ENVIRO – CHEMICAL POLLUTANTS: THE UNWELCOME YET UNAVOIDABLE HUMAN COMPANIONS

THE 68TH INAUGURAL LECTURE OF THE UNIVERSITY OF UYO
The 68th Inaugural Lecturer:

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PROFESSOR OF ENVIRONMENTAL CHEMISTRY
INTRODUCTION (1/5)
The Author of Environment

• “In the beginning, God created the heavens and the earth” (Genesis 1:1)

• “By the word of the Lord were the heavens made, their starry host by the breath of his mouth” (Psalm 33: 6)
INTRODUCTION (2/5)
The Author of Environment

God created the universe - the heavens and the earth, darkness and light, day and night, water and dry land, the sky, plants and trees that bear fruits with seeds in them, living creatures including animals, fish and birds from nothing.
Finally He created man and woman.

All these creations constitute the environment.

Then God blessed the man and woman and said to them “Be fruitful and multiply; fill the earth and subdue it and have dominion--” (Gen. 1: 28 – 30).

God provided everything needed by man to survive.
God is therefore the sole founder and owner of the environment.

The ownership and control of all God made; from the earth itself to natural resources, plants and animals is uncontestable.

Man was created to manage and monitor the environment.
Human beings were created to partner with God in making provision for our temporal well being and enhance the beauty and fruitfulness of the rest of the earth and not to destroy it.
THE CONCEPT OF ENVIRONMENT

• This is simply the surrounding and everything that affects it.

• It is the sum total of water, air and land and their interrelationships with each other and with human beings, other animate and inanimate things.
ENVIRONMENT AND MATTER

• Everything created by God is called matter as long as it has weight and occupies space.

• Matter is therefore the essence of life.

• Since matter exists in the environment, what affects the environment, affects it and vice versa.

• The Environmental Chemist is concerned with what matter is composed of, their properties, and how they are affected by changes in the environment.
ENVIRONMENTAL STEWARDSHIP

• An *Environmental Chemist* is the steward of the environment.

• *Environmental Chemist* ensures that things created by God are sustainably utilised.
THE CONCEPT OF ENVIRONMENTAL CHEMISTRY

• It is one of the Applied Chemical Sciences that is closely associated with Analytical Chemistry.

• It is an interdisciplinary subject that uses subjects such as chemistry, biology, physics, mathematics, microbiology, meteorology, etc. to solve chemical pollution problems.
THE ROLE OF ENVIRONMENTAL CHEMIST

The Environmental Chemist:

• Uses his knowledge of chemistry and chemicals to solve the problems of environmental destabilisation.

• Analyses all forms of matter to know the constituents, chemistry and uses of the matter.

• Interprets results of analysis and proffer solution.
THE CONCEPT OF ENVIRONMENTAL POLLUTION

• Environment as created for us by God was perfect, neat and sustainable (unpolluted).

• Man’s interaction with the environment led to imperfect, artificial and abnormal situation.

• Pollution results from man’s undue interference with nature.

• All forms of pollution are environmental and results from natural and anthropogenic activities.
CLASSIFICATION OF ENVIRONMENTAL POLLUTION (1/2)

1. Natural Pollution

Natural pollution occurs as a result of activities that take place naturally and include among others:

- radioactive decay and volcanic eruption.
- tsunami and mudslide.
- earthquake and landslide.
- microbial activities.
This occurs as a consequence of man’s interference with the natural environment.

Sources include among others:

• domestic, industrial and commercial activities
• vehicular emission, bush burning, gas flaring
• refuse incineration
• indiscriminate waste disposal
SOURCES OF ENVIRONMENTAL POLLUTION (1/2)

1. **Point Source Pollution:** any single identifiable source such as:

- Pipe, ditch, channel, conduit, ship, factory, generator, sewage, treatment plant, factory smokestack, chimney, gutter, etc.

- Easy to control
SOURCES OF ENVIRONMENTAL POLLUTION (2/2)

2. Non – point Source Pollution

This comes from many different unidentifiable sources including:

• land runoff, atmospheric deposition, storm water, drainage, particulate matter, aerosols, fly ash, dust, bacteria, fungi, poisonous gases, air pollutants, emerging organic compounds such as PPCPs and EDCs, etc.

