

GLOBAL CHALLENGE OF ENVIRONMENTAL POLLUTION: A REVIEW

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ABSTRACT

Environmental pollution is a global challenge that influences human health. However, in developing countries and in countries in transition, environmental pollution levels are still at relatively high levels, though the levels have been gradually decreasing or have remained stable during rapid economic development.. This review provides the insight view about the effects and remedies of environmental pollution in the perspective of air pollution, water and land/soil waste pollution on human by diseases and problems, animals and trees/ plants.

Keywords: Environmental Pollution, Air Pollution, Water Pollution, Soil Pollution, Land Pollution, Remedies.

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INTRODUCTION

Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution (Kimani, 2007). Human exposure to pollution is believed to be more intense now than at any other time in human existence (Schell *et al.*, 2006). Pollution can be made by human activity and by natural forces as well (Fereidoun *et al.*, 2007; T. Selfish private enterprise and their lack of awareness of public well-being and social costs (Carter, 1985) and natural disasters e.g. volcanic ash from Iceland (WHO, 2010a) are the one of the main reasons of pollution. British Airways (1993) expresses their concern about environment in their general goal 'to be a good neighbor, concerned for the community and the environment. This implies that, businesses now adopted this responsibility as part of their overall business strategy; which should match their broader business goals (Pearce, 1991).

While modern societies face growing concern about global environmental issues, developing countries are experiencing complex, serious and fast-growing pollution problems of their own. The potent combination of industrialization, urban development and mass consumption trends is exacerbated by foreign companies operating with little regard for the impact on the local environment.

Nowadays the process of controlling environmental pollution is voluntary but future legislation could well make it mandatory. (Goodall, 1995). Interestingly, Goodall (1995) refers tourism as the potential to damage the environment. There is no doubt that excessive levels of pollution are causing a lot of damage to human and animal health, plants and trees including tropical rainforests, as well as the wider environment. (Tropical Rainforest Animals, 2008). According to Fereidoun *et al.* (2007), Tehran is one of victim cities in terms of environmental pollution. Gautam *et al.*, (2009) nominated Indian cities, among the most polluted cities in the world. Carter (1985) found pollution in formally known Czechoslovakia (now Czech Republic and Slovakia) a serious issue which ultimately affects soils and vegetation. Environmental pollution is more than just a health issue; it is a wider social issue in that pollution has the potential to destroy homes and communities. Pollution problems are also closely tied to the mode of development in developing countries. Despite this, many developing countries either have not developed environmental pollution control measures, or have not provided adequate implementation structures to ensure that policies are effective.

What is environmental pollution?

Environmental pollution involves the release of harmful substances or energy in such quantities that cause harm to people or other organisms in the environment. Pollution can affect all aspects of the environment, human-made and natural, biotic and abiotic, and may be readily transferred between the components of the life support system. (Taylor 2008).

Types of environmental pollution

Category	Major causes	Major effects
Atmospheric pollution	Smoke, dust, exhaust fumes, toxic substances (such as sulfur dioxide and nitrogen dioxide)	Asthma, bronchitis
Water pollution	Polluted waste water, waste fluids (such as petroleum), sludge, household sewage, sewage discharge, general waste, agricultural chemicals	Noxious odors, poisoning
Soil pollution	Arsenic, heavy metals (especially in agricultural chemicals)	Cancer
Noise	Factories, construction work, road traffic, trains and aircraft, late-night commercial operations, advertising	Headaches, insomnia, depression, hearing loss, impaired development
Vibration	Factories, construction work, road traffic, trains and Aircraft	Dizziness, discomfort, structural damage to homes

Ground Subsidence	Up swelling of groundwater, gravel quarrying, coal mining	Structural damage to Buildings
Noxious odors	Exhaust fumes, river contamination, sanitation facilities, accumulated sewage, livestock farms, etc.	Headaches, discomfort

Source: Based on the Basic Law for Environmental Pollution Control. [IJMA]

Environmental pollution:

The significance of environmental factors to the health and well-being of human populations is increasingly apparent (Rosenstock, 2003; WHO, 2010b). Environmental pollution is a worldwide problem and its potential to influence the health of human populations is great (Fereidounet *al.*, 2007; Progressive Insurance, 2005.). Pollution reaches its most serious proportions in the densely settled urban-industrial centers of the more developed countries (Kromm, 1973). In poor countries of the world more than 80% polluted water have been used for irrigation with only seventy to eighty percent food and living security in industrial urban and semi urban areas. (Mara and Cairncross, 1989).

Air pollution:

Clean air is one of the basic requirements of human health and well-being. However, during the process of economic development, air pollution has been and continues to be a significant health hazard worldwide. The driving forces of air pollution include; economic development, urbanization, energy consumption, transportation and motorization, as well as increase of urban population. Exposure to air pollutants is a problem of increasing concern due to the diversity of the pollutants in question, adverse effects observed in a broad range of air pollution levels, and the vast number of people at risk. The effects of air pollution can sometimes be observed even when the pollution level is below the level indicated by air quality guidelines. Individuals differ widely in genetic predisposition and physiological response to pollutants. Young children, the elderly, persons with predisposed diseases, such as cardiovascular and pulmonary diseases, and workers in certain industries may be at a higher risk owing to their increased biological sensitivities and different exposure patterns. The most common ambient air pollutants encountered in our daily life are particulate matter (PM), sulfur dioxide (SO₂), nitrogen dioxide

(NO₂), ozone (O₃), carbon monoxide(CO), and carbon dioxide (CO₂). The environmentalKuznets curve (EKC) can be used to study the relationship between economic development and air pollution levels.

During the early stage of economic development, air pollutionlevel is generally low. However, when economicdevelopment reaches an intermediate stage, air pollutionconcentration levels tend to increase appreciably or evenrise sharply if no effective ameliorating measures aretaken. It might then reach an inflexion point later at ahigher development stage due to better environmentalawareness and relevant control measures taken in protectingthe environment (Fig. 1). As zero risk is neitherpractical nor necessary, it is crucial to set appropriate airpollutant guidelines for air pollution management to meet.[Hae and Wang, 2005].

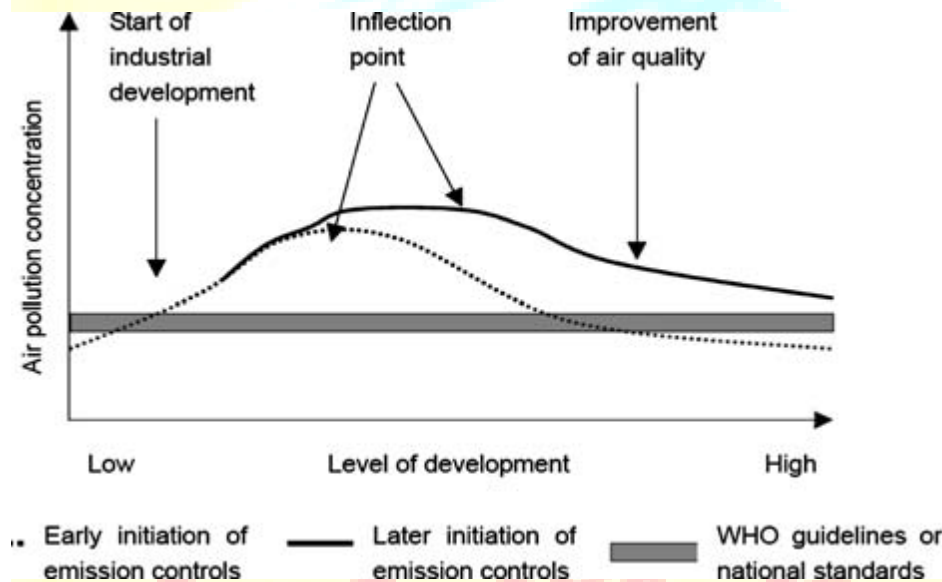


Fig. 1: Environmental Kuznets curve (EKC) (Hae and Wang 2005)

Water pollution:

The water we drink is essential ingredients for our wellbeing and a healthy life.Unfortunately polluted water and air are common throughout the world (European Public HealthAlliance, 2009). The WHO states that one sixth of the world’s population; approximately 1.1 billionpeople do not have access to safe water and 2.4 billion lack basic sanitation (European Public HealthAlliance, 2009). Polluted water consists of Industrial discharged effluents, sewagewater, rain waterpollution (Ashraf *et al.*, 2010) and polluted by agriculture or households cause damage to humanhealth or the environment. (European Public Health Alliance, 2009). In fact, the effects of water pollution are said to be the leading cause of death forhumans across the globe,

moreover, water pollution affects our oceans, lakes, rivers, and drinkingwater, making it a widespread and global concern (Scipeeps, 2009). A drinking water contained afluride content ranging from 5.26 to 26.32mg/l and this is too high as compared tothe World Health Organization's standard of 0.6 to 1.7 milligram per liter (Rizvi, 2000).

Land pollution:

Land pollution is one of the major forms of environmental catastrophe our world isfacing today (Khan, 2004). As Bulgaria and the Slovak Republic, heavy metal industries haveproduced wastes that are deposited into landfills without special precautions (Lenkova and Vargova, 1994; Spassov, 1994). Cucuet *al.*, (1994) posit that approximately half of the population lives in thevicinity of waste sites that do not conform to contemporary standards in Romania. Czech Republic'scoal and uranium mines have produced serious pollution problems, and much of the solid industrialwaste containing heavy metals is disposed of, without pretreatment, in open dumps (Rushbrook, 1994).

Noise pollution:

Noise is a major environmental issue, particularly in urban areas, affecting a largenumber of people. To date, most assessments of the problem of environmental noisehave been based on the annoyance it causes to humans, or the extent to which it disturbs various human activities. Assessment of health outcomes potentially related tonoise exposure has so far been limited (*Guidelines for community noise 2002*. According to preliminary results from the Environmental Burden of Disease (EBD). In Europe project in six European countries (Directive 2002) reported at the WHO MinisterialConference held in Parma in March 2010,traffic noise was ranked second among the selected environmental stressors evaluated in terms of their public healthimpact in six European countries. Further, the trend is that noise exposure is increasing in Europe compared to other stressors (e.g. exposures to second handsmoke, dioxins and benzene), which are declining Environmentalissues (Hollander *et al.*, 2009).

International environmental organizations:

- INFORSE-Europe
- Institute for Transportation and Development Policy
- International Anti-Poaching Foundation

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- International Arctic Buoy Program
- International Association of People-Environment Studies
- International Coral Reef Initiative
- International Council for Game and Wildlife Conservation (CIC)
- International Crane Foundation
- International Ecological Safety Collaborative Organization
- International Environmental Law Research Centre
- International Federation of Organic Agriculture Movements
- International Network for Environmental Compliance and Enforcement
- International Network for Sustainable Energy
- International Organization for Sustainable Development
- International POPs Elimination Network
- International Rivers
- International Solar Energy Society
- International Union for Conservation of Nature
- Islands First

International environmental law:

International environmental law (sometimes, international ecological law) is a field of international law regulating the behavior of states and international organizations with respect to the environment. Principles of International Environmental Law (Cambridge, 2003). Core domains for international regulation include management of the world's oceans and fisheries, the polar ice caps, and the regulation of carbon and other particulate emissions into the atmosphere.

The main international treaties concerning the environment are:

- 1972 UN Convention on the Human Environment;
- 1992 United Nations Conference on Environment and Development (UNCED), which produced the Rio Declaration;
- 1997 Kyoto Protocol, entered into force on February 16, 2005;
- 2002 World Earth Summit

- Anne Burnett, *ASIL Guide to Electronic Resources for International Law: International Environmental Law*.
- United Nations Environment Programme (<http://www.unep.org/>);
- Convention on Biological Diversity (<http://www.cbd.int/>) (WHO,2013)

Control measures to environmental pollution:

Air pollution:

The atmosphere has several built-in self-cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc to cleanse the atmosphere. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies.

Source control: Some measures that can be adopted in this direction are:

- Using unleaded petrol
- Using fuels with low Sulphur and ash content
- Encouraging people to use public transport, walk or use a cycle as opposed to private vehicles
- Ensure that houses, schools, restaurants and playgrounds are not located on busy streets
- Plant trees along busy streets as they remove particulates, carbon dioxide and absorb noise
- Industries and waste disposal sites should be situated outside the city preferably on the downwind of the city.
- Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons (Hae and Wang 2005).

Equipment used to control air pollution:

Air pollution can be reduced by adopting the following approaches;

- Ensuring sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete thereby eliminating much of the smoke consisting of partly burnt ashes and dust.
- To use mechanical devices such as scrubbers, cyclones, bag houses and electro-static precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants are shown below. All

methods retain hazardous materials that must be disposed safely. Wet scrubber can additionally reduce Sulphurdioxide emissions.

- The air pollutants collected must be carefully disposed. The factory fumes are dealt with chemical treatment.

Control of water pollution:

With increasing urbanization and expanding agricultural and industrial production, water pollution problems have progressively become more serious and necessitated the adoption of suitable control measures for ameliorating pollution. For a given body of water, the desired level of quality is usually specified in terms of parameters such as dissolved oxygen concentration, nutrient levels etc. The intended beneficial uses of the water resource are generally the basis on which the required quality criteria are formulated. Sources of pollution should then be regulated so as to achieve and maintain the minimum required water quality. This is usually accomplished through effluent discharge standards which specify the compliance requirements for the disposal of effluents in the environment.

Approaches to controlling sources of water pollution:

These may be grouped into three broad categories:

- minimization of waste or pollutant generation,
- Treatment prior to disposal of waste streams at source, and
- "in-situ" reduction or elimination of pollution.

Minimization of pollutant generation:

- Reduction of the quantity of waste or pollutants generated by an activity is obviously the most desirable approach to pollution control. Since it conserves resources that would otherwise be wasted, and at the same eliminates the cost of removing pollutant after they are produced.

- As a general rule, a resource becomes a waste when it can no longer be economically utilized or recovered. It is then disposed of in the environment in the cheapest manner possible.
- In the past, decisions concerning resource usage or waste disposal have been governed largely by immediate economic considerations and have not always considered the effects of these actions on the quality of the environment. As accountability for environmental damage gains increased recognition, fostered by a growing desire within society for sustainable development and a cleaner environment, more attention and effort will undoubtedly be devoted to reducing resources going to waste and causing pollution.
- Minimizing soil erosion by improved agricultural practices (e.g. by minimizing surface runoff and leaving crop residues in the ground), more efficient use of nutrients (e.g., NPK fertilizer) though.

Wastewater treatment at source:

The multitude of different wastewater treatment technologies can be classified as physical, chemical and biological processes, depending on the nature of the purification mechanism employed. The character of the pollutants and the form (suspended or dissolved) in which they are present usually determine the most suitable process for their removal. For example, gross suspended solids and floatable materials such as oil and fat are readily removed by physical processes such as sedimentation or flotation respectively.

Biological methods:

These are effective and economical when the waste water contains mostly biodegradable pollutants such as organic matter. A key advantage of biological processes is that the microorganisms involved in waste stabilization are themselves produced in the process.

For dilute wastes - including general domestic wastewaters, "aerobic" biological processes (activated sludge, oxidation ponds and aerobic bio filter) are usually favored since they are capable of producing an effluent with very low residual pollutant concentrations. These

processes, however, require oxygen, in proportion to the pollutant load present. Oxygen is supplied through aeration, which is a significant cost component.

For strong wastes, "anaerobic" biological treatment in enclosed vessels is generally preferred as they proceed in the absence of oxygen, and in addition produce a useful, energy-rich by-product in the form of methane. The effluents from anaerobic processes, however, contain higher levels of residual organic materials and may require further polishing treatment (often in aerobic processes).

Chemical method:

This is used when the pollutant of interest is non- biodegradable and is not amenable to removal by simple physical means (e.g. when it occurs in dissolved form). Heavy metals are typically removed by chemical precipitation, while toxic substances such as cyanide may be chemically oxidized. An important disadvantage of chemical treatment methods is that they generally require dosing with a chemical which can prove to be quite expensive. In addition, disposal of the chemical sludge produced in these processes may also pose some problems.

When a community based treatment system is impractical, it is still possible to provide a degree of treatment prior to discharging sewage into the environment. A popular method used for individual homes and small groups of residences is the SEPTIC TANK. It consists of a simple baffled tank which traps most of the solids in the waste water and also affords some decomposition of soluble organic matter. The effluent is disposed of into the ground through a system of leach drains. As solids progressively accumulate in the tank, it is necessary to periodically dislodge the system, typically every 3 to 7 years.

As deep skewering in built-up areas is very expensive, other more efficient alternatives to the septic tank are also desirable for on- site use. In recent years, a number of new systems, which are essentially miniature versions of the biological processes used for large-scale plants, have become available(Mara and Caincross, 1989).

In-situ Pollution Control:

Waste minimization and treatment help prevent pollution from occurring and should be the principal approaches to water quality maintenance. Occasionally, however, when a water body is already adversely affected, it will be necessary to consider action aimed at helping the ecosystem recover from the impact of pollution. Methods to facilitate this are collectively grouped under in-situ control techniques.

Aeration of lakes and reservoirs, especially when they are thermally stratified (in summer), has been used to prevent anaerobic conditions from occurring. Forced circulation of water in stratified lakes is an alternative method. Dredging nutrient rich superficial sediments from highly eutrophic lakes, while very expensive, have sometimes helped reduce occurrence of severe algal blooms. Addition of aluminum or iron salts to assist the precipitation of phosphorus has also been practiced in some lakes to control dissolved phosphorus levels in the lakes (UNICEF 2006).

Land pollution measures:

Waste Minimization/Cleaner Production:

Waste minimization is one of the strategies adopted for minimizing the industrial pollution. The objective of the scheme is to assist the small and medium scale industry in adoption of cleaner production practices. Obligation of investigations for land-owners and others when specified facilities produce, use or treat designated hazardous substances are abandoned, the landowner, owner or site management is obliged to commission designated investigation companies investigate soil contamination of manufacturing/operating areas where the specified facilities were previously located and the results reported to the prefectural governors.

Introduction of Regional Industrial Planning Policies:

Regional industrial planning policies helped to reduce pollution levels by limiting the density of pollution sources (particularly factories) in a given area and encouraging the use of joint pollution control facilities.

Pollution Awareness Campaigns:

The level of commitment to pollution control and effective outcomes is very much subject to public opinion. Control of land character changes.

- Notification to regulatory authority about character change of land in designated areas
- If inappropriate, regulatory authority direct applicants to redraft plans

Contamination remediation measures:

Regulatory authority directs the polluter in the execution of contamination remediation.

- Measures to prevent direct ingestion: (1) area restrictions, (2) concrete capping, (3) fill, (4) replacement of soil, (5) treatment of contaminated soil
- Measures for prevent ingestion of groundwater: (1) groundwater quality control, (2) immobilization of contaminant to groundwater, (3) barriers, (4) remediation of contaminated soil

Direction by regulatory authorities to conduct soil contamination investigations:

Governors and others can direct land-owners and other parties to investigate and report on the soil contamination conditions when encountering concerns of adverse health hazards caused by soil contamination

Bioremediation:

This involves cleaning of toxic contaminants in the environment using the activity of natural's microbial populations in the contaminants (WHO, 2013).

Noise pollution:

There are three types of protection measures that should be taken against the urban noise:

Administrative – legislative protection measures: Administrative – legislative protection measures impose:

(a) Maximum admitted levels for various sources of noise, which can be respected by:

- Different types of vehicles which can be admitted on various roads;
- The restrictions of traffic hours;
- The restrictions of operation hours for various urban functional zones.

(b) The establishment of acoustic protection distances between residential areas and aerial, road and railway traffic.

Active measures fighting against the noise: Which represent actions directly oriented to the sources of noise, having as goal the reduction of the intensity level of the noise that they generate.

Passive protection measures: Active measures involves fighting against the noise, which represent actions directly oriented to the sources of noise,

To obtain acoustic comfort in urban environment it is necessary to adopt the principles of systematization and optimization of urban areas so that the noise level is at an admissible recommendable boundary at the receptor.

To ensure this desideratum it is necessary that the equivalent noise level “Lech” at 2.00 m away from the building and at a height of 1.50 m over earth should not exceed the values presented in table 6.1

	Urban protected area	Admitted boundary of noise level out of the buildings [dB(A)]
1	Residential area	50
2	Recreation area	45
3	Functional protected zones	45
4	Centre of district	55
4	City center	60

These values can be obtained by architectural design using various constructive and functional criteria (UNEP, 2006).

CONCLUSIONS

Environmental pollution is more than just a health issue; it is a wider social issue in that pollution has the potential to destroy homes and communities. Pollution problems are also closely tied to the mode of development in developing countries. It appears that polluted environment is global an issue and world community would bear worst results more as they already faced. As effective response to pollution is largely based on human appraisal of the problem. Education, research, and advocacy, are lacking in the region as preventive strategy for pollution especially in Asia. Improving air quality has substantial, measurable and important public health benefits. Efforts should be made and goals set in order to control air pollution in every country. Strategies for reaching a sustainable built environment should reflect varied regional conditions and priorities, and various implementation models.

REFERENCES:

- 1) Ashraf, M. A., Maah, M. J., Yusoff, I. & Mehmood, K. (2010). Effects of Polluted Water Irrigation on Environment and Health of People in Jamber, District Kasur, Pakistan, *International Journal of Basic & Applied Sciences*, 10(3), Pp. 37-57.
- 2) Avdeev, O. & Korchagin, P. (1994). Organization and Implementation of Contaminated Waste Neutralization in the Ukraine - National Report II, *Central. European Journal of Public Health*, 2(suppl), Pp. 51-52.
- 3) Cucu. M., Lupeanu, M. I., Nicorici, M., Lonescu, L. & Sandu, S. (1994). The Dangerous Wastes and Health Risks in Romania: National Report, *Central European Journal of Public Health*, 2 (suppl), Pp. 41-43
- 4) Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. *Official Journal of the European Communities*, 2002, L 189:12–25.
- 5) Fereidoun, H., et al. (2007). The Effect of Long-Term Exposure to Particulate Pollution on the Lung Function of Teheranian and Zanjanian Students, *Pakistan Journal of Physiology*, 3(2), pp. 1-5.
- 6) *Guidelines for community noise*. Geneva, World Health Organization, 1999 (<http://www.who.int/docstore/peh/noise/guidelines2.html>, accessed 21 July 2010)
- 7) Hao, J, Wang, L. (2005). Improving urban air quality in China: Beijing case study. *J Air Waste Manag Assoc.*;55(9):1298–305
- 8) Hollander, A. E *et al.*, (1999). An aggregate public health indicator to represent the impact of multiple environmental exposures. *Epidemiology*, 0:606–617
- 9) Kimani, N. G. (2007). *Environmental Pollution and Impacts on Public Health: Implications Of the Dando Dumping Site Municipal in Nairobi, Kenya*, United Nations Environment Programme, pp. 1-31. Retrieved from http://www.korogocho.org/english/index.php?option=com_docman&task=doc_download&gid=54&Itemid=73
- 10) Lenkova, K. & Vargova, M. (1994). Hazardous Wastes in the Slovak Republic-National Report, *Central European Journal of Public Health*, 2(suppl), Pp. 43-48.

- 11) Mara, D. & Cairncross, S. (1989). *Guidelines for Safe Use of Wastewater and Excreta in Agriculture and Aquaculture: Measures for Public Health Protection*. World Health Organization, Geneva, Pp.187
- 12) McGeehin, M. A., Qualters, J. R. & Niskar, A. S. (2004). National Environmental Public Health Tracking Program: Bridging the Information Gap, *Environmental Health Perspectives*, McGeehin, M. A., Qualters, J. R. & Niskar, A. S. (2004). National Environmental Public Health Tracking Program: Bridging the Information Gap, *Environmental Health Perspectives*, 112(14), pp. 1409-1413
- 13) *Night noise guidelines for Europe*. Copenhagen, WHO Regional Office for Europe. (2009). (http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf, accessed 7 October
- 14) Pearce, D. (1991). *Corporate Responsibility and the Environment*. London: British Gas. Iijima, Nobuko (1993) *Kankyo Shakaigaku* [Environmental Sociology] Yukikaku.
- 15) Rizvi, M. (2000). *Bone Disease Spurs Pakistan to Environmental Action*, Fluoride Action Network, Retrieved from <http://www2.fluoridealert.org/Alert/Pakistan/Bone-disease-spurs-Pakistan-to-environmental-action>
- 16) Rushbrook, P. (1994). Regional Health Issues Related to Hazardous Wastes, *Central European Journal of Public Health*, 2(suppl), Pp. 16-20
- 17) Scipeeps, (2009). Effects of Water Pollution. Retrieved from <http://scipeeps.com/effects-of-water-pollution>.
- 18) Sivertsen, B. (2005). Global ambient air pollution concentrations, trends. In: World Health Organization, editor. *Air Quality Guidelines, Global Update*. Copenhagen: WHO Regional Office for Europe; 2006. Pp. 31–59
- 19) Ui, Jun. (2001). “*Nihon no Kogai Taiken* [Japan’s Experience of Environmental Pollution] Yoshida, Fumikazu and Miyamoto, Kenichi, *Iwanami Koza Kankyo Keizaigaku 2 kan, Kankyo to Kaihatsu* [Iwanami Lecture Environmental Economics Vol. 2, Environment and Development].
- 20) World Health Organization, (2010). *Guidelines for community noise*. Geneva, (<http://www.who.int/docstore/peh/noise/guidelines2.html>, accessed 21 July 2010).
- 21) UNEP, (2006). *Global Environment Outlook* <http://www.unep.org/geo/yearbook/yb2006/055.asp>. Accessed 10 October 2007.