Urbanized Environment: Health and Economic Effects

Teera Kolladarungkri, M.D.

Department of Preventive Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Siriraj Med J 2010;62:29-31

E-journal: http://www.sirirajmedj.com

Pollution means an undesirable state of the natural environment which has been contaminated with harmful substances as a consequence of human activities. Pollution can be anything which damages the ecosystem and destroys the delicate balance in the ecosystem. Moreover, it creates health hazards to human beings and animals besides. For example, industries polluting air have created an imbalance in composition of the air and make it unworthy to breathe-thereby causing innumerable health problems to human and animal life. Extensive use of heavy metal in textile manufacture has set an imbalance in the ecosystems of lands besides causing drinking water pollution. Heat which comes from the tall congested buildings in the big cities has caused the term "heat island". It is described by built up areas that are hotter than nearby rural areas.

Like other big cities in the world, Bangkok grows rapidly both in economical and social aspects. Consequently, Bangkok and its vicinities face with progressive increases in the environmental effects including:

1. Waste pollution
2. Air pollution
3. Noise pollution
4. Water pollution
5. Heat island effect

Waste is considered as on of the most problematic pollutions in Bangkok. The amount per day is approximately 8,500 tons and is estimated to be 1 kilogram per person per day. Waste can divide into 4 categories: septic waste, wet waste, dry waste and hazardous waste. Since waste may be contaminated with chemical and biological agents, waste management facilities may expose the involved workers and surrounding communities to health risks. Septic waste mostly originates from hospitals and clinics around Bangkok which may be as much as about 130 tons per day and the average daily waste elimination cost is 2.6 million baht. Septic waste may spread the bacterial, fungal and viral infection and biological products such as endotoxin. Blood and serum components from sick people will be contaminated with those organisms. They can spread both wet and dry particles to the environment. Without proper management of septic waste, the drug-resistant mycobacterium and virus may rapidly multiply and disseminate. Incineration is the technique recommended in managing septic waste, although main hindrances are the high cost of the process and concerns of dioxins generation as by products of incineration.[1] For wet waste came from residual food and drink, the process of management is dumping for fermentation. The dry waste is some kinds of paper, glass and metal which can be recycled back to the new product. Hazardous waste comes mainly from industrial and laboratorial areas. In big cities, this kind of waste affects the people's health by penetrating the environment and contaminates the food cycle, air and water supply. Emitted pollutions from industries may contaminate nearby rivers, and finally enter the food chain through fish and shellfish. The magnitude of hazardous waste such as fluorescent lamps and handheld batteries doubles every year. Mercury and cadmium are heavy metals which are mostly found in the lamp and small size batteries, respectively. The environment will take a long time to get rid the metal contamination and the cost of environmental management is tremendously expensive at nearly 2,000 million baht per year.[2] These waste pollutions may not cause immediate health damage, but rather chronic or latent conditions. Heavy metal will affect the function of the nervous system, bone marrow and kidneys. Children who are exposed to these toxins may experience impairment in IQ, growth and development. Although many studies have been conducted to evaluate health effects associated with working or live close to the waste management locations, the results are still inconsistent and inconclusive.

Outdoor air pollutants, such as carbon monoxide (CO), sulfur dioxide (SO2) nitrogen oxides (NOx), volatile organic compounds (VOCs), ozone (O3), heavy metals, and particulate matters, are significant air-borne health threats in big cities all over the world. Great amount of studies have shown that these pollutants may contribute to large varieties of health effects, mainly in the respiratory and cardiovascular systems.[3] Respiratory effects can result in increased difficulty in breathing, wheezing, coughing and aggravation of existing

respiratory conditions. Allergic problems in nasal cavities, pharynx, larynx and trachea may also be exacerbated. Carbon dioxide and carbon monoxide from the traffic jam may interact directly with the cardiovascular system to cause structural changes, such as degenerative necrosis and inflammatory reactions. Particulate and gaseous pollutions are known to cause cardiovascular effects, including progression of atherosclerosis, cardiac arrhythmias, cardiac ischemia and myocardial infarction. A study to evaluate the health-benefits from specific pollution-reduction programs in Canada revealed a four times decease in health-economic values after implementation of programs such as changing gasoline composition. Indoor air quality is referred to the air quality within the building which affected by mold, bacteria, carbon monoxide, radon and volatile organic compounds (VOC). The method of measurement of air pollution is environmental air quality and indoor air quality (IAQ). The time-weighted average (TWA) limit for carbon monoxide (630-08-0) is 25 parts per million. The limits of OSHA for carbon dioxide concentration in the workplace are 5,000 parts per million for prolonged periods, and 35,000 part per million for 15 minutes. Carbon dioxide and carbon monoxide affect red blood cell-oxygen transportation and decrease brain function. It will make some people feel drowsy, dizziness, headache, visual and hearing dysfunction, and unconsciousness within a few minutes to an hour if its concentration rises above 100,000 parts per million. Toxicity and its effects increase with the concentration, such as one percent can occur in a crowded auditorium with poor ventilation, which can cause drowsiness with prolonged exposure, two percents will mildly increase narcotic effects and causes increased blood pressure and pulse rate, and causes reduced hearing, five percents will cause stimulation of the respiratory centre, dizziness, confusion and difficulty in breathing accompanied by headache and shortness of breath and eight percents will cause headache, sweating, poor vision, tremor and loss of consciousness after exposure for between five and ten minutes.[4] Air pollution is managed by controlling industrial areas, controlling air quality within, decreasing gas consumption and increasing the public parks.

Noise pollution which was detected in the cities included residential noise, road traffic, industrial noise, entertainment noise, alarm noise, motor vehicle noise, aircraft noise, railway maintenance noise and others. Noise disturbs people's work by decreasing their concentration, relaxation and sleep. It causes stress and worsens physical problems such as high blood pressure, chronic exhaustion and heart disease.[5] Noise pollution can affect hearing loss by permanently destroying the inner ear function. It can cause heart disease by increased adrenaline release and change both heart rate and heart pumping. It disturbs the sleep cycle by affecting both the quantity and quality of sleep. All of these will decrease work efficiency and healthy status. During the year 2006-2008, Suvarnabhumi Airport, the newest international airport of Thailand, has conflicted with the citizens around the airport in noise pollution. All projects which could help relieve difficulties for the people who are affected by noise pollution, were set a budget of 390 million baht. It will place noise restrictions on all planes and plans to adjust the landing routes of aircraft to help ease noise pollution affecting local residents. Some of the budget will pay for the noise prevention program such as noise absorber material around their building. However, the problem is not yet solved.[6]

Waste water is one of the pollutions which involve the human system. Water from occupied households and industry were different in quality control. Food and drink from the household contains more fat and oil. Bacteria will manage this waste by fermentation with oxygen. The monitoring of water is BOD (Biological Oxygen Demand), while the industrial water waste contained more chemical substances. The monitoring of industrial waste water was polluted by heavy metal contamination. Industrial waste water with toxic compounds will cause immune suppression and reproductive failure. Microbial pollutants from sewage often result in infectious diseases that transit to humans by drinking water. Cholera and typhoid fever are the epidemic diseases which come from drinking contaminated water. Organic matter and food waste causes an increase in aerobic algae and depletes oxygen from the water column. These cause the suffocation of fish and other aquatic organisms. In Bangkok, there are five new water treatment plants which can manage 500,000 cubic meters per day. However, it is only 20 percents of the total waste water in this city (average 2,500,000 cubic meters per day). Until now, the management is free but in the near future the cost of management will incur a charge of 10 baht per cubic meter or 25 million baht per day.

Urban areas are known to warm due to their increased area of thermal mass such as concrete buildings, pavements, etc. The increased thermal mass results in increasing temperatures with time, since not all of the heat is released. This is known as the urban heat island (UHI) effect. Elevated temperatures from urban heat islands affect the environment and the quality of life. The annual mean air temperature of a city with 1 million people or more can be 1.8-5.4^{O}F (1-3^{O}C) warmer than its surroundings. In the evening, the difference can be as high as 22^{O}F (12^{O}C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.[7] Impaired water quality is the result of hot temperatures which change the local ecosystems and water food cycle. Negative economic impacts include the following: increased energy consumption and increased demand for cooling during hot summer weather. Higher air temperatures also promote the formation of ground-level ozone and cause the global warming effect. Health effects include body dehydration, tiredness, weakness, and poor work concentration. Violent heat stroke causes sudden death every year. Individuals such as the elderly and those with respiratory problems like asthma must be careful in extreme heat waves. The cities planning for a heat island or heat temperature will need to provide to the citizens some types of prevention for some kinds of diseases such as skin burn, dermal carcinoma, dehydration and heat stroke.

REFERENCES

1. Gordon LJ, Davis T, Powitz R, et al. The future of environmental health: part one. J Environ Health. 1993;55(4):38-50.

2. Kungskulniti N, Pulket C, Miller FD, Smith KR. Solid waste scavenger community: an investigation in Bangkok, Thailand. Asia Pac J Public Health. 1991;5(1):54-65.
3. Jinsart W, Tamura K, Loetkamonwit S, Thepanondh S, Karita K, Yano E. Roadside particular air pollution in Bangkok. J Air Waste Manag Assoc 2002 Sep;52(9):1102-10.
4. Smith KR, Samet JM, Romieu I, Bruce N, Indoor air pollution in developing countries and acute lower respiratory infections in children. Thorax. 2000 Jun; 55 (6): 518-32.
5. Babisch W, Ising H, Gallacher JE. Health status as a potential effect modifier of the relation between noise annoyance and incidence of ischemic heart disease. Occup Environ Med 2003 Oct;60(10):739-45.
6. Cohen BS, Bronzaft AL, Heikkinen M, Goodman J, Nádas A. Airport-related air pollution and noise. J Occup Environ Hyg. 2008 Feb;5(2): 119-29.
7. Chiu T, Wong P, Lam S, Burd A, Nichol J. Urban temperatures in Hong Kong: thermal environmental safety and implications for city planning. J Burn Care Res. 2009 Jul-Aug;30(4):735-9.