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Impact of Industrial Effluent on Soil Health

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ABSTRACT: The soil properties in general are negatively affected by industrial effluents, organic matter in the soil affected by industrial effluents is higher 5 times greater than the normal range of organic matter in the soil due to the continuous deposition of petroleum hydrocarbons in the soil. Soil content of macronutrients is significantly affected by industrial effluents. . Effluents are enhancing nutrient levels in soil, and they also impact tolerance limits and induce toxicity when they are too high. In addition, the dissolved oxygen in soil is reduced due to the high concentration of biological and biochemical oxygen demand in these effluent which negatively impact on the soil microorganism . Furthermore, the most common element discovered in paper effluent were sodium, magnesium, Sulphur and chloride which negatively effect of crop nutrition, rise salinity of soil, deteriorate soil structure and finally decreased crop productivity. Moreover, it has been discovered that detergents have a variety of consequences, including reduced natural water quality, changes water and soil pH, eutrophication, reduced light transmission, and increased salt in water, due to their low biodegrade ability and toxicity.

KEYWORDS: soil, toxicity, effluents, health, microorganism, detergents, quality, eutrophication, biodegrade

I.INTRODUCTION

Soil is an essential natural resource like water and air. In India the main source of soil pollution is the effluent discharge from industries. Generally, industries discharge huge amount of effluent to the open land or to the nearby water resources. The composition of effluent differs according to the source of production. The macro and micro nutrients present in the effluent increases the soil fertility; along with it the heavy metals and toxic substance present in the soil also can be increased in concentration. Effluent discharge to the soil destroys the soil productivity and also affects the crop yield cultivating in the surrounding land area. It is very necessary to do on site effluent treatment in order to minimise the harm to the environment. The pressure facing by the environment due to the release of effluent is too high. This is a globally important issue; very few are aware about the effects of effluent discharge and how important is the treatment process before discharge. Our soil ecosystem has been destroyed completely by the action of environment and now it is capable to make health hazards through food chain. Industrial wastes contain varying amounts of harmful substances and dangerous compounds, which, when deposited in soil, alter the soil layer strength in the topsoil, lowering soil fertility and biological activity. Chemicals such as mercury, lead, copper, zinc, cadmium, cyanides, thiocyanates, chromates, acids, alkalies, organic substances, and others are found in industrial waste. Most countries have passed regulations to address the issue of industrial waste, but the degree of strictness and compliance varies. Soil pollution is defined as the "adding of substances to the soil that has a negative impact on the physical, chemical, and biological aspects of the soil and lowers its productivity."It's a build-up of poisonous compounds, chemicals, salts, radioactive materials, or disease-causing agents in the soil that harm plant development and human and animal health.Soil naturally contains few harmful chemicals.The amounts of contaminants found naturally in soil are not high enough to constitute a risk.Soil pollution can also be defined as when the levels of contaminants in soil surpass the levels that should be present naturally. Uncontrolled disposal of industrial wastes carrying a range of contaminants into soil is a common source of soil pollution.It has high toxic contaminants such as dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals, scrap lumber, even vegetable matter from restaurants.If these industrial wastes are dumped into the environment without being treated, major environmental issues may arise.This will surely reduce soil productivity and have a negative impact on agricultural production in the surrounding area.Industrialization is a necessity for emerging countries, and this activity is still required for the development of self-reliance and the upliftment of nations' economies.As a result, industrial wastes appear to be a consequence of growth.Developing

