluze and Associates carried out the valuation of NIGERGAS in 2001. In the concluding part of their report Frank Maluze Associates (2001) declares that "consequent upon the foregoing and having regards to the location and condition of the property as well as the present economic circumstances in the country, it is our well considered opinion that the capital value of NIGERGAS Company Limited, Emene, Enugu for Balance Sheet purposes as at 12th September, 2001 or within a reasonable period of that date is ₦111,841,000 (One Hundred and Eleven Million, Eight Hundred and Forty-One Thousand Naira only)". It must be stated that as at 2001 the exchange rate of dollar to naira is about One Dollar to One Hundred and Twenty Naira (1:120). The summary of the valuation is as follows:

1.	Land	₦10,608,000
2.	Building & Improvement	₦44,106,000
3.	Motor Vehicles	₦10,020,000
4.	Plant, Machinery & Equipment	₦39,595,000
5.	Furniture and Fittings	₦ 7,517,000
	Total	**₦111,846,000**

7.0 Valuation of NIGERGAS Using the E-Factor Model

The procedure for determining the E-factor was clearly demonstrated by Aniagolu, Iloeje and Emoh (2015). According to them, the data required for the E-factor model include data on air, effluent and soil quality. Also data on noise level including industrial Health and Safety were also required. The valuer in practice needs to determine the E-factor alongside his physical and socio-economic analysis of the properties.

7.1 Determination of Rate of Compliance of NIGERGAS to Air Quality Standards.

Air quality at NIGERGAS was monitored in-situ at four different locations namely central workshop, Ramp, Acetylene Plant and Waste Treatment Area. These locations where chosen because of their strategic nature. Gascom gasometers fitted with special gas detectors/sensors and calibrated in parts per million were used to collect data on air quality. The average of the results from the four locations was then compared with World Health Organization (WHO) / Federal Ministry of Environment (FMENV) Standards. The result is presented in table 2.

Table 2: Comparison Between WHO/FMENV Standards and NIGERGAS Air Quality.

Parameters	Methodology	FMENV/ WHO Standard	Result from Industrial Sample	Deviation	Rate of Compliance	Rate of Non Compliance	Remarks
Dust Particles	Gasometer	NS	-	-	16.67%	3.33%	NC
Carbon II Oxide (CO)	“	1-5	14	9			ASL
Sulphur IV Oxide (SO2)	“	0.5	0.1	-			WSL
Carbon IV Oxide (CO_2)	“	1-5	NC	NC			NC
Nitrogen IV Oxide (NO_2)	“	0.085	0.0	-			WSL
Ammonia (NH_3)	“	0.2	0.14	-			WSL
Hydrocarbons	“	6.0	2.0	-			WSL
Chlorine	“	1.0	0.14	-			WSL
Hydrogen Cyanide	“	NS	0.0	NC			NC

Source: Aniagolu (2009)

Legend: NC = Not Compared , NS = Not Stated, WSL = Within Stipulated Limit, ASL = Above Stipulated Limit

Table 2 clearly shows that the rate of compliance of NIGERGAS to air quality standard is 16.67 percent while the rate of non-compliance is 3.33%. Hence, of the 20 marks which the model assigned to air quality NIGERGAS scored 16.67 marks and lost 3.33 marks.

7.2 Determination of the Rate of Compliance of NIGERGAS Effluent to Water Quality Standards.

Water sample was collected from NIGERGAS effluent discharge point and sent to the laboratory for analysis. The result was then compared with WHO/FMENV Standards. The result is presented in table 3.

Table 3: Result of Comparison Between NIGERGAS Effluent Quality and WHO/FMENV Standards.