• Harder to control
ENVIRONMENTAL POLLUTANTS

• Substances which contaminate or degrade the environment.
• Are dangerous and interfere with the quality of the environment to render it less desirable.
• Affect plants, animals and inanimate things such as structures, vehicles, buildings, roads, etc. adversely.
• Have deleterious effects on the living and non living resources.
• Could be primary or secondary.
PRIMARILY POLLUTANTS

• Are substances released directly into the environment in their harmful forms.
• Emanate from point sources.
• Are capable of contaminating or degrading an environment directly.
• Include substances such as domestic wastes, toxic and obnoxious gases such as NOx, SOx, NH₃, H₂S, CO, VOCs, PM (dust, soot, ash, etc.), trace metals, e.g. Hg, Pb, Cd, etc.
SECONDARY POLLUTANTS

These are pollutants produced when a substance reacts with another substance to produce another substance that is more harmful than any of the reactants or all combined, e.g.

(i) \( \text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2 \)

(ii) \( 2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3 \)

(iii) \( \text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3 \)
THE CONCEPT OF CHEMICAL POLLUTION

• This is a by-product of advancement in technology, industrialisation, urbanisation and population growth.

• Chemicals discharged into the environment as a result of the above phenomena produce chemical pollution.

• Media usually affected by chemical pollution are water, land(soil) and air.
TYPES OF CHEMICAL POLLUTION

1. Water Pollution

This is the disruption of the stability of surface water by the presence of harmful chemical substances from factories, industries, refineries, treatment plants, oil spills, insecticides, agricultural run off, fertiliser plants, river dredging, etc.
RIVER DREDGING AS AGENT OF CHEMICAL POLLUTION
EFFECTS OF WATER POLLUTION

Once wastes are discharged into any water body, they get absorbed/adsorbed by the sediment or sink to the bottom of the water body while some move on as the water flows downward.

• The water is rendered non-potable
• The available oxygen is depleted
• Eutrophication sets in resulting in death of aquatic organisms
• Light transmission is reduced
• Photosynthesis of aquatic plant is reduced
• Aquatic organisms such as fishes are polluted and subsequently man who consumes them through the principle of the 5Bs.
DOWNSTREAM FLOW OF POLLUTANTS
The practical way of preventing water pollution is to educate members of the public formally and informally of the negative consequences of dumping wastes into water bodies directly or into gutters/drainages.
PREVENTION OF WATER POLLUTION

Education and enlightenment campaigns, seminars, workshops and conferences would enable citizens to appreciate the importance of:

- Proper disposal of all types of wastes
- Not throwing trash, chemicals or solvents into sewers
- Not sinking borehole near soak away pits
- Avoiding the application of pesticides, insecticides and fertilisers on runoff-prone sites
- Not washing paint brushes into gutters
- Using environmentally friendly methods to remediate polluted sites
2. LAND POLLUTION

Land/soil degradation, destruction or defacement directly or indirectly by natural or anthropogenic activities such as earthquake, tsunami, volcanic eruption, land slides, mining, quarrying, road construction, careless disposal of wastes, construction/demolition of structures, farming/agriculture, etc.
LAND POLLUTION BY WASTE
CONSEQUENCES OF LAND POLLUTION

• Harmful to humans and wildlife because the toxic substances can get into their bodies directly by skin contact.
• Consumption of vegetables and fruits grown on polluted soil could lead to some diseases in people who consume them.
• Children are the most vulnerable especially if metals like lead and cadmium are present.
PREVENTION/REDUCTION OF LAND POLLUTION

This could be done by:
• reusing or recycling of wastes
• buying biodegradable products
• storing all liquid chemicals and wastes in spill-proof containers
• buying products that require no plastic packaging
• avoiding the pouring of motor engine oil or any petroleum products on the ground.
3. AIR POLLUTION

• This refers to a condition in which certain substances known as air pollutants are present in such amounts that they produce harmful effects on man and his environment.

• Agents of air pollution include gas flaring, vehicular emissions, smoking, fossil fuel burning, cooking with firewood, power plants, uncontrolled dumpsites, car pool, aerosol spray, manufacturing facilities.
COOKING WITH FIREWOOD
HORIZONTAL AND VERTICAL GAS FLARING
EFFECTS OF AIR POLLUTION

• Pollutants which enter the human body often find their ways to organs such as kidney, lungs, liver, heart and brain.

• Major ailments caused include emphysema, bronchitis, lung cancer, pneumonia, bronchial asthma, sore eyes.

• Air pollution is injurious to fauna and flora, increases cost of cleaning houses, precipitates acid rain, causes accident by blocking out natural light, causes waldsterben, causes ozone layer depletion which leads to global warming and climate change.

\[
\begin{align*}
S + O_2 \rightarrow SO_2; \\
2SO_2 + O_2 \rightarrow 2SO_3 \\
2SO_3 + 2H_2O \xrightarrow{\text{sunlight}} 2H_2SO_4
\end{align*}
\]
INDOOR AIR POLLUTION

• As the name implies, indoor pollution is a phenomenon associated with activities that go on inside our homes and offices leading to the contamination of the air.

• Such activities include burning of fossil fuels in our houses, e.g. cooking with firewood, use of mobile generators, use of insecticides, perfumes, coolants, refrigerators.

• Major pollutants found indoors include smoke (from generators, cigarette smoking and cooking), asbestos (used in roofing and ceiling), vinyl chloride (used in plumbing pipe), radon, formaldehyde (used in thousands of products including foam insulation, building materials, etc.).

• It is more deadly because pollutants are confined in a closed space and enter into synergic reactions to produce more deadly toxicants.

• Man spends most of his time in the office and rooms.
PREVENTION/CONTROL OF INDOOR AIR POLLUTION

• Avoiding cooking with firewood
• Stopping using pesticides, insecticides and perfumes in the rooms
• Keeping soot and smoke producing appliances such as generators far away from living rooms
• Putting off lanterns and other such lamps when not needed and before going to sleep
• Stopping smoking inside room or office
• Avoiding using asbestos materials for roofing and ceiling our houses
• Providing adequate ventilation in our rooms and offices
ENVIRONMENTAL POLLUTION CYCLE

This was designed to explain the interrelatedness of the three forms of pollution viz. land, water and air pollution.
MY RESEARCH FOCUS AND FINDINGS

• Interest was on finding out the extent of impact by industries on environment.

• Research topic was “Aqua – terrestrial environmental pollution studies of inorganic substances from two industrial firms viz. The Sunshine Batteries Industry and Peacock Paints Industry.”
SUNSHINE BATTERIES INDUSTRY

• Located in Ukana, Essien Udim Local Government Area in Akwa Ibom State.
• Produced different types of batteries.
• Produced liquid and semi solid waste.
• The liquid effluent was discharged into the nearby Atan stream after passing through treatment (neutralisation) plant.
• The semi solid waste containing mainly antimonial lead was stored in open drums and left exposed to sunlight and rain in the environment.
DRUMS CONTAINING SEMI SOLID WASTES
APPRAISAL OF SUNSHINE BATTERIES’ TREATMENT FACILITIES

• The production line of the industry showing pollutants and effluent treatment methods was studied.

• Samples of effluent inside and outside the industry as well as the neutralised effluent were analysed for certain parameters.

• Based on the results, a flow chart of the major production processes in the industry indicating suspected pollutants and their discharge routes was proposed as shown.
Flow Chart of Major Production Processes in Sunshine Batteries Ltd., indicating suspected pollutants and discharge routes
• Analyses for levels of Cu, Sb, Cd, Pb and Zn in water and fish were carried out upstream of Atan stream.

• Analyses for levels of same metals in water and same species of fish were carried out downstream of Atan stream after effluent discharge point

• In water all metal levels below effluent discharge point were significantly higher

• In fish, trends of increasing levels were apparent for Cu, Pb and Zn in some species downstream
• Cd showed a decreasing trend downstream in some species

• On the whole, Pb levels in all fish species appeared higher than the internationally recommended limits.

• The higher levels of Pb was traceable to negligence/carelessness on the part of operators of the treatment plant.

• The quality of water deteriorated downstream a water course which received the pollutants.
RESEARCH ON METAL LEVELS IN ARTHROPTERIS ORIENTALIS FROM BATTERIES INDUSTRY ENVIRONMENT (1/2)

- Research was carried out as a follow up of findings in previous research.
- Period of research covered wet and dry seasons to find out impact on the entire ecosystem.
- Aquatic plants collected from four sites: BPD, ADP, QIR\textsuperscript{1} and QIR\textsuperscript{2} were analysed for the levels of Pb, Sb, Cd, Cu and Co.
- Results were compared with levels in samples collected from UPS site.
• Levels of Pb and Sb were very high at ADP and QIR\(^1\) (impacted sites) relative to UPS (background site) (Table 1).

