

# ENVIRONMENTAL DEGRADATION BY IMPROPER DISPOSAL OF E-WASTE

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## Abstract:

One of the main causes of environmental damage in the world today is improper disposal of electronic garbage, or "e-waste." A significant portion of discarded electronics wind up in landfills, open dumps, or burned in unofficial recycling activities due to the rapid obsolescence of technological gadgets. These actions hasten the depletion of natural resources and discharge dangerous chemicals into the environment. Due to their short lifespan, computers and cell phones are disproportionately common among the discarded electronic appliances that make up e-waste. The Global E-waste Monitor 2024 estimates that 62 million tons (62 billion kg) were produced worldwide. More than fifty elements from the periodic table can be found in e-waste. Heavy metals (such as cadmium, mercury, copper, nickel, lead, barium, hexavalent chromium, and beryllium), phosphor, plastics, brominate flame retardants, and battery chemicals are among the deadly ingredients. The majority of e-waste is dumped in landfills. It is costly to deploy efficient reprocessing technology that can recover valuable materials with little impact on the environment. Extreme localized contamination is the initial effect of such reprocessing, and then the contaminants migrate into receiving waters and food chains. Thus, the purpose of this study investigated on environmental degradation caused by the improper disposal of electronic waste in Chennai's Perungudi dump yard. The project analyzed environmental and health impacts, and provided suitable management strategies. The project is based on both survey analysis and secondary data.

**Keywords** —E-waste, Leachate, Water quality, Heavy Metals, Air Quality Index, Recycling, Waste management

## I. INTRODUCTION

The amount of e-waste produced worldwide is concerning. The Global E-waste Monitor (2024) estimates that 62 million metric tons of e-waste were produced globally. Due to rising urbanization and digitalization, this figure is predicted to increase gradually. One of the waste streams in the modern world that is expanding the fastest is Ewaste. Electronic gadgets are being replaced at a never-before-seen rate due to quick technology breakthroughs and rising consumer demand for new

devices. More than fifty elements are found in e-waste, including dangerous materials like lead, mercury, and cadmium as well as valuable metals like copper and gold. Although these items can be recovered through appropriate recycling procedures, inappropriate disposal has detrimental effects on the environment.

## II. PROBLEM STATEMENT

The Perungudi Dump Yard has emerged as a crucial location for the improper segregation and

treatment of mixed trash, including electronic waste. As a result, dangerous chemicals are released into the environment. The accumulation of e-waste and mixed municipal rubbish at the Perungudi dumping site, which is close to the environmentally delicate Pallikaranai marshes, presents serious problems.

Toxic gases are released when waste is improperly disposed of and burnt at the site, causing respiratory problems and air pollution in the surrounding towns. Because garbage dumping endangers nearby ecosystems and groundwater quality, the dumpyard's close proximity to water bodies has further increased the possibility of contamination.

### **III. STUDY AREA PROFILE**

With an informal sector managing more than 95% of its electronic garbage, Chennai is the leading producer of e-waste in Tamil Nadu. Chennai is regarded as a particularly vital place for generation, even though Tamil Nadu produced 4.66 lakh tonnes of e-waste in 2024–2025. Informal aggregators frequently break components using unsafe, unscientific ways, posing serious environmental risks.

To inform the public about the significance of disposing of e-waste properly, public awareness campaigns have been launched. Sustainable e-waste management techniques are also being promoted by a number of private businesses and non-governmental organizations. With the introduction of the Extended Producer Responsibility (EPR) concept, producers are now accountable for the end-of-life management of their products.

Despite these initiatives, problems including low awareness, poor infrastructure, and lax enforcement of laws continue to exist. Due to the convenience and financial advantages, many people still favor selling e-waste to unofficial collectors. This reduces formal recycling systems' efficacy.

One location in Chennai for disposing of solid garbage is the Perungudi Dump Yard. It is situated along Old Mahabalipuram Road (OMR) in the southern section of the city, close to the IT corridor. The dump yard is one of Chennai's main landfills for municipal solid garbage. The Greater Chennai Corporation is in charge of running it.

Instead of using scientific landfill techniques, the Perungudi dump yard is mostly distinguished by open dumping operations. Large piles of mixed trash have resulted from this. The complexity of waste management at the site is exacerbated by improper segregation at the source.

Another serious problem is leachate generation, which occurs when liquid waste seeps through trash and contaminates groundwater and soil. Environmental dangers are increased by the dump yard's close proximity to environmentally vulnerable places, such as the Pallikaranai marshes.

Additionally, the dump yard presents significant health risks to surrounding residents and employees. Long-term exposure to pollution frequently causes respiratory disorders and other health problems in the local population. Without protective gear, informal waste pickers labor in hazardous conditions at the site.

### **IV. EXPERIMENTAL WORK**

The Leachate test was conducted for soil quality assessment and the results were compared with standard values. The physical and chemical parameters of water were found and compared with Indian standards. Air quality index was taken from air quality index website.

#### **A. Soil Quality Assessment**

Toxic metal buildup, hazardous organic compounds, and chemical property changes brought on by inappropriate disposal and recycling are the main objectives of soil quality assessment for electronic waste.

#### **B. Water quality assessment**

In order to establish whether water is safe for consumption, agriculture, or ecosystem health, water quality assessment compares the physical, chemical, and biological properties of water to standards (e.g., WHO, EPA).