Parameters	Methodology	FMENV/ WHO Standard	Result from Industrial Sample	Deviation	Rate of Compliance	Rate of Non Compliance	remarks
(a) Physical Analysis					9.45%	10.55%	
Odour	-	NC	NC	-			
Colour (Haven Unit)	Lovibond	25	10	-			NC
Ph (31^{0C})	Meter	6.5 – 9	10	1			WSL
Conductivity (chm/km)	Meter	1000	130,000	129,000			ASL
(b) Chemical Analysis							
Acidity Ng/Ica/Co_3	Microbiological	400	100	-			WSL
Alkalinity Mg/LCa/Co_3	Microbiological	30 – 500	2,650	2150			ASL
Total Solid Mg/L	A.P.H.A	2000	1520	-			WSL
Dissolved Solids Mg/L	A.P.H.A	500	1380	880			ASL
Suspended Solids Mg/L	A.P.H.A	30	NC	-			NC
Calcium Mg/L	E.D.T.A	75	76.152	1.152			ASL
Magnesium Mg/L	E.D.T.A	30	389.12	359.12			ASL
Total Hardness Mg/L	E.D.T.A	50 – 200	1790	1590			ASL
Sodium Mg/L	Flame Photometer	NS	NC	NC			NC
Potassium Mg/L	“	NS	NC	-			NC
Copper Mg/L	“	NS	NC	-			NC
Zinc Mg/L Ca/Co_3	ASS	200	32,493.5	32,293.5			ASL
Iron Mg/L	Spectrophotometer	0.3	2.167	1.867			ASL
Manganese Mg/L		0.1-0.5	0	-			WSL
Lead PPM		0.01	5.25	5.24			ASL
Chloride Mg/L	“	250	35.46	-			WSL
Sulphate Mg/L	“	250	NC	NC			NC
Nitrate Mg/L	“	50	0.10	-			WSL
COD Mg/L	A.P.H.A	80	49.77	-			WSL
BOD Mg/L	A.P.H.A	30	54.80	24.8			ASL
Dissolved Oxygen Mg/L		NS	NC	NC			NC
(c) Microbiological Analysis							
E-Coli 100ml	Microbiological	-ve	-ve	-			WSL
Coliform 100ml	Microbiological	100	NC	NC			NC
Total Plate	Plate count	100	NC	NC			NC

Count							

Source: Aniagolu (2009).

Legend: NC = Not Compared , NS = Not Stated, WSL = Within Stipulated Limit, ASL = Above Stipulated Limit

The result shows that out of the 20 marks which the model assigned to water quality NIGERGAS scored 9.45 marks and lost 10.55 marks. This result shows immediately that the recycling plant in the factory is not working.

7.3 Determination of the Rate of Compliance of NIGERGAS to Soil Quality Standards.

Soil quality analysis is subdivided into solid waste management system and soil element analysis. The model assigned 10 marks each to the two. To assess the solid waste management system, the model considered the waste collection method, percentage of waste that is non-biodegradable, availability of recycling equipment and solid waste disposal method. The result of the assessment carried out in NIGERGAS is presented in table 4.

Table 4: Result from Inspection of Solid Waste Management System in NIGERGAS

S/No	Parameters	Maximum Points Obtainable	Points Obtained	Deviation	Rate of Compliance	Rate of Non Compliance	Remarks
1	Collection methods	2.5	1.0	1.5	4.5%	5.5%	FAIR
2.	% Non Biodegradable	2.5	1.5	1.0			-
3.	Availability of Recycling Equipment	2.5	1.0	1.5			FAIR
4.	Disposal Method	2.5	1.0	1.5			FAIR

Source: Aniagolu (2009).

From table 4, it could be seen that the rate of compliance of NIGERGAS to acceptable solid waste management practices is 45% while the rate of non-compliance is 55%. Hence out of the 10 marks allocated by the model NIGERGAS scored 4.5 marks and lost 5.5 marks.

Also, for the soil element Analysis, soil sample from NIGERGAS dumpsite was collected and sent to the laboratory for analysis. The result from the analysis was then compared with WHO/FMENV Standards as presented in table 5.

Table 5: Result of the Comparison Between NIGERGAS Soil Sample and WHO/FMENV Standard.

Parameters	Methodology	FMENV/ WHO Standard	Result from Industrial Sample	Deviation	Rate of Compliance	Rate of Non Compliance	Remarks
(b) Element Analysis	Composite Soil Analysis				10%	0%	
Calcium (Ca)		NS	NC				NC
Magnesium (Mg)		2 – 10	4.80	-			WSL
Sodium (Na)		NS	NC	-			NC
Iron (Fe)		0.5-1.0	0	-			WSL
Aluminium (Al)		10-100	60.0	-			WSL
Lead (Pb)		1 – 20	3.40	-			WSL
Zinc (Zn)		0.10-300	0.03	-			WSL
Copper (Cu)		20	0	-			WSL
Manganese (Mn)		0.20-300	0.3	-			WSL
Silica (Si)		NS	NC	-			NC
Titanium (Ti)		NS	NC	-			NC
Cadmium (Cd)		0.03-0.3	0	-			WSL
Loss on Ignation (Lol)		NS		NC			NC

Source: Aniagolu (2009)

Legend: NC = Not Compared , NS = Not Stated, WSL = Within Stipulated Limit

Table 5 shows that all the parameters measure and compared are within stipulated limits. Thus, NIGERGAS scored full 10 marks in the area of soil element analysis.