• Pb and Sb were very high because antimonial lead was used in making the battery plates.

• Because of the health implications of the presence of the metals, particularly Pb, the management was advised to be serious with the treatment and discharge of the effluent.

• Results also revealed that pollutants including metals got trapped by the sediment and absorbed through the roots to other parts of the plant.
Table 1: Mean Metal Levels (µg/g) in *Arthropteris orientalis* On Site Basis from Battery Industry Environment during Wet and Dry Seasons

<table>
<thead>
<tr>
<th>S/N</th>
<th>METALS</th>
<th>SEASON</th>
<th>UPS</th>
<th>BDP</th>
<th>ADP</th>
<th>QIR(^1)</th>
<th>QIR(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>LEAD</td>
<td>WET</td>
<td>11.40</td>
<td>16.46</td>
<td>32.39</td>
<td>16.75</td>
<td>13.61</td>
</tr>
<tr>
<td></td>
<td>(Pb)</td>
<td>DRY</td>
<td>11.52</td>
<td>15.28</td>
<td>42.32</td>
<td>16.38</td>
<td>11.64</td>
</tr>
<tr>
<td>2.</td>
<td>ANTIMONY</td>
<td>WET</td>
<td>17.17</td>
<td>34.40</td>
<td>44.21</td>
<td>60.04</td>
<td>20.64</td>
</tr>
<tr>
<td></td>
<td>(Sb)</td>
<td>DRY</td>
<td>20.94</td>
<td>26.72</td>
<td>43.19</td>
<td>67.35</td>
<td>22.32</td>
</tr>
<tr>
<td>3.</td>
<td>CADMIUM</td>
<td>WET</td>
<td>0.94</td>
<td>3.19</td>
<td>1.01</td>
<td>1.46</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>(Cd)</td>
<td>DRY</td>
<td>1.05</td>
<td>2.99</td>
<td>1.08</td>
<td>1.15</td>
<td>1.29</td>
</tr>
<tr>
<td>4.</td>
<td>COPPER</td>
<td>WET</td>
<td>2.22</td>
<td>3.69</td>
<td>3.21</td>
<td>5.69</td>
<td>2.32</td>
</tr>
<tr>
<td></td>
<td>(Cu)</td>
<td>DRY</td>
<td>2.60</td>
<td>2.41</td>
<td>4.13</td>
<td>5.05</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>(Co)</td>
<td>DRY</td>
<td>12.39</td>
<td>13.17</td>
<td>12.83</td>
<td>30.42</td>
<td>27.44</td>
</tr>
</tbody>
</table>
RESEARCH ON HEAVY METAL LEVELS IN ULTISOLS FROM AN ABANDONED BATTERIES INDUSTRY ENVIRONMENT (1/2)

• To find out if the soils were impacted by the industrial wastes and effluent discharge into the environment

• Research was carried out during wet and dry seasons

• Metals analysed for were Pb, Ni, Cr, Cd, Sb, V

• Results for wet and dry seasons are as presented in Tables 2 and Table 3, respectively.
Table 2: Concentrations of heavy metals in soil samples in wet season (µg g\(^{-1}\))

<table>
<thead>
<tr>
<th>Sample ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁</td>
</tr>
<tr>
<td>S₂</td>
</tr>
<tr>
<td>S₃</td>
</tr>
<tr>
<td>S₄</td>
</tr>
<tr>
<td>S₅</td>
</tr>
<tr>
<td>S₆</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>SD</td>
</tr>
<tr>
<td>CV(%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Pb</th>
<th>Ni</th>
<th>Cr</th>
<th>Cd</th>
<th>Sb</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁</td>
<td>0.131</td>
<td>0.086</td>
<td>0.722</td>
<td>0.090</td>
<td>0.078</td>
<td>0.179</td>
</tr>
<tr>
<td>S₂</td>
<td>0.122</td>
<td>0.084</td>
<td>0.899</td>
<td>0.122</td>
<td>0.028</td>
<td>0.193</td>
</tr>
<tr>
<td>S₃</td>
<td>0.128</td>
<td>0.103</td>
<td>0.706</td>
<td>0.155</td>
<td>0.002</td>
<td>0.284</td>
</tr>
<tr>
<td>S₄</td>
<td>0.327</td>
<td>0.128</td>
<td>0.861</td>
<td>0.242</td>
<td>0.001</td>
<td>0.229</td>
</tr>
<tr>
<td>S₅</td>
<td>0.285</td>
<td>0.128</td>
<td>0.885</td>
<td>0.144</td>
<td>0.001</td>
<td>0.250</td>
</tr>
<tr>
<td>S₆</td>
<td>0.016</td>
<td>0.050</td>
<td>0.025</td>
<td>0.005</td>
<td>BDL</td>
<td>0.062</td>
</tr>
<tr>
<td>X</td>
<td>0.216</td>
<td>0.106</td>
<td>0.814</td>
<td>0.150</td>
<td>0.022</td>
<td>0.227</td>
</tr>
<tr>
<td>SD</td>
<td>0.091</td>
<td>0.022</td>
<td>0.093</td>
<td>0.056</td>
<td>0.033</td>
<td>0.042</td>
</tr>
<tr>
<td>CV(%)</td>
<td>42.130</td>
<td>20.754</td>
<td>11.425</td>
<td>37.33</td>
<td>150.00</td>
<td>18.502</td>
</tr>
</tbody>
</table>
### Table 3: Concentrations of heavy metals in soil samples in dry season (µgg⁻¹)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Pb</th>
<th>Ni</th>
<th>Cr</th>
<th>Cd</th>
<th>Sb</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁</td>
<td>78.425</td>
<td>0.536</td>
<td>0.588</td>
<td>0.006</td>
<td>0.144</td>
<td>0.225</td>
</tr>
<tr>
<td>S₂</td>
<td>42.778</td>
<td>0.540</td>
<td>0.750</td>
<td>0.006</td>
<td>0.079</td>
<td>0.179</td>
</tr>
<tr>
<td>S₃</td>
<td>4.431</td>
<td>0.672</td>
<td>0.236</td>
<td>0.006</td>
<td>0.002</td>
<td>0.406</td>
</tr>
<tr>
<td>S₄</td>
<td>33.234</td>
<td>0.772</td>
<td>0.836</td>
<td>BDL</td>
<td>0.007</td>
<td>0.424</td>
</tr>
<tr>
<td>S₅</td>
<td>5.352</td>
<td>0.318</td>
<td>0.906</td>
<td>0.005</td>
<td>0.006</td>
<td>0.300</td>
</tr>
<tr>
<td>S₆</td>
<td>0.001</td>
<td>0.060</td>
<td>0.205</td>
<td>BDL</td>
<td>BDL</td>
<td>0.004</td>
</tr>
<tr>
<td>X</td>
<td>32.844</td>
<td>0.568</td>
<td>0.664</td>
<td>0.004</td>
<td>0.048</td>
<td>0.306</td>
</tr>
<tr>
<td>SD</td>
<td>30.576</td>
<td>0.170</td>
<td>0.222</td>
<td>0.002</td>
<td>0.062</td>
<td>0.170</td>
</tr>
<tr>
<td>CV(%)</td>
<td>93.094</td>
<td>29.930</td>
<td>33.434</td>
<td>50.00</td>
<td>129.170</td>
<td>29.930</td>
</tr>
</tbody>
</table>
• The mean levels for all the metals during wet and dry seasons followed the trends: Cr > Pb > V > Cd > Ni > Sb and Pb > Cr > Ni > V > Sb > Cd, respectively.

• High levels of Pb during wet and dry seasons was attributable to use of Pb as major raw material in the production of batteries.
PROF. UDOSEN IN SKLEAC LABORATORY IN BEIJING, CHINA
PEACOCK PAINTS INDUSTRY

• Located in Ikot Ekan in Etinan Local Government Area.

• Produced two main types of paints at the period of research — emulsion and gloss paints.

• Discharged the untreated wastes into a nearby farmland.
PAINT EFFLUENT DISCHARGED INTO A NEARBY FARMLAND
The semi solid wastes were disposed of at various ravines in Uyo.

The practice was discontinued after my presentation of a paper on the topic “Levels of Pb, Cu and Fe in fish from some streams within a ravine in Uyo Municipality” at a workshop organised by AKSEPA.
EVALUATION OF SOME METALS IN THE INDUSTRIAL WASTES FROM A PAINT INDUSTRY AND THE ENVIRONMENTAL POLLUTION IMPLICATIONS (1/3)

• Effluent (EFF) and sludge (SLD) samples as well as precipitates (PPTs) of the wastes were collected and analysed.

• Metals of interest were Zn, Pb, Cd, Cu and Cr.

• Samples of soils in the immediate environment which received the effluent and sludge wastes (SRW) were analysed for the same metals.

• Samples from background site (BGS) along Etinan-Abak road were also analysed for the same metals.
Precipitates and soils receiving paint wastes had higher levels of the metals compared with effluent and sludge samples.

Levels of metals in the samples followed the sequence:

- Zn: PPT » SRW › BGS » EFF › SLD
- Pb: PPT » SRW › BGS › EFF › SLD
- Cd: PPT › SRW › BGS › SLD › EFF
- Cu: SRW › PPT › BGS » SLD › EFF
- Cr: SWR › PPT › BGS › SLD › EFF
The above sequence shows that most of the metals were concentrated in the precipitates (PPT) and soils receiving paint wastes (SRW) compared with background soils (BGS).

Therefore, wastes should be treated before discharging into the environment or better still recycled to recover useful components of the wastes for reuse.
<table>
<thead>
<tr>
<th>Metals</th>
<th>Effluent</th>
<th>Sludge</th>
<th>Precipitate</th>
<th>Soil Receiving paint wastes</th>
<th>Background Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn</td>
<td>4.35</td>
<td>0.48</td>
<td>325.68</td>
<td>189.04</td>
<td>85.46</td>
</tr>
<tr>
<td></td>
<td>(2.90 – 6.00)</td>
<td>(0.24 – 0.85)</td>
<td>(81.16 – 530.88)</td>
<td>(125 -237.16)</td>
<td>(80 - 91.28)</td>
</tr>
<tr>
<td>Pb</td>
<td>1.06</td>
<td>0.35</td>
<td>219.04</td>
<td>126.05</td>
<td>5.64</td>
</tr>
<tr>
<td></td>
<td>(0.91 – 2.00)</td>
<td>(0.31 – 0.40)</td>
<td>(81’48 – 480.48)</td>
<td>(10 – 295.68)</td>
<td>(5.00 – 6.16)</td>
</tr>
<tr>
<td>Cd</td>
<td>0.17</td>
<td>0.39</td>
<td>16.11</td>
<td>10.15</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td>(0.00 – 0.34)</td>
<td>(0.31 – 0.47)</td>
<td>(3.14 – 25.12)</td>
<td>(3.00 – 25.12)</td>
<td>(2.00 – 3.14)</td>
</tr>
<tr>
<td>Cu</td>
<td>0.29</td>
<td>0.04</td>
<td>37.58</td>
<td>39.74</td>
<td>25.59</td>
</tr>
<tr>
<td></td>
<td>(0.06 – 0.50)</td>
<td>(0.00 – 0.06)</td>
<td>(3.78 – 71.82)</td>
<td>(81.25 – 70.56)</td>
<td>(25 – 26.50)</td>
</tr>
<tr>
<td>Cr</td>
<td>0.48</td>
<td>3.55</td>
<td>39.87</td>
<td>69.83</td>
<td>26.53</td>
</tr>
<tr>
<td></td>
<td>(0.00 – 1.00)</td>
<td>(0.71 – 7.14)</td>
<td>(19.60 – 71.40)</td>
<td>(30.10 – 128.52)</td>
<td>(25 -28.56)</td>
</tr>
</tbody>
</table>
LEVELS OF TOXIC METALS IN *TELFAIRIA OCCIDENTALIS* FROM PAINTS INDUSTRY ENVIRONMENT (1/2)

- Research was carried out to find out if metals in soil receiving paints wastes were easily absorbed by the plants grown on that soil.

- Metals analysed for were Pb, Zn, Cd, Cu, and Cr.

- Samples were plant grown on soils receiving paints wastes (PSPW) and those from background soils (PBGS).

- Zn and Cr were higher in PSPW samples than in PBGS while Pb and Cu were higher in PBGS than in PSPW.
• Coefficients of variation and degrees of accumulation of the metals in plant samples were also computed.

• Pb and Cd were lower in PSPW compared with levels in PBGS samples suggesting that the paints contained little or no Pb and Cd.
Table 5: Mean Levels, Ranges, Coefficients of Variation and Degrees of Accumulation of Metals in Plant Samples

<table>
<thead>
<tr>
<th>Metal</th>
<th>Sample</th>
<th>Mean Levels (µg/g)</th>
<th>Range of Levels (µg/g)</th>
<th>Coefficients of Variation</th>
<th>Degrees of Accumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn</td>
<td>PSPW</td>
<td>2.26</td>
<td>1.53 – 2.56</td>
<td>15.99</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>PBGS</td>
<td>2.05</td>
<td>1.88 – 2.21</td>
<td>4.55</td>
<td>0.00</td>
</tr>
<tr>
<td>Pb</td>
<td>PSPW</td>
<td>0.34</td>
<td>N.D – 0.75</td>
<td>69.72</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>PBGS</td>
<td>0.86</td>
<td>0.50 – 1.25</td>
<td>30.62</td>
<td>0.00</td>
</tr>
<tr>
<td>Cd</td>
<td>PSPW</td>
<td>0.03</td>
<td>N.D – 0.06</td>
<td>66.70</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>PBGS</td>
<td>N.D.</td>
<td>-</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cu</td>
<td>PSPW</td>
<td>0.82</td>
<td>0.50 – 1.10</td>
<td>24.38</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>PBGS</td>
<td>1.02</td>
<td>0.75 – 1.25</td>
<td>14.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Cr</td>
<td>PSPW</td>
<td>3.16</td>
<td>1.15 – 6.00</td>
<td>49.26</td>
<td>2.98</td>
</tr>
<tr>
<td></td>
<td>PBGS</td>
<td>1.06</td>
<td>N.D. – 2.10</td>
<td>77.48</td>
<td>0.00</td>
</tr>
</tbody>
</table>

* N.D. = Not Detected
OTHER ENVIRONMENTAL IMPACT RESEARCHES (1/2)

In addition to the few researches outlined above, over forty other researches within and outside industrial environments have been carried out singly and with my colleagues (Ref. My Curriculum Vitae). They include among others:

- Heavy Metal Levels in Water and Fish from Streams in Ikot Ekpene (Nigeria) in relation to Municipal Discharges.
- Determination of Trace Metal Levels and Fluxes in Sediments Along a Segment of Qua Iboe River in Southern Nigeria.
- Levels of Trace Metals in Sediments from Qua Iboe River and its Tributary.
- Trace Metal Levels in Soils within Abandoned Steel Industry.
IN – SITU SOIL TESTING BY PROF. UDosen AND A TECHNOLOGIST
OTHER ENVIRONMENTAL IMPACT RESEARCHES (2/2)

• Quantification and distribution of Atmospheric trace elements in Ibeno Local government Area, Akwa Ibom State.

• Levels of Toxic Metals in *Achatina achatina* From Parts of Akwa Ibom State, Nigeria.

• New Ecological Risk Indices for Evaluating Heavy Metals Contamination in Aquatic sediment: A Case Study of the Gulf of Guinea.

• Rain Water Chemistry Within the Vicinity of Qua Iboe Estuary, Nigeria.
SUMMARY OF SOME METALS AND THEIR TOXICOLOGICAL EFFECTS ON MAN (1/3)

- **Antimony**: slow poison, could cause skin and eye irritation, could damage lungs, heart, liver and kidney at high concentration over long period of time; could lead to vomiting, diarrhea, heat, stomach cancer, and sudden death

- **Arsenic(As)**: could cause lung cancer, diabetes, cardiovascular disease, aneroxia, *melanosis*, diarrhea, *facial edema*, heart disease, lip burning, loss of reflexes

- **Cadmium(Cd)**: not useful to biological systems, accumulative poison, causes *pulmonary emphysema*, *protein-urea*, *glucosurea*, *amino-urea*, bronchitis, *pneumonitis*, hypertension, anaema, destruction of testicular tissue
SUMMARY OF SOME METALS AND THEIR TOXICOLOGICAL EFFECTS ON MAN (2/3)

- **Cobalt (Co):** moderately toxic, could cause pneumonia, wheezing and asthma in high concentration.

- **Copper (Cu):** in high concentration leads to severe mucosal and gastrointestinal irritation; irritation of nose, mouth and eyes; capillary, hepatic and renal damage as well as depression, headache, stomach ache, dizziness, vomiting, diarrhea, liver and kidney damage which could lead to sudden death.

- **Iron (Fe):** excess could lead to chorditis, haemochromatosis, conjunctivitis and rentinitis

- **Lead (Pb):** One of the most feared, most toxic and most poisonous. No known physiological function., powerful neurotoxin, causes plumbism, cot death, still birth, stomach pains, insomnia, nausea, aneroxia, seizures, dizziness. anaemia, coma, low I.Q. in children
SUMMARY OF SOME METALS AND THEIR TOXICOLOGICAL EFFECTS ON MAN (3/3)

- **Mercury(Hg):** dangerous in vapour form, get oxidised in the brain and blood stream and endangers the organs; causes respiratory disorders, loss of appetite, tremors, insomnia, diarrhea, vomiting, minamata disease; pregnant women are most susceptible as foetus is very sensitive to Hg poisoning

- **Nickel(Ni):** in large quantities causes lung cancer, larynx cancer, prostate cancer, cough, dizziness, respiratory failure, birth defect, asthma, nausea, vomiting, abdominal pain, headache, chronic bronchitis, skin rashes

- **Vanadium(V):** persists in the environment, causes acute and chronic poisoning; inhalation of dusts of $V_2O_5$ results in rhinitis, kidney damage, bronchitis, fatigue, wheezing, conjunctivitis, nausea, aneroxia, tinnitus, dizziness, asthma, anemia, its carcinogenic
CONTRIBUTION TO E. I. A.
STUDIES AND REVIEWS (1/5)

• Got appointment to serve as the pioneer Board Chairman of AKSEPA by His Excellency, Lt. Col. Yakubu Bako fss, psc, the Military Governor of Akwa Ibom State in 1994.

• Successfully organised the first World Environment Day in the State on 5th June, 1995.

• Formed and inaugurated Environmental Protection Committees in almost all the existing Local Government Councils in the State.
CONTRIBUTION TO E. I. A. STUDIES AND REVIEWS (2/5)

• Served as Lead Consultant for Uniuyo Consult for many years.
• Consulted for communities, state governments, federal government, private companies, and oil companies notably Shell, Mobil and Elf.
• Served as Chairman/Subject expert of E.I.A Review Committees set up by the Federal Ministry of Environment to review reports of ongoing or completed E.I.A. studies (see details in the text).
CONTRIBUTION TO E. I. A. STUDIES AND REVIEWS (3/5)
CONTRIBUTION TO E. I. A. STUDIES AND REVIEWS (4/5)
CONTRIBUTION TO E. I. A. STUDIES AND REVIEWS (5/5)
CONCLUSIONS

• Existence of chemical pollution in the environment is a fact, not a myth or fable.
• Release of chemicals leads to pollution that disrupts the ecosystem.
• Chemical pollution fouls the air, contaminate our food, threatens the health of living things.
• Chemical pollution will persist as long as technological and scientific innovations aimed at solving man’s problems continue.
• Pollutants are found everywhere and are no respecter of anybody.
• Pollutants and industrialisation are unidentical twins.
RECOMMENDATIONS (1/2)

• Man should desist from discharging or dumping waste into the environment indiscriminately.
• Industries, factories and all business houses should be compelled by regulatory agencies to sort and treat their wastes.
• Governments should provide approved waste dump sites and assist in the evacuation of wastes.
• Members of the communities should be convinced about the importance of providing waste bins at homes and work places.
Recommendations (2/2)

• Efforts should be made by members of the communities to reduce, recycle or reuse their wastes to prevent pollution.
• The use of pesticides and insecticides should be stopped or minimised.
• People should use eco – friendly household products.
• Generators and other smoke/soot producing appliances should be kept far away from rooms and offices.
• Lanterns and other such lamps should be put off when not in use.
• Environmental Science should be taught at all levels of education including the non formal ones.
• Enlightenment campaigns should be mounted and workshops, seminars, conferences organised for members of the public.
CONCLUDING THOUGHTS

DON’T IGNORE POLLUTANTS. BE CONSCIOUS OF THEIR EXISTENCE. TOLERATE THEM BUT BE CAUTIOUS WHILE YOU CO-EXIST WITH THEM SINCE THEY ARE UNFRIENDLY, DANGEROUS AND THREAT TO YOUR SURVIVAL.
WE APPRECIATE YOU!
THANKS FOR LISTENING
GOD BLESS YOU!