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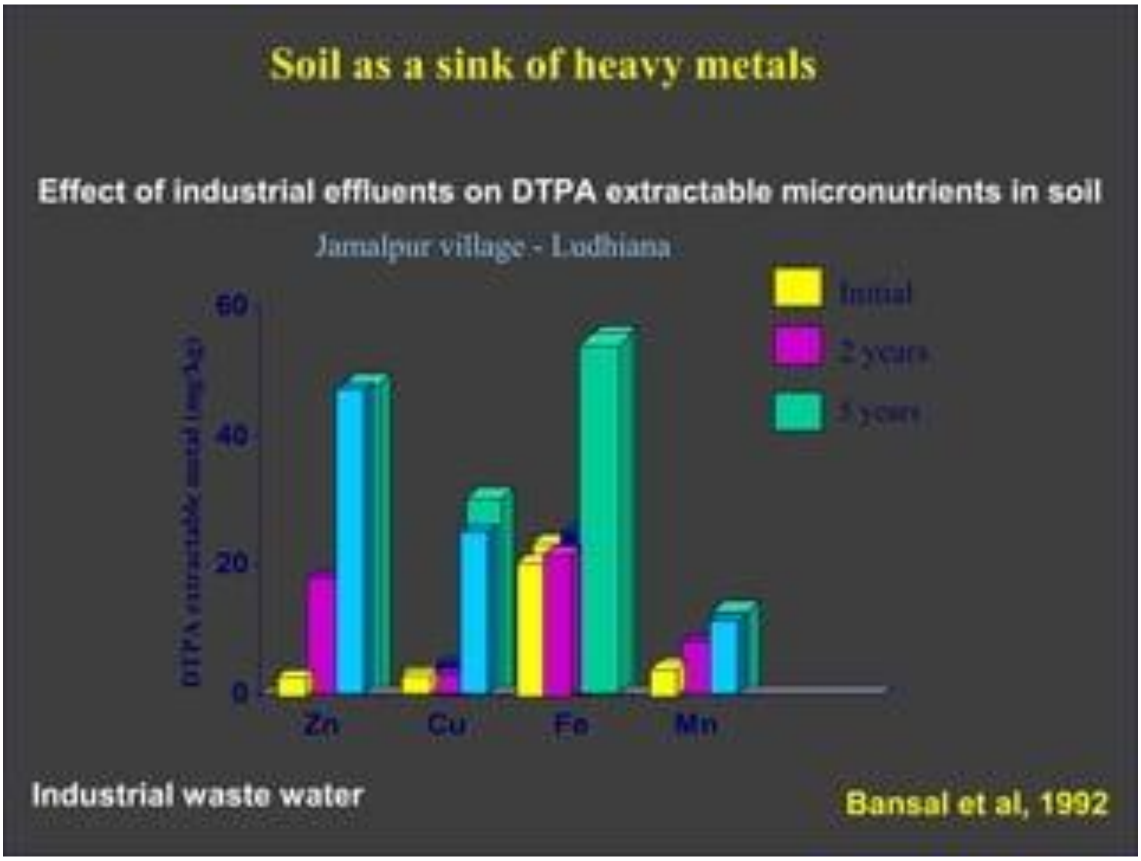
nations like India cannot afford to lose them as a waste of resources.Non-renewable resources, on the other hand, are rapidly depleting due to rising demand for raw materials for industrial production.The issues regarding the disposal of industrial solid waste are linked to a lack of infrastructure and industries' failure to take adequate precautions.These pollutants have an impact on and change the chemical and biological properties of soil.As a result, hazardous chemicals from the soil or water can enter the human food chain, disrupting the biochemical process and ultimately causing serious effects on living organisms.Heavy metals in soil also disrupt the food chain and have a negative impact on human health.As a result, proper management and treatment of industrial solid waste is essential for our health and wealth.



Soil contamination, soil pollution, or land pollution as a part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste. The most common chemicals involved are petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo(a)pyrene), solvents, pesticides, lead, and other heavy metals. Contamination is correlated with the degree of industrialization and intensity of chemical substance. The concern over soil contamination stems primarily from health risks, from direct contact with the contaminated soil, vapour from the contaminants, or from secondary contamination of water supplies within and underlying the soil. Mapping of contaminated soil sites and the resulting cleanups are time-consuming and expensive tasks, and require expertise in geology, hydrology, chemistry, computer modeling, and GIS in Environmental Contamination, as well as an appreciation of the history of industrial chemistry

Soil pollution can be caused by the following (non-exhaustive list) :

- Microplastics
- Oil spills

- Mining and activities by other heavy industries
- Accidental spills may happen during activities, etc.
- Corrosion of underground storage tanks (including piping used to transmit the contents)
- Acid rain
- Intensive farming
- Agrochemicals, such as pesticides, herbicides and fertilizers
- Petrochemicals
- Industrial accidents
- Road debris
- Construction activities
- Exterior lead-based paints
- Drainage of contaminated surface water into the soil
- Ammunitions, chemical agents, and other agents of war
- Waste disposal
  - Oil and fuel dumping
  - Nuclear wastes
  - Direct discharge of industrial wastes to the soil
  - Discharge of sewage
  - Landfill and illegal dumping
  - Coal ash
  - Electronic waste
  - Contaminated by rocks containing large amounts of toxic elements.
  - Contaminated by Pb due to vehicle exhaust, Cd, and Zn caused by tire wear.
  - Contamination by strengthening air pollutants by incineration of fossil raw materials.

The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead, and other heavy metals.Any activity that leads to other forms of soil degradation (erosion, compaction, etc.) may indirectly worsen the contamination effects in that soil remediation becomes more tedious. Historical deposition of coal ash used for residential, commercial, and industrial heating, as well as for industrial processes such as ore smelting, were a common source of contamination in areas that were industrialized before about 1960. Coal naturally concentrates lead and zinc during its formation, as well as other heavy metals to a lesser degree. When the coal is burned, most of these metals become concentrated in the ash (the principal exception being mercury).

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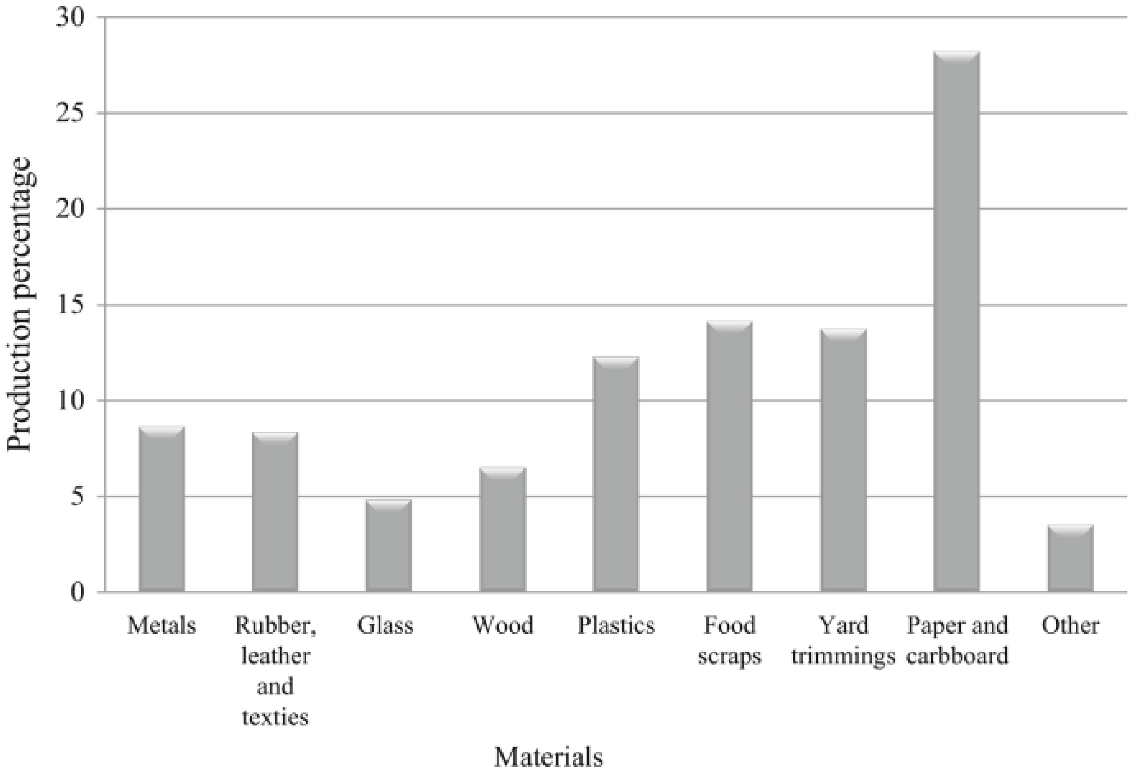

Coal ash and slag may contain sufficient lead to qualify as a "characteristic hazardous waste", defined in the US as containing more than 5 mg/L of extractable lead using the TCLP procedure. In addition to lead, coal ash typically contains variable but significant concentrations of polynuclear aromatic hydrocarbons (PAHs; e.g., benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(cd)pyrene, phenanthrene, anthracene, and others). These PAHs are known human carcinogens and the acceptable concentrations of them in soil are typically around 1 mg/kg. Coal ash and slag can be recognised by the presence of off-white grains in soil, gray heterogeneous soil, or (coal slag) bubbly, vesicular pebble-sized grains.

Treated sewage sludge, known in the industry as biosolids, has become controversial as a "fertilizer". As it is the byproduct of sewage treatment, it generally contains more contaminants such as organisms, pesticides, and heavy metals than other soil. Contaminated or polluted soil directly affects human health through direct contact with soil or via inhalation of soil contaminants that have vaporized; potentially greater threats are posed by the infiltration of soil contamination into groundwater aquifers used for human consumption, sometimes in areas apparently far removed from any apparent source of above-ground contamination. Toxic metals can also make their way up the food chain through plants that reside in soils containing high concentrations of heavy metals.

II.DISCUSSION

Health consequences from exposure to soil contamination vary greatly depending on pollutant type, the pathway of attack, and the vulnerability of the exposed population. Researchers suggest that pesticides and heavy metals in soil may harm cardiovascular health, including inflammation and change in the body's internal clock. There are radical soil chemistry changes which can arise from the presence of many hazardous chemicals even at low concentration of the contaminant species. These changes can manifest in the alteration of metabolism of endemic microorganisms and arthropods resident in a given soil environment. The result can be virtual eradication of some of the primary food chain, which in turn could have major consequences for predator or consumer species. Even if the chemical effect on lower life forms is small, the lower pyramid levels of the food chain may ingest alien chemicals, which normally become more concentrated for each consuming rung of the food chain. Many of these effects are now well known, such as the concentration of persistent DDT materials for avian consumers, leading to

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weakening of egg shells, increased chick mortality and potential extinction of species. Effects occur to agricultural lands which have certain types of soil contamination. Contaminants typically alter plant metabolism, often causing a reduction in crop yields. This has a secondary effect upon soil conservation, since the languishing crops cannot shield the Earth's soil from erosion. Some of these chemical contaminants have long half-lives and in other cases derivative chemicals are formed from decay of primary soil contaminants. Heavy metals and other soil contaminants can adversely affect the activity, species composition and abundance of soil microorganisms, thereby threatening soil functions such as biochemical cycling of carbon and nitrogen. However, soil contaminants can also become less bioavailable by time, and microorganisms and ecosystems can adapt to altered conditions. Soil properties such as pH, organic matter content and texture are very important and modify mobility, bioavailability and toxicity of pollutants in contaminated soils. The same amount of contaminant can be toxic in one soil but totally harmless in another soil. This stresses the need for soil-specific risks assessment and measures.

here are several principal strategies for remediation:

- Excavate soil and take it to a disposal site away from ready pathways for human or sensitive ecosystem contact. This technique also applies to dredging of bay muds containing toxins.
- Aeration of soils at the contaminated site (with attendant risk of creating air pollution)
- Thermal remediation by introduction of heat to raise subsurface temperatures sufficiently high to volatilize chemical contaminants out of the soil for vapor extraction. Technologies include ISTD, electrical resistance heating (ERH), and ET-DSP.
- Bioremediation, involving microbial digestion of certain organic chemicals. Techniques used in bioremediation include landfarming, biostimulation and bioaugmentating soil biota with commercially available microflora.
- Extraction of groundwater or soil vapor with an active electromechanical system, with subsequent stripping of the contaminants from the extract.
- Containment of the soil contaminants (such as by capping or paving over in place).
- Phytoremediation, or using plants (such as willow) to extract heavy metals.
- Mycoremediation, or using fungus to metabolize contaminants and accumulate heavy metals.
- Remediation of oil contaminated sediments with self-collapsing air microbubbles.
- Surfactant leaching
- Interfacial solar evaporation to extract heavy metal ions from moist soil

Soil health is a state of a soil meeting its range of ecosystem functions as appropriate to its environment.

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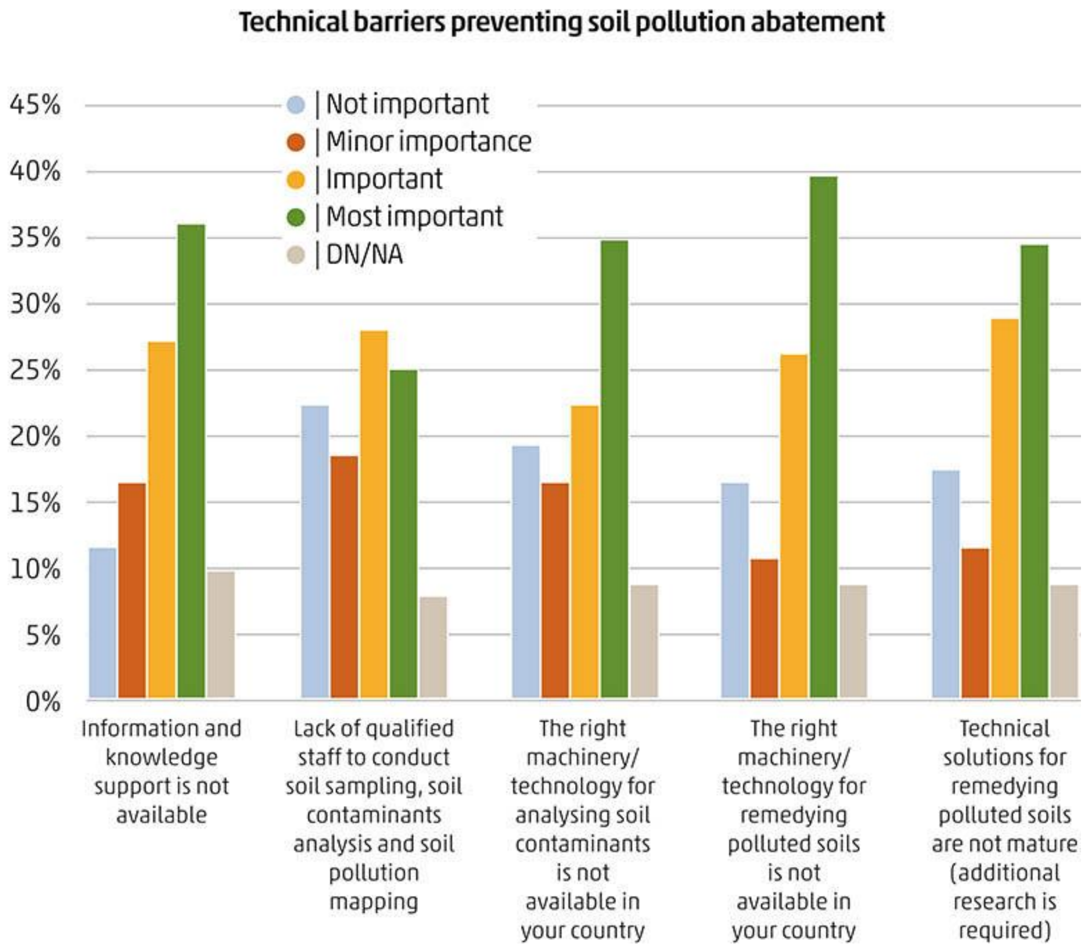

In more colloquial terms, the health of soil arises from favorable interactions of all soil components (living and non-living) that belong together, as in microbiota, plants and animals. It is possible that a soil can be healthy in terms of eco-system functioning but not necessarily serve crop production or human nutrition directly, hence the scientific debate on terms and measurements.

Soil health testing is pursued as an assessment of this status[1] but tends to be confined largely to agronomic objectives, for obvious reasons. Soil health depends on soil biodiversity (with a robust soil biota), and it can be improved via soil management, especially by care to keep protective living covers on the soil and by natural (carbon-containing) soil amendments. Inorganic fertilizers do not necessarily damage soil health if 1) used at appropriate and not excessive rates and 2) if they bring about a general improvement of overall plant growth which contributes more carbon-containing residues to the soil.

III.RESULTS

The term soil health is used to describe the state of a soil in:

- Sustaining plant and animal productivity (agronomic focus);
- Enhancing biodiversity (Soil biodiversity) (ecological focus);
- Maintaining or enhancing water and air quality (environmental/climate focus);
- Supporting human health and habitation.
- sequestering carbon

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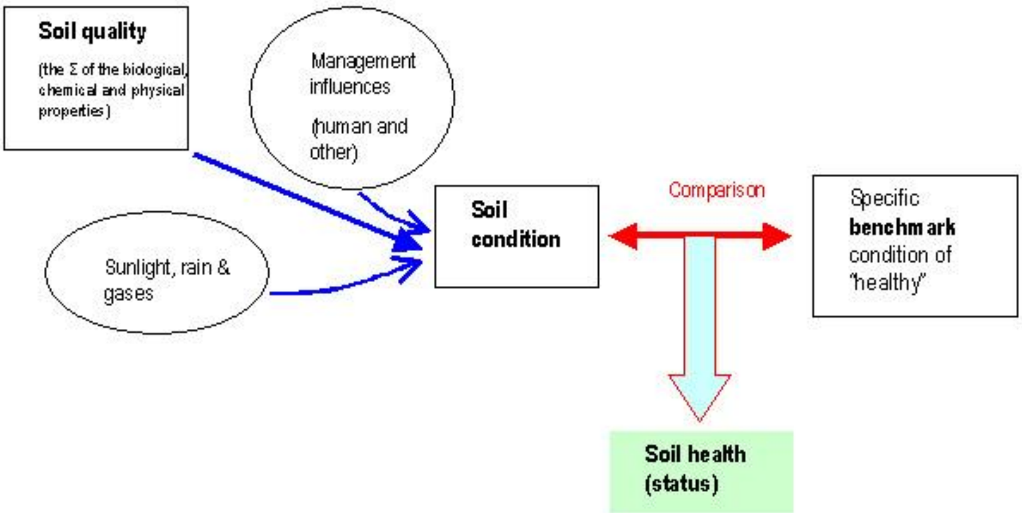
Using the human health analogy, a healthy soil can be categorized as one:

- In a state of composite well-being in terms of biological, chemical and physical properties;
- Not diseased or infirmed (i.e. not degraded, nor degrading), nor causing negative off-site impacts;
- With each of its qualities cooperatively functioning such that the soil reaches its full potential and resists degradation;
- Providing a full range of functions (especially nutrient, carbon and water cycling) and in such a way that it maintains this capacity into the future.

Soil health is the condition of the soil in a defined space and at a defined scale relative to a set of benchmarks that encompass healthy functioning. It would not be appropriate to refer to soil health for soil-roadbed preparation, as in the analogy of soil quality in a functional class. The definition of soil health may vary between users of the term as alternative users may place differing priorities upon the multiple functions of a soil. Therefore, the term soil health can only be understood within the context of the user of the term, and their aspirations of a soil, as well as by the boundary definition of the soil at issue. Finally, intrinsic to the discussion on soil health are many potentially conflicting interpretations, especially ecological landscape assessment vs agronomic objectives, each claiming to have soil health criteria.



Soil quality refers to the condition of soil based on its capacity to perform ecosystem services that meet the needs of human and non-human life.Soil quality reflects how well a soil performs the functions of maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling, and providing support for plants and other structures. Soil management has a major impact on soil quality.Soil quality relates to soil functions. Unlike water or air, for which established standards have been set, soil quality is difficult to define or quantify. The physical category of soil quality indicators consists of tests that measure soil texture, bulk density, porosity, water content at saturation, aggregate stability, penetration resistance, and more. These measures provide hydrological information, such the level of water infiltration and water availability to plants. Chemical indicators include pH and nutrient levels. A typical soil test only evaluates chemical soil properties. Biological measures include diversity of soil organisms and fungi.The movement and biological functions of soil organisms (including earthworms, millipedes, centipedes, ants, and spiders) impact soil processes such as the regulation of soil structure, degradation of contaminants, and nutrient cycling.

IV.CONCLUSIONS

The toxic substances that are deposited on the earth's surface harm our health and well-being and affect food, water and air quality. Soil pollutants enter our body through the food chain, causing illnesses to appear. Moreover, the spread of

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antibiotics in the environment increases the pathogens' resistance to these drugs. Soil degradation affects the quality of air and water, particularly in developing countries. By definition, any substance in the soil that exceeds naturally-occurring levels and poses human health risks is a soil contaminant. As a quick example, arsenic naturally occurs in some soils. But if a person sprays certain pesticides on their yard, that could cause soil contamination. Lead is also very dangerous but occurs naturally in some soils. It was used in gasoline until 1989 and can still be found contaminating soils today.The biggest risks for soil contamination are in urban areas and former industrial sites. If you are unsure about the condition of the soil near your home or property, it's best to have a soil test done to be sure about its safety. Of course, most soil is perfectly safe for play, gardening, and recreation, but it's best to be safe.Common contaminants in urban soils include pesticides, petroleum products, radon, asbestos, lead, chromated copper arsenate and creosote. In urban areas, soil contamination is largely caused by human activities. Some examples are manufacturing, industrial dumping, land development, local waste disposal, and excessive pesticide or fertilizer use. Heavy car and truck traffic can contaminate soil, and so can a single car: Have you ever noticed a shiny puddle under your car in the driveway? That's oil–a petroleum product–and when it rains, that oil will end up in the soil!When soil is contaminated with these substances, it can hurt the native environment. Many of these substances are just as toxic to plants as they are to humans. In addition, since soil is the "earth's kidney," contaminants can trickle through the soil and get to our water supply. Industrial and manufacturing sites often have a range of contaminants polluting their soils. The type of contaminant will depend on what the factory was producing. Contamination can occur when chemicals leak out onto the soil from buildings or trucks. Other times, the factory may have a waste stockpile or holding area that was once considered safe but now known to be a pollution problem. Industrial sites can also be quite large. This makes full-site soil remediation an expensive and challenging, but necessary, task. Landfills, junkyards and waste disposal sites pose high risk of soil contamination, much like industrial sites.These areas often contain a large mix of contaminant types like lead, arsenic, and petroleum products. All are dangerous to human safety on their own. When combined, they may react with each other to create even more toxic compounds. Containment and remediation of these areas are costly, technically complex, and logistically challenging.

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