7.4 Determination of the Rate of Compliance of NIGERGAS to Noise Level Analysis

Noise Level Analysis was also done in-situ using Radio shack sound level meter which is calibrated in decibel (dBA). The meter ranges from between 50 dBA – 120 dBA. Noise level in the administrative block, workshop area, generator area, distribution area, security post and waste treatment area were measure and compared with WHO/FMENV Standard. The result is presented in table 6.

Table 6:Result of Noise Level Analysis Carried out in NIGERGAS

S/N	Parameters	Methodology	FMENV / WHO Standard (dBA)	Result from Industrial Sample	Deviation	Rate of Compliance	Rate of Non Compliance	Remark
1.	Administrative block		90	72	-	20%	0%	WSL
2.	Workshop Area	Radio Shack	90	80	-			WSL
3.	Generator Area	Sound Level	90	80	-			WSL
4.	Distribution Area	Meter	90	85	-			WSL
5.	Security Post		90	85	-			WSL
6.	Waste Treatment Plant		90	85	-			WSL

Source: Aniagolu (2009)

Legend: WSL = Within Stipulated Limit

Again, table 6 shows that noise level in all the section of the factory are within stipulated limits. Hence, NIGERGAS is fully compliant to acceptable noise level. This means that NIGERGAS scored full 20 marks that the model assigned to Noise pollution.

7.5 Determination of the Rate of Compliance of NIGERGAS to Industrial Health and Safety Standards

The model assigned 20 marks to Industrial Health and Safety. The parameter for determination of the rate of compliance is shown in table 7. Facilities in NIGERGAS were then inspected and scored accordingly. The result is presented in table 7.

Table 7: Industrial Health and Safety Analysis in NIGERGAS, Enugu

Parameters	Methodology	Maximum Point Obtainable	Points Obtainable	Deviation	Rate of Compliance	Rate of Non Compliance	Remark
Availability of Clinics and First Aid Boxes	Inspection / Observation	2.0	0.4	1.6			P00R
Availability of Fire Fighting Prevention Equipment / System	Inspection / Observation	2.0	0.4	1.6			POOR
Availability and use of Industrial Safety Devices	Inspection / Observation	2.0	0.8		5.6%	14.4%	
Availability of Facility for Solid Waste Management	Inspection / Observation	2.0	1.2	1.2			FAIR
Establishment of Pollution Monitoring Unit	Inspection / Observation	2.0	0.4	0.8			GOOD
Availability of list of Chemicals use in the Industry	Inspection / Observation	2.0	0.8	1.6			POOR
Availability of Pollution Responses Machinery & Equipment	Inspection / Observation	2.0	0.4	1.2			FAIR
Availability of FEPA Discharge Permit	Inspection / Observation	2.0	0.4	1.6			POOR
Availability of Pollution Prevention Equipment	Inspection / Observation	2.0	0.4	1.6			POOR
Evidence of Environmental Audit Report	Inspection / Observation	2.0	0.4	1.6			POOR

Source: Aniagolu (2009)

Table 7 clearly shows that out of the 20 marks assigned by the model, NIGERGAS scored 5.6 marks and lost 14.4 marks. This result shows that a lot desires to be done in NIGERGAS in term of Industrial Health and Safety.

7.6 Summary of the Parameters for E-Factor Model.

Summary of the results from air quality analysis, effluent discharge quality, soil element analysis and solid waste management system as well as noise pollution level are presented in table 8.

Table 8: Summary of the Results from E-Factor Analysis for NIGERGAS

S/No	Parameters	NIGERGAS	
		Compliance Rate %	Non-Compliance Rate %
1.	Air Quality	16.67	3.33
2.	Effluent Discharge	9.45	10.55
3.	Solid Waste Management	4.50	5.50
4.	Soil Quality	10.00	0.00
5.	Noise	20.00	0.00
6.	Industrial Health and Safety	5.60	14.40
	Total	66.22	33.78

Source: Aniagolu (2009)

This shows a rate of compliance of 66.22% and a rate of non-compliance of 33.78%.

7.7 Valuation of NIGERGAS Using the E-Factor Model.

The E-factor model as propounded by Aniagolu (2009) and demonstrated by Aniagolu, Iloeje and Emoh (2015) is as follows:

$CV = V_L + V_{BI} + V_{FF} + [(V_{PME} + V_{MV}). \text{E-factor}]$

Where:

CV = Capital Value of Industry

V_L = Value of Land

V_{BI} = Depreciated Replacement Cost of Buildings and Improvements

V_{FF} = Depreciated Replacement Cost of Furniture and Fittings

V_{PME} = Depreciated Replacement Cost of Plant, Machinery and Equipment

V_{MV} = Depreciated Replacement Cost of Motor Vehicles

E-Factor = Rate of Compliance of the Industry to Environmental Standards

Therefore, valuation of NIGERGAS using the E-factor model is as follows:

CV = ₦54,714,000 + ₦7,517,000 + [(₦39,595,000 + ₦10,020,000) x 0.662]

= ₦54,714,000 + ₦7,517,000 + [₦49,615,000 x 0.662]

= ₦54,714,000 + ₦7,517,000 + ₦32,845,130

= ₦95,579,980

This shows a reduction in value of about ₦16,266,020 (Sixteen Million, Two Hundred and Sixty Six Thousand and Twenty Naira) and 14.54% loss of value.

8.0 Discussion of Findings:

NIGERGAS Company Emene, Enugu, Nigeria was valued using the Conventional Cost Approach to Valuation. Messrs Frank Maluze and Associates interpreted the value of the company in 2001 to be ₦111,846,000 (One Hundred and Eleven Million, Eight Hundred and Forty-Six Thousand Naira). Since industries in Nigeria are heavy polluter of the environment proponents of environmental protection called for models that would consider environmental factor in valuation of industries. Aniagolu (2009) then developed the Environmental Factor Adjusted Cost Approach to Valuation or the E-factor model. The model considers the level of air, noise and soil pollutions generated by the industry, as well as the quality of effluent discharge and compliance to industrial health and safety standards. The model was then used to re-value NIGERGAS Company, Emene, Enugu, Nigeria.

The air quality analysis shows that NIGERGAS scored 16.67 marks out of the 20 marks assigned to air quality by the E-factor model. Also the quality of effluent discharge from NIGERGAS was also investigated. It was also discovered that out of the 20 marks assigned to effluent discharge quality, NIGERGAS scored 9.45 marks losing as much as 10.55 marks. Further, the soil quality of NIGERGAS was again investigated. The model assigned 10 marks each to soil element analysis and solid waste management system. NIGERGAS obtained 10 marks and 4.5 marks respectively. Furthermore, the noise level in the factory was compared with international standards. It was discovered that NIGERGAS score 20 full marks that the model assigned to noise pollution. Finally under industrial Health and Safety, NIGERGAS performed very poorly scoring 5.6 marks out of the 20 marks which the model assigned to Industrial Health and Safety.

At the end of our analysis NIGERGAS score a total rate of compliance of 66.22% loosing 33.78%. When the factory was then re-valued with the E-factor model the value of the factory came down to ₦95,579,980 (Ninety-Five Million, Five Hundred and Seventy-Nine Thousand, Nine Hundred and Eighty Naira only). This represents a loss of value of 14.54%.

9.0 Recommendations

NIGERGAS Company, Emene, Enugu, Nigeria was valued with E-factor model. The result shows a 14.54% loss in value due to the inability of NIGERGAS to meet up with international best practices in terms of environmental protection. It is therefore recommended that the E-factor model should be adopted by the Nigerian Institution of Estate Surveyors and Valuers (NIESV) for the valuation of industries and other facilities generating waste in Nigeria. Also the model should be integrated into the academic curriculum of Tertiary Institutions offering Estate Surveying and Valuation in Nigeria. Again the valuer in practice in Nigeria should adopt this model since it is not too academic. Finally, further research should be extended to integration of environmental considerations into other valuation models.

10.0 Conclusion

The valuation of NIGERGAS using the E-factor model reveals that the company does not comply with international best practices. The E-factor detected about 33.78% rate of non-compliance to WHO/FMENV Standards. This resulted in about 14.54% loss in value when the valuation figure from the conventional valuation is compared with the valuation figure obtained from the use of the E-factor model. Valuers as environmental protection advocates should therefore make extensive use of the model.

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