

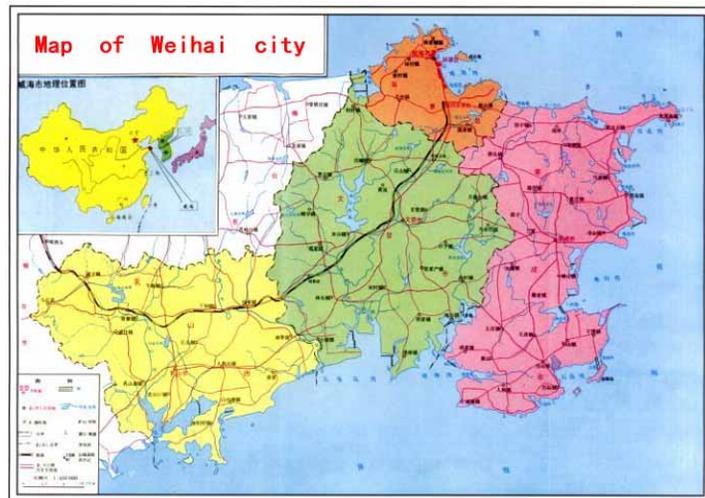
The solid waste management in Weihai

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1. Background

Weihai is located in the eastern tip of Shandong Peninsula of China, opposite to Liaodong Peninsula, Korean Peninsula and Japanese Islands across the sea. Weihai has a history of over 600 years. It had been a small frontier town till 1980s' with a population less than 70,000. In the past, there was a vivid doggerel about the old city "There is only one road with two lamps, with one loