The climate change crisis: a focus on Ghana's coastal communities

By: Angelina Ama Tutuah Mensah | Monday, 09 June 2014 08:36 | Category: Opinion

Ready to submerge? Credit: EPA

Over the past century, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere. This has led to temperature rising, the ice caps melting, the oceans warming and becoming acidic, and the body count growing.

These and other changes will become more pronounced in the coming decades. We must act strongly now and expect to continue the action over the coming decades.

According to the United States of America EPA, global sea level has risen by eight inches since 1870. The change has already affected many low lying Islands nations that have had to adapt, and some populations have moved to higher areas, or have tried to buy land from other countries to migrate as citizens.

The current climate change crisis is not new and immediate, but years if not centuries in the making. This requires urgent and decisive action because the clock is ticking.

Recognising the climate crisis, the United Nations Environment Programme (UNEP) chose the theme "Small Islands Development States" (SIDS) and the slogan "Raise Your Voice, Not Sea Level rise". The theme calls for increased awareness of the effects of climate change and minimisation of carbon emissions into the atmosphere which contributes substantially to global warming and rise in sea-levels which poses serious threats and risks to small island states.

Consequently, the United Nations declared 2014 as: "The International Year of Small Island States."

As part of a global effort to mobilise action on climate change, the Environmental Protection Agency (EPA) chose the theme "Greening our Environment to save Ghana'' and the slogan ''Raise Your Voice; Grow a Tree, To Green Our Environment".

Some impacts

Though World Environment Day (WED) 2014 will focus on the challenges of Island nations and climate change, the environment knows no borders, since the effects of human-induced climate change are being felt in every corner of the world.

Around May 2012, the world entered a danger zone when concentrations of carbon dioxide in the atmosphere passed 400 parts per million for the first time in recorded history. It came with serious weather events.

A single Tornado wiped out an entire town in Oklahoma; Australia experienced soaring temperatures and wildfires even before the summer; and a new breed of super Typhoon smashed into the Philippines.

In Ghana, few hours' rainfall on January 31, 2014, submerged major streets in Accra and flooded the Kwame Nkrumah Circle, parts of Asylum Down and Kaneshie. Economic and social activities came to a standstill, and the implications are yet to be quantified in monetary terms.

This is beyond crisis

Ghana's coastline is highly vulnerable to the various manifestations of climate change. Human activities such as sand winning, coupled with coastal and beach erosion, already pose a problem for the country - a problem that is likely to be exacerbated by sea-level rise.

Considering the fact that nearly 25 per cent of Ghanaians live in the coastal zone and about 10 per cent depend on coastal fishery for their livelihood, it is likely that any changes in climate will affect the production of the fishery sector and will impact on the socio-economic lives of the people.

In August 2013, a publication entitled: "Assessing the Impact of Sea-level rise..." by Appeaning Addo and Adeyemi projected that approximately 645,556 people, 926 buildings, the Densu Wetlands and a total area of about 0.78 km of land would be submerged by 2100 in the Greater Accra Region.

Forts, castles, monuments, heritage sites, including Asomdwe Park, hospitals such as Effia Nkwanta, Korle-Bu, and Interberton in the Western, Greater Accra and the Central Regions respectively, will not be spared the impact of climate change - some of them will disappear eventually if the sea level rises a further 18 centimetres as forecasted by IPCC.

Equally, there will be loss of human lives, and fishing communities, ministries, departments and agencies, major educational institutions and residential properties dotted along the coastline would disappear.

The 550 km stretch of coastal land of Ghana includes some areas that lie well below sea level. Already, the east coast of the country, in particular the Keta area, is experiencing annual coastal erosion at the rate of three metres. Since 1999, more than 80 million US dollars has been invested to protect, restore and stabilise the coast of Keta; and an amount of 1.14 billion US dollars to protect all shorelines at risk.

How do you raise Your voice, not the sea level?

Scientist have mentioned that even if current global greenhouse gas emission were significantly reduced in the short term--which currently seems unlikely--- the cumulative build-up of carbon in the atmosphere will ensure continuing climate change for decades to come.

At the 2013 Conference of the Parties (COP-19) to the UN Framework Convention on Climate Change (UNFCCC) meeting in Warsaw-Poland, the developing countries (Ghana included) asked for increased climate finance, and for a new mechanism to help especially vulnerable nations cope with unavoidable "loss and damage" resulting from climate change.

Though countries had earlier agreed in 2012 in Doha, Qatar, at COP-18 to address “loss and damage” in Warsaw, the issue took on new prominence when Typhoon Haiyan struck the Philippines just days before the conference.

So in Warsaw-Poland the Islands States proposed a “Warsaw Work plan” to quickly reduce emissions by accelerating the uptake of renewable and improved efficiency of energy use and supply.

Therefore, tackling the cause of climate change by reducing the emission of greenhouse gases is a critical and vital complement to coping with the impacts of climate change.

On a personal note, to raise your voice, not sea level implies a change in attitude and lifestyles, and in consumption patterns, i.e. a desire for needs, not wants, and a respect for the environment.

- See more at: http://graphic.com.gh/features/opinion/24689-the-climate-change-crisis-a-focus-on-ghana-s-coastal-communities.html#sthash.UzT7u1s7.dpuf

Human Health

Burning trash in the open produces many pollutants, including:

- dioxins,
- particle pollution,
- polycyclic aromatic hydrocarbons,
- volatile organic compounds,
- carbon monoxide,
- hexachlorobenzene, and
- ash.

Many dangerous health conditions can be caused by inhaling or ingesting even small amounts of these pollutants. Small children, the elderly, or people with preexisting respiratory conditions can be especially vulnerable to some of these pollutants.

Dioxins

Backyard burning is of particular health concern because it produces significant quantities of dioxins. Dioxins and "dioxin like" compounds are a group of 30 highly toxic chlorinated organic chemicals. They are produced naturally in small quantities, but are primarily the result of human activity. They can be produced through industrial processes such as chlorinated chemical manufacturing and metal smelting. Currently, however, the largest quantified source of dioxin emissions is the uncontrolled burning of household trash (backyard burning). Studies have shown that only small amounts of chlorinated materials in waste are required to support dioxin formation when burning waste. This means that even when materials containing high levels of chlorine, such as PVC, are removed from household trash, burning the waste still creates dioxins because nearly all household waste contains trace amounts of chlorine.

Much of the dioxins created and released into the air through backyard burning settle on plants. These plants are, in turn, eaten by meat and dairy animals, which store the dioxins in their fatty tissue. People are exposed to dioxins primarily by eating meat, fish, and dairy products, especially those high in fat. Backyard burning occurs most

commonly in rural farming areas where dioxin emissions can more easily be deposited on animal feed crops and grazing lands. These dioxins then accumulate in the fats of dairy cows, beef, poultry, and swine, making human consumption of these harmful chemicals difficult to avoid.

Dioxins are classified as persistent, bioaccumulative, and toxic pollutants (PBTs). PBTs are highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. Persistent means they remain in the environment for extended periods of time. Bioaccumulative means their concentration levels increase as they move up the food chain. As a consequence, animals at the top of the food chain (such as humans) tend to have the highest dioxin concentrations in their bodies.

Dioxins are potent toxicants with the potential to produce a broad spectrum of adverse effects in humans. Dioxins can alter the fundamental growth and development of cells in ways that have the potential to lead to many kinds of impacts. These include adverse effects upon reproduction and development, suppression of the immune system, disruption of hormonal systems, and cancer. For more detailed information on dioxin health effects, safety issues, and risk, visit EPA's Dioxin and Related Compounds Web site.

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Particle Pollution

Particle pollution, also referred to as particulate matter, or PM, refers to microscopic particles released by open burning. Particles that are small enough to get into the lungs (those less than or equal to 10 um in diameter) can cause numerous health problems. Particles can aggravate respiratory conditions such as asthma and bronchitis, and have been associated with cardiac arrhythmia (heartbeat irregularities) and heart attacks. People with heart or lung disease, the elderly, and children are at highest risk from exposure to particles. For more information EPA's particulate matter site.

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Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons, or PAHs, are a group of chemicals commonly found in particulate matter (or smoke and soot) released from backyard burning. The are formed from the incomplete combustion of certain materials. Some PAHs are carcinogenic, or cancer-causing.

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Volatile Organic Compounds

People in the immediate vicinity of a burn barrel are also exposed to high levels of volatile organic compounds (VOCs) produced by open burning. Many VOCs are harmful to humans. They also contribute to ground-level ozone pollution, also known as smog, which can worsen respiratory, heart, and other existing health problems. Inhaling certain VOCs can lead to eye, nose, and throat irritation; headache; loss of coordination; nausea; and damage to liver, kidney, and central nervous system.

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Carbon Monoxide

Another major pollutant generated by backyard burning is carbon monoxide (CO). At low levels of exposure to CO, humans may experience a variety of neurological symptoms including headache, fatigue, nausea, and vomiting. For more information, visit EPA's carbon monoxide site.

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Hexachlorobenzene

Hexachlorobenzene, or HCB, is a highly persistent environmental toxin that degrades slowly in air and, consequently, undergoes long-range atmospheric transport. HCB bioaccumulates in fish, marine animals, birds, lichens, and animals that feed on fish or lichens. Based on studies conducted on animals, long-term low-level exposures may damage a developing fetus, cause cancer, lead to kidney and liver damage, and cause fatigue and skin irritation. HCB is considered a probable human carcinogen and is toxic by all routes of exposure.

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Ash

Backyard burning also produces ash residue, which can contain toxic metals such as mercury, lead, chromium, and arsenic. These metals can be toxic when ingested. When a person ingests hazardous amounts of lead, for example, he or she may experience high blood pressure, cardiovascular problems, kidney damage, and brain damage. Unaware of the potential danger, some people scatter the ash in their gardens or bury it on their property. Garden vegetables can absorb and accumulate these metals, which can make them dangerous to eat. Children playing in the yard or garden can incidentally ingest soil containing these metals. Also, rain can wash the ash into groundwater and surface water, contaminating drinking water and food.

Diarrhoeal disease

Fact sheet N°330
April 2013

Key facts

- Diarrhoeal disease is the second leading cause of death in children under five years old. It is both preventable and treatable.
- Each year diarrhoea kills around 760 000 children under five.
- A significant proportion of diarrhoeal disease can be prevented through safe drinking-water and adequate sanitation and hygiene.
- Globally, there are nearly 1.7 billion cases of diarrhoeal disease every year.
- Diarrhoea is a leading cause of malnutrition in children under five years old.

Diarrhoeal disease is the second leading cause of death in children under five years old, and is responsible for killing around 760 000 children every year. Diarrhoea can last several days, and can leave the body without the water and salts that are necessary for survival. Most people who die from diarrhoea actually die from severe dehydration and fluid loss. Children who are malnourished or have impaired immunity as well as people living with HIV are most at risk of life-threatening diarrhoea.

Diarrhoea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhoea, nor is the passing of loose, "pasty" stools by breastfed babies.

Diarrhoea is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene.

Interventions to prevent diarrhoea, including safe drinking-water, use of improved sanitation and hand washing with soap can reduce disease risk. Diarrhoea can be treated with a solution of clean water, sugar and salt, and with zinc tablets.

There are three clinical types of diarrhoea:

- acute watery diarrhoea – lasts several hours or days, and includes cholera;
- acute bloody diarrhoea – also called dysentery; and
- persistent diarrhoea – lasts 14 days or longer.

Scope of diarrhoeal disease

Diarrhoeal disease is a leading cause of child mortality and morbidity in the world, and mostly results from contaminated food and water sources. Worldwide, 780 million individuals lack access to improved drinking-water and 2.5 billion lack improved sanitation. Diarrhoea due to infection is widespread throughout developing countries.

In developing countries, children under three years old experience on average three episodes of diarrhoea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhoea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhoea.

Dehydration

The most severe threat posed by diarrhoea is dehydration. During a diarrhoeal episode, water and electrolytes (sodium, chloride, potassium and bicarbonate) are lost through liquid stools, vomit, sweat, urine and breathing. Dehydration occurs when these losses are not replaced.

The degree of dehydration is rated on a scale of three.

- Early dehydration – no signs or symptoms.
- Moderate dehydration:
    - thirst
    - restless or irritable behaviour
    - decreased skin elasticity
    - sunken eyes

- Severe dehydration:
    - symptoms become more severe
    - shock, with diminished consciousness, lack of urine output, cool, moist extremities, a rapid and feeble pulse, low or undetectable blood pressure, and pale skin.

Death can follow severe dehydration if body fluids and electrolytes are not replenished, either through the use of oral rehydration salts (ORS) solution, or through an intravenous drip.

Causes

Infection: Diarrhoea is a symptom of infections caused by a host of bacterial, viral and parasitic organisms, most of which are spread by faeces-contaminated water. Infection is more common when there is a shortage of adequate sanitation and hygiene and safe water for drinking, cooking and cleaning. Rotavirus and *Escherichia coli* are the two most common etiological agents of diarrhoea in developing countries.

Malnutrition: Children who die from diarrhoea often suffer from underlying malnutrition, which makes them more vulnerable to diarrhoea. Each diarrhoeal episode, in turn, makes their malnutrition even worse. Diarrhoea is a leading cause of malnutrition in children under five years old.

Source: Water contaminated with human faeces, for example, from sewage, septic tanks and latrines, is of particular concern. Animal faeces also contain microorganisms that can cause diarrhoea.

Other causes: Diarrhoeal disease can also spread from person-to-person, aggravated by poor personal hygiene. Food is another major cause of diarrhoea when it is prepared or stored in unhygienic conditions. Water can contaminate food during irrigation. Fish and seafood from polluted water may also contribute to the disease.

Prevention and treatment

Key measures to prevent diarrhoea include:

- access to safe drinking-water;
- use of improved sanitation;
- hand washing with soap;
- exclusive breastfeeding for the first six months of life;
- good personal and food hygiene;
- health education about how infections spread; and
- rotavirus vaccination.

Key measures to treat diarrhoea include the following:

- Rehydration: with oral rehydration salts (ORS) solution. ORS is a mixture of clean water, salt and sugar. It costs a few cents per treatment. ORS is absorbed in the small intestine and replaces the water and electrolytes lost in the faeces.
- Zinc supplements: zinc supplements reduce the duration of a diarrhoea episode by 25% and are associated with a 30% reduction in stool volume.a
- Rehydration: with intravenous fluids in case of severe dehydration or shock.

- Nutrient-rich foods: the vicious circle of malnutrition and diarrhoea can be broken by continuing to give nutrient-rich foods – including breast milk – during an episode, and by giving a nutritious diet – including exclusive breastfeeding for the first six months of life – to children when they are well.
- Consulting a health professional , in particular for management of persistent diarrhoea or when there is blood in stool or if there are signs of dehydration.

WHO response

WHO works with Member States and other partners to:

- promote national policies and investments that support case management of diarrhoea and its complications as well as increasing access to safe drinking-water and sanitation in developing countries;
- conduct research to develop and test new diarrhoea prevention and control strategies in this area;
- build capacity in implementing preventive interventions, including sanitation, source water improvements, and household water treatment and safe storage;
- develop new health interventions, such as the rotavirus immunization; and
- help to train health workers, especially at community level.

For more information contact:

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US EPA Waste Disposal System Article:

Non-Hazardous Waste Management Hierarchy

Because no single waste management approach is suitable for managing all waste streams in all circumstances,

EPA developed a hierarchy ranking the most environmentally sound strategies for municipal solid waste. The hierarchy places emphasis on reducing, reusing, and recycling the majority of wastes and demonstrates the key components of EPA's Sustainable Materials Management Program (SMM).

SMM is an effort to protect the environment and conserve resources for future generations through a systems approach that seeks to reduce materials use and their associated environmental impacts over their entire life cycles, starting with extraction of natural resources and product design and ending with decisions on recycling or final disposal.

Source Reduction and Reuse

Source reduction, also known as waste prevention, means reducing waste at the source. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction also is important in manufacturing. Lightweighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction.

Source reduction can:

- Save natural resources;
- Conserve energy;
- Reduce pollution;
- Reduce the toxicity of our waste; and
- Save money for consumers and businesses alike.

Recycling/Composting

Recycling is a series of activities that includes the collection of used, reused, or unused items that would otherwise be considered waste; sorting and processing the recyclable products into raw materials; and remanufacturing the recycled raw materials into new products. Consumers provide the last link in recycling by purchasing products made from recycled content. Recycling also can include composting of food scraps, yard trimmings, and other organic materials.

Recycling prevents the emission of many greenhouse gases and water pollutants, saves energy, supplies valuable raw materials to industry, creates jobs, stimulates the development of greener technologies, conserves resources for our children's future, and reduces the need for new landfills and combustors.

Energy Recovery

Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery. This process is often called waste-to-energy (WTE).

Treatment and Disposal

Landfills are the most common form of waste disposal and are an important component of an integrated waste management system. Landfills that accept municipal solid waste are primarily regulated by state, tribal, and local governments. EPA, however, has established national standards these landfills must meet in order to stay open. The federal landfill regulations have eliminated the open dumps of the past. Today's landfills must meet stringent design, operation, and closure requirements. Methane gas, a byproduct of decomposing waste, can be collected and used as

fuel to generate electricity. After a landfill is capped, the land may be used for recreation sites such as parks, golf courses, and ski slopes.

GreenConduct:

Sweden is a Model of Sustainable Waste Management

Sweden has a garbage problem, but unlike the US and many other places in the world, Sweden's problem is not that there is too much trash, it is that there is too little. Thanks to Sweden's highly efficient recycling habits only four percent of the nations waste ends up in landfills.

This is in stark contrast to nations like the US where half of all waste ends up in landfills according to the US Environmental Protection Agency (EPA). Americans recycled just 34 percent of their waste in 2010, and a total of 136 million tons of garbage ended up in landfills. Americans throw away nearly half of their food, costing roughly $165 billion per year, according to a study by the Natural Resources Defense Council.

In Sweden it is mandatory for households to separate recyclables from trash, and producers help handle waste management.

The nation's innovative waste-to-energy program burns garbage to generates twenty percent of their district heating, a system of distributing heat by pumping heated water into pipes through residential and commercial buildings. It also provides electricity for a quarter of a million homes.

Sweden is so effective at managing waste that it has begun importing garbage to power its waste-to-energy program. The country is now importing 800,000 tons of trash each year from other European countries like Norway which pays Sweden to take the waste.

Together, Sweden's recycling programs and their waste-to-energy system ensures minimal environmental impact from the country's waste. However, there is still some toxic waste left behind in the ash from incinerating garbage which are then returned to Norway.

[medium_ad_left]According to Catarina Ostlund, Senior Advisor for the Swedish Environmental Protection Agency, Sweden has the world's best incineration plants as far as energy efficiency is concerned. Nonetheless the nation continues to explore ways to reduce its own waste even further.

"This is not a long-term solution really, because we need to be better to reuse and recycle, but in the short perspective I think it's quite a good solution," Ostlund concluded

Sweden is a model of waste management that other countries can learn from. Their radically efficient circle of consumption, waste management, and energy output are a model for a more sustainable future.

It appears that other countries are following Sweden's example with new waste-to-energy initiatives in Italy, Romania, Bulgaria, and Lithuania. Only a very small amount of trash is incinerated in the US.

[richard_matthews]

Comments are closed.

WTE in China

Waste to energy is proving to be an unstoppable technology, as its growth in China shows us. Here, we look at the extent of this growth plus the environmental issues concerned

by Nickolas Themelis and Zhixiao Zhang

The need for intelligent waste management has led to the concept of the 'hierarchy of waste management' that places the various means for dealing with MSW in order of environmental preference.

Of the estimated one billion tons (907 million tonnes) of global 'post-recycling' MSW, close to 200 million tons (181 million tonnes) are processed in Waste-to-Energy (WTE) plants that recover the energy content of waste in the form of electricity or heat. The dominant WTE technology involves combustion of MSW on an inclined or horizontal grate. There are over 500 WTE plants of this type operating in 35 countries.

Most of the global urban MSW, i.e. over 800 million tons (725 million tonnes), is landfilled. The Earth Engineering Center of Columbia University has estimated that one square metre (about 10 square feet) is used up, forever, for every ten tons (nine tonnes) of MSW landfilled. True sustainable development requires that only inorganic residues be landfilled, as is already the practice in several countries. However, this would require us to considerably increase the present global WTE capacity of about 200 million tons (181 million tonnes) and this is a very costly proposition, especially for developing nations.

Obviously, the need is greatest in large nations with rapidly growing cities, such as China and India, where existing dump sites are overfilled.

Waste management world:

Waste management in China

China has the largest population (1.33 billion) on Earth and is experiencing rapid economic growth. This country has a GDP of $8.8 trillion in terms of Purchasing Power Parity (PPP), which is the third largest in the world after the EU and the US. However, its population is over four times that of the US so the actual per capita GDP is only $6.800 and corresponds to a fraction of the US GDP per capita.

Despite the relatively high capital cost of WTE, the central government of China has been very proactive with regard to increasing WTE capacity. One of the measures brought in provided a credit of about $30 per MWh of electricity generated by means of WTE rather than by using fossil fuels.

‘Harmless treatment’ of MSW in China

The term ‘harmless treatment’ in China means the disposal of MSW by recycling, composting, WTE and sanitary landfilling. The ‘harmless treatment’ rate is defined as the percentage of the weight of total MSW treated with these methods. The generation of MSW, and also the ‘harmless treatment’ fraction have been increasing over the past 30 years in China.

Table 1² shows the reported data from 2001 to 2007 and also the number of WTE plants and their total capacity. The Chinese WTE capacity has increased steadily from 2.2 million tons in 2001 to nearly 14 million tons by 2007. However, landfilling remains the dominant means of waste disposal in China.

MSW generation million tons/y)	Fraction disposed by “Harmless Treatment”, %	Number of WTE plants	Total WTE capacity, million tons/y
134.70	< 25	36	2.17
136.55	<30	45	3.39
148.57	50.8	47	3.7
155.09	52.1	54	4.49
155.77	51.7	67	7.91
148.41	52.2	69	11.38
152.14	62	66	14.35

Table 1. MSW generation, treatment and WTE capacity in China[2]

Most WTE plants are located in eastern China, especially in the districts of the Changjiang and Pearl River Deltas. As of 2007, three provinces in these two districts, Guangdong, Zhejiang and Jiangsu had fifteen, fourteen and nine WTE plants, respectively. These plants constitute 64 % of the existing WTE capacity in China. This is explained by the relatively high economic development in these provinces.

China’s 11th Five-Year Plan (2006-2011) is very ambitious, showing expected construction of many new WTE facilities across the country, as shown in Table 2.

Region	Quantity	Capacity (10^6 tons/ yr)	Percentage (%)
East	56	15.03	67.7
Middle	9	2.4	10.8
West	10	3.13	14.1
North East	7	1.63	7.4
Total	82	22.2	100

Table 2. New WTE plants planned for period 2006-2011.

WTE technologies used in China

Stoker grate incinerator and circulated fluidized bed (CFB) incinerator are the main types of technology used in WTE plants in China. According to a preliminary survey of 100 WTE plants in operation or under construction, most of the MSW incinerators are of the grate combustion type ('mass burn'), and are based either on imported or domestic technologies. The CFB incinerators co-fire MSW with coal (up to 15 % coal by weight) and have been developed by Chinese academic research centers, such as Zhejiang University, Chinese Academy of Sciences (CAS), and Tsinghua University. Most of the new plants are based on the stoker grate design.

The capacity of the WTE plants built in earlier years was generally less than 800 tons/day (725 tonnes/day). However, recent WTE plants are larger, typically over 1000 tons/day (907 tonnes/day). The capacity of a single line within a plant has also increased, from the 200 tons/day (181 tonnes/day) in early years to over 500 tons/day (453 tonnes/day) in recent years.

Air pollution control systems

Most of the air pollution control systems built in the Chinese WTE plants are similar to the predominant gas control systems in the US: a combination of semi-dry scrubber, activated carbon injection (to remove volatile metals and organic compounds) and fabric filter baghouses (to remove particulate matter). In some WTE plants, selective non-catalytic reduction is included to remove nitrogen oxides, such as, for example, the WTE plants under design for Guangzhou, Shantou, and Chongqing.

A major problem that faced the western incinerators in the late 1980s was the discovery of high dioxin emissions. For example, the US WTE plants in 1989 emitted a total of 10,000 grams of toxic equivalent dioxins (grams TEQ), corresponding to 100 nanograms TEQ per standard cubic meter of stack gas. This led to the USEPA regulation of Maximum Achievable Control Technology (MACT) that resulted in the retrofitting of about 90 WTE plants in the US and the closing of nearly 50 small plants. As of 2002, this retrofit resulted in decreasing WTE dioxin emissions by a factor of 1000 to less than 10 grams TEQ. 3

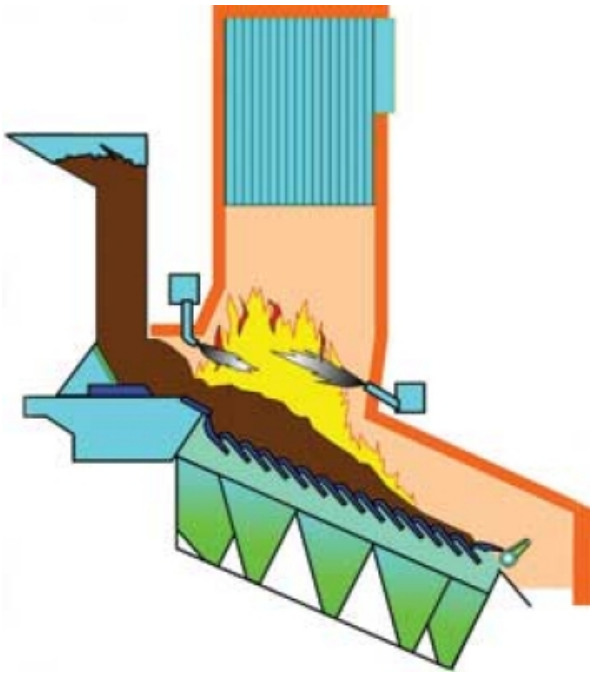

Figure 1: Combustion of MSW on a moving grate.

The emissions of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins) from 19 MSW incinerators in China were investigated by the Chinese Academy of Science (CAS). Sixteen stoker grate and three circulating fluid bed incinerators with capacities from 150-500 tons/day (136-453 tonnes/day) were examined. The air pollution control systems of nine of the grate combustion WTE plants consisted of semi-dry scrubber, activated carbon injection and fabric filter baghouse; the other seven plants did not use activated carbon injection. The results of this study showed that the dioxin emissions of these 19 MSW incinerators ranged from 0.042 to 2.461 nanograms TEQ /Nm3; the average value was 0.423 ng TEQ/Nm3.

The dioxin emission levels of three MSW incinerators were higher than the 1.0 ng TEQ/Nm3, which is the emission standard in China. Only six MSW incinerators had dioxin emission levels below 0.1 ng TEQ/Nm3, which is the emission limit in Europe, the US and other developed countries. Therefore, the average emissions of dioxins from Chinese incinerators ranged from being as low as European and US plants to being 24 times the western standard. Considering the significant amount of MSW generation in China, the dioxin emissions from some poorly-operated WTE have been a severe problem and caused an adverse public reaction against all WTE facilities.

The dioxin emission factors to the atmosphere from these 19 MSW incinerators were calculated to range from 0.169-10.72 μg TEQ for per ton MSW with an average 1.728 μg TEQ per ton MSW.

Conclusions

The generation of billions of tonnes of solid waste by humanity presents both a challenge and an opportunity to developing nations. The information presented in this article shows that China, more than any other developing nation, is taking major steps to increase its WTE capacity.

Since the beginning of the 21st century, China has increased its WTE capacity from 2 to 14 million tons of municipal solid wastes. This makes China the fourth largest user of waste-to-energy (WTE), after the EU, Japan, and the US. There were 66 WTE plants in China by 2007 this is projected to increase to one hundred by 2012. Two

thirds of these plants employ either imported or domestic versions of combustion on a moving grate; and the other third various forms of a home-developed technology, the circulating fluid bed reactor.

Fuzhou Hongmiaoling EfW plant
Credit: Sanfeng Covanta Environmental Company, Chongqing, China

This study also examines in detail the environmental performance of Chinese WTE plants. Using as a yardstick the emission of dioxins from a group of 19 Chinese WTE plants, we found that seven operate below the EU dioxin standard (0.1 nanograms TEQ per standard cubic meter of stack gas) and 12 above this standard. The fact that several WTEs in China are able to control dioxin emissions to the very strict EU standard (which is 10 times lower than the present Chinese standard for dioxins) is very encouraging and indicates that Chinese operators and air pollution control systems can be as good as those in the west.

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This article is on–line. Please visit www.waste-management-world.com

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Trash Planet: India

August 3, 2009 EARTH WATCH Marie Look

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The Trash Planet *series highlights various countries around the world and how they handle their waste.*

Waste management is a major problem in India. Faced with rapid population growth, disorganization of city governments, a lack of public awareness and limited funding for programs, cities have struggled for years to find a way to responsibly manage the country's ever-increasing amount of trash.

The Central Public Health and Environmental Engineering Organization (CPHEEO) has estimated that waste generation in India could be as much as 1.3 pounds per person per day. That figure is relatively low, compared to the 4.6 pounds of waste generated per person per day in the U.S. However, as of July 2009, the U.S. population was close to 307 million, whereas India's population was nearly four times greater, at 1.2 billion.

These statistics mean that India could be generating as much as 27 million more tons of waste than the U.S. per year, although it has only one-third the land space when it comes to finding suitable locations for final disposal.

India's rapid population growth only magnifies the problem. The urban population has grown at a rate of more than 20 percent each year since 1980 and is projected to reach a rate of more than 30 percent by 2015.

Many argue that the country's poorly organized waste management scheme will continue to result in serious health problems and irreversible damage to the environment. Most agree that the government, industry and citizens need to work together to make major improvements.

India is the second-most populated country in the world, making waste management an imperative task. Photo: CIA.gov

A City's Seven Responsibilities

In India, each municipality is responsible for organizing its own waste management in the following areas:

- Waste segregation and storage at the source
- Primary collection
- Street sweeping
- Secondary waste storage
- Transport of waste
- Treatment and recycling options for solid waste
- Final disposal

Unfortunately, each of these seven stages are frought with difficulties, and city services and citizen cooperation can be, overall, inefficient.

Currently, there is no official system for the widespread collection of recyclables, and the tasks of collecting, transporting and disposing of waste are done under very unsanitary conditions. These problems have been created in part by low budgets and a lack of technology and manpower.

Street Sweeping

In some areas, people are permitted to simply dump their trash on the streets, creating a dangerous mix of rotten food, harmful chemicals and human and animal excreta. This contributes to flooding, breeding of insects and rodents and spreading of diseases.

“It is definitely a culture shock,” says Velika Lotwala of the urban scene in India. The 28-year-old marketing manager currently lives in Phoenix but frequently travels back to Bombay, where her family is from. “There are cows, dogs and other animals roaming the streets, nobody follows driving guidelines, and the noise and smell are overwhelming,” she says of typical Indian cities.

Door-to-door collection is virtually non-existent in India. Instead, the official method for primary collection is called “street sweeping.”

In higher trafficked city areas, such as important roads or markets, the municipality employs people to remove the trash with short-handled brooms and handcarts. These street sweepers spend the first half of the day sweeping the trash into piles and then the second half carting the trash to the designated waste bin.

A street sweeper is usually assigned a particular area or distance, which could be as small as one kilometer of road, or as large as 32,000 square feet. Given the fact that the sweepers are tasked with covering an impossible size of ground, it’s easy to see why not all streets are swept every day — some are swept only every other day, a few times a week or very rarely.


Indian rag-pickers collect polythene bags from a large heap of garbage at a land fill to sell at a market in New Delhi. Photo: Daylife.com

Rag Pickers

A second, unofficial method of primary collection is carried out by “rag pickers.” These are usually very poor women and children who will sift through the garbage in the streets, waste bins and even landfills, searching for items that they can resell.

Reusable materials are most often newspaper, glass bottles, tin cans, plastic bags and old clothes or fabric. The rag pickers earn a small living by collecting these materials and then selling them to waste buyers who will further sort and clean the trash before reselling it in bulk to a manufacturer with the means to recycle it.

In the process of rummaging through the city's trash, rag pickers often overturn waste bins and spread garbage into the streets, furthering unsanitary conditions. Also, rag pickers come in contact with all kinds of dangerous waste on a daily basis, including biomedical, human and animal waste.

Secondary Waste Storage

Community waste bins are meant to hold waste in bulk until it can be transported to landfills. However, they are unevenly distributed, and there are too few of them per number of households. It's common for individuals to have to carry their trash long distances in order to reach the closest dumpster.

Cities don't regularly empty the containers, either, although residents and street sweepers quickly fill them to capacity. The bins have no lids, leading to trash overflow and creating highly unsanitary conditions in neighborhoods.

Transportation

When sanitation workers transport waste from the bins out of residential areas, they use open trucks or tractors, which they load manually, often without wearing protective gear. Trash often falls out of these trucks during transport, making the process that much more time-consuming, inefficient and unhygienic.

The vast majority of cities have little funding available for waste management and therefore can't afford as many sanitation workers as are needed to sweep the streets and collect and transport waste from community dumpsters.

Treatment and Final Disposal

Ideally, trash that makes it to the final disposal stage should be responsibly incinerated or undergo mechanical-biological treatment before being sent to a landfill. But in India, 94 percent of waste is disposed of unsafely, either burned in an uncontrolled manner, or dumped in untreated landfills, where contaminants can leach into groundwater.

 In the capital of New Delhi, workers are paid to sweep major streets and outlets. Photo: Destination360.com

Given the size of India's population and the size of the country itself, finding enough land that meets the state pollution board criteria and can hold 20 to 30 years worth of waste is extremely difficult. And even if suitable land can be found, sometimes the purchase price is higher than the city can afford.

"India is so over-populated that many people make their homes in landfills and set up shanties using other people's trash. It's very sad," says Lotwala. "One minute, you could be driving in front of a huge high-rise building … and the next you could be driving in front of a landfill turned [into] shanties for homeless people."

Waste Management Legislation

State and city legislation include some directives for the collection, transport and disposal of waste, but the wording lacks specifics. The laws require each city's chief executive to see to it that streets are swept, trash bins are provided and waste is transported to dumping sites, but the laws do not say exactly how these tasks should be carried out.

The majority of city legislation also does not:

- Clearly prohibit citizens from littering
- Outline any widespread collection schemes
- Specify types of waste bins for storage
- Require sanitation workers to use covered transportation
- Require treatment of waste and landfills

Without laws to govern accountability, India's waste management system remains outdated.

In 1996, a public interest litigation was filed in the Supreme Court (Special Civil Application No. 888 of 1996) against the government of India, state governments and municipal authorities, claiming they were failing to fulfill their waste management duties in an acceptable manner.

A committee was appointed by the court to investigate. After speaking with city authorities, sanitation workers and citizens, the committee delivered to the Supreme Court a report with detailed recommendations. As a result, the Supreme Court advised India's states and city officials to take the necessary steps to resolve these issues.

In line with these events, in 2000, India's Ministry of Environment and Forests issued the Municipal Solid Waste (Management and Handling) Rules 2000, guidelines for all Indian cities and states to follow in order to make improvements.

Municipal Solid Waste Rules 2000

The four steps of the MSW Rules 2000 are:

1. Set up waste processing and disposal facilities.
2. Monitor the performance of processing and disposal once every six months.
3. Improve existing landfill sites.
4. Identify landfill sites for future use and make the sites ready.

The Rules 2000 put forth more strict requirements for collection, transport and disposal of waste. For example, different types of waste should not be combined and must be collected separately. Also, city officials must ask their state's pollution control board for authorization to set up waste bins and processing facilities, and these officials must also deliver annual progress reports to the board.

Indian cities were given until December 2003 to incorporate these rules into their current systems. The deadlines have all since passed, with very few local governments being able to comply with all four of the mandates. The Supreme Court committee cited reasons for non-compliance to be a lack of community involvement and insufficient technology and financial resources.

Sanitation workers transport waste using open trucks or tractors, which they load manually, often without wearing protective gear. Photo: Delhigreens.com

Funding for Waste Management

City funds for waste management services come from a number of sources. What little income is available for providing waste services comes mostly from the taxes and fees associated with the operating costs of running water, drainage and sanitation. Some states also offer grants to their cities, but these are often insubstantial.

According to the Supreme Court report, most cities spend 70 to 75 percent of their waste management budget on street sweeping, 25 to 30 percent on collection processes and 0 to 5 percent on disposal.

The fact that so little money is invested in the treatment and disposal of waste signals a very "here and now" mindset in India with regard to controlling the waste situation, rather than a focus on the country's future.

Future Progress

According to a 2008 report by The World Bank, if an efficient system were in place, roughly 15 percent of India's waste materials such as paper, plastic, metal and glass could be recovered and recycled. If the 35 to 55 percent that is organic waste could also be recovered, that would leave only 30 to 50 percent to be sent to landfills.

Part of India's improvements for waste sanitation will need to include better outreach to its citizens regarding the benefits of clean waste practices and caring for the environment. Also, experts have suggested that assigning some responsibilities to the private sector could provide advantages such as salaries based on job performance, access to better technology, job creation and more effective administration.

But as countries such as Switzerland, the Netherlands and Germany have already proven, a major key to reducing waste is limitation at the source of creation. Perhaps by creating more programs and initiatives to better encourage citizens, manufacturers and communities to be less wasteful, the country of India will find it easier to continue taking steps toward a cleaner, safer environment.

GhanaWeb:

Ghana adopts Chinese technology for waste management

ACCRA, April 1 (Xinhua) -- In an effort to find a lasting solution to waste management in major cities in Ghana, the Ghanaian government and a private company have decided to adopt Chinese technology in at least three waste recycling plants.

One of the waste management project has already set up in Accra with the estimated daily capacity of disposing 300 tons of wastes in the capital city through the public-private partnership between the government and the Zoomlion Ghana Ltd.

The plant is one of three planned plants build up by Zoomlion, using Chinese technology. Another two will be built in Kumasi, a commercial city, and Takoradi, a coastal city west of the capital.

The plant in Accra was designed to process 300 metric tonnes of waste, he said, adding that the plastic and metals sorted would be supplied to fast establishing recycling companies in the country.

"China for decades now have had this technology developed in cities like Beijing, Shanghai and others to manage waste efficiently and we are pleased to be sharing this with Ghana," Ding said.

Chairman of the Local Government Committee in Ghana's parliament, Dominic Azumah, who also spoke to Xinhua during a tour of the project site, said the committee, after visiting China to familiarize themselves with the Chinese

waste management system, had come to the conclusion that Ghana needed such a module to deal with its waste management situation.

"We therefore have convince the government to commit 5 million cedis (3.27 million U.S. dollars) as equity to the project in the 2011 budget," Azumah said, urging the local government ministry to facilitate the quick release of that money for the completion of the project.

He also called for the establishment of smaller recycling machines in all 10 regions of the country to deal with waste at all levels, saying that "we collect the waste well enough, but the problem has always been how to dispose of it."

The current dump-site in the city, an abandoned stone quarry pit sited at the westernmost end of the capital, is being filled with solid waste for reclaiming purposes.

It however has less than 12 months to be exhausted, and a capital that has already been hard-hit by cholera epidemic needs to find an alternative waste disposal system in the shortest possible time.

Already the residents of Weija, a suburb of the capital where the dumping site is located, have complained to the joint parliamentary committees on local government and road transport about the manner the waste was affecting their community.

Sited close to the Weija dam from which water is collected and treated for over 5 million residents, it is feared that, waste water from this site sipping through features in the rocks into the dam, posed serious health risks for consumers in the capital.

Moreover, flies hover from the dumping site into the communities posing serious health challenges to the people.

Project coordinator, George Kwesi Rockson disclosed that the recycling plant, occupying a land of 140 acres, would be offering employment to hundreds of university and polytechnic graduates who would be trained in modern waste management methods and technology.

Zoomlion Ghana Ltd started partnering government of Ghana since its inception in 2007 to manage waste in the country, using modern technology.

The company, which adopted the name of the Chinese equipment manufacturer, Zoomlion China Ltd, relies heavily on cost effective and simple Chinese technology to do its work.

The waste management company was in charge of waste management at the stadia during the 2008 Africa Cup of Nations finals (CAN 2008) held in Ghana as well as the CAN 2010 finals in Angola. Speaking to Xinhua at the project site, Ding Zhiqiang, project engineer of the waste management plants, said that the project was designed to improve sanitation in the west African country.

When completed, the facilities would have a sorting department using both technology and human resources to sort plastic and other objects from the waste.

It would also have a magnetic separator, bailer for plastic and paper, a vibrating screen and a composting bay where organic manure would be composted into manure for agricultural use.