#### **C. Air quality assessment**

Dump sites for electronic garbage, or "e-waste," are among the most severely contaminated places in the modern world. A variety of harmful contaminants are released into the environment by the uncontrolled disassembly, open burning, and acid leaching of abandoned electronic equipment.

These contaminants include dioxins, volatile organic compounds (VOCs), heavy metals, and persistent organic pollutants (POPs), all of which are extremely dangerous to both human health and ecological integrity.

In order to collect the sample, the plastic bottles were cleaned and sun-dried. The average value of samples has been compared with acceptable limit as per IS:10500 standards and the values are shown in the table 2

V. RESULTS AND DISCUSSION

A. Leachate Test

In order to collect the sample, the plastic bottle was washed and sun-dried. When gathering the leachate sample from the dump yard, appropriate safety measures must be followed, such as using gloves. The leachate sample was taken from the dump yard's waterlogged section. To assess the leachate sample's parameters, the collected sample is taken to the lab. The leachate sample was analysed using Atomic Absorption Spectrometer and Inductive Coupled Plasma Mass Spectrometer.

The results were compared with permissible limit as shown in the table 1

TABLE 1  
RESULTS OF THE LEACHATE TEST

S.NO	DESCRIPTION	RESULTS	PERMISSIBLE LIMIT
1	Appearance	Turbid	Turbid
2	Colour	Brownish	Blackish
3	Odour	Foul smell	Foul smell
4	Turbidity(NTU)	3.4	5
5	TSS(mg/L)	300	0-200
6	TDS(mg/L)	8000	0-2100
7	Electrical Conductivity (Micro mho/cm)	12.4	1000
8	pH	7.58	5.5-8.5
9	COD(mg/L)	1600	Oct-15
10	BOD(mg/L)	410	0-350
11	Chromium (mg/L)	0.16	< 2.0
12	Copper (mg/L)	0.08	< 3.0
13	Total Hardness (mg/L)	1600	400-200

B. Water Quality Test

Ten groundwater samples were gathered from different locations within the Perungudi Dump Yard. Triple system collection is the process of gathering three 250 ml samples from each sample location.

TABLE 2  
COMPARISON OF VALUES AS PER IS: 10500 STANDARDS

PARAMETERS	ACCEPTABLE LIMIT	AVERAGE VALUE OF SAMPLES	REMARKS
pH	6.5 to 8.5	6.86	ACCEPTABLE
TDS	500	472.3	ACCEPTABLE
Hardness	200	698.3	UNACCEPTABLE
Lead	0.01	<0.01	ACCEPTABLE
Cadmium	0.003	0.0131	UNACCEPTABLE
Nickel	0.02	<0.01	ACCEPTABLE
Mercury	0.001	<0.01	ACCEPTABLE
Chromium	0.05	0.2	UNACCEPTABLE
Zinc	5	0.305556	ACCEPTABLE
Copper	0.05	0.153	UNACCEPTABLE
Iron	0.3	0.283	ACCEPTABLE

C. Air Quality Index (AQI)

TABLE 3  
COMPARISON OF VALUES AS PER WHO STANDARDS

POLLUTANT	NOTATION	VALUE	ACCEPTABLE LIMIT
Particulate Matter (µg/m3)	PM2.5	51	15
Particulate Matter (µg/m3)	PM10	49	45
Carbon Monoxide(ppb)	CO	362	3490
Sulfer Dioxide (ppb)	SO2	1	15.27
Nitrogen Dioxide (ppb)	No2	2	13.29
Ozone (ppb)	o3	1	50.96

The daily air quality is calculated and reported using the air quality index. It alerts us to the unhealthful nature of the air we breathe and the potential health risks. The comparison values are shown in above table 3.

## VI. CONCLUSIONS

- The leachate from Perungudi site was collected in a dried bottle and the physio and chemical properties of leachate tested in the laboratory. Atomic Absorption Spectrometer (AAS) and Inductive Coupled Plasma Mass Spectrometer (ICPMS) were used to test the leachate.
- The total suspended solids exceeded the allowable limit by 25 mg/L. It results in long-term chronic disorders, cholera, nausea, and neurological problems.
- The total dissolved solids exceeded the allowable limit. It is the main contaminant in drinkable water. Kidney stones, dehydration, and gastrointestinal problems could result from it.
- The COD and BOD values are more in line with allowable levels. It irritates the skin and eyes, causes respiratory discomfort, increases the risk of infection, and spreads waterborne illnesses.
- The overall hardness is also significantly higher than the allowable limit. It results in kidney stones and gastrointestinal distress.
- The mean value of samples collected and contrasted with the allowed limit. The levels of hardness, cadmium, chromium, and copper are higher than the typical drinking water permitted limit. Consuming drinking water on a regular basis increases a person's risk of developing cancer, ulcers, vomiting, and allergic reactions in both their internal and external bodies. Therefore, untreated water cannot be used for drinking.
- Major air pollutants include particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO) and ozone (O<sub>3</sub>) were found.
- Air Quality Index value (AQI) generally vary between 50 to 100 and it denotes yellow colour which means moderate living condition. Sometimes AQI Poor levels, primarily driven by PM<sub>2.5</sub> and PM<sub>10</sub> pollutants in Perungudi area.
- As a result, people living close to the Perungudi Dump Yard are impacted by the E Waste, which makes it difficult for them to lead normal lives and may also have an impact on future generations.
- The only way to assist the residents of the adjoining Perungudi trash yard is through proper disposal. Additionally, it can promote Refuse, Reduce, Reuse, Repurpose, and Recycle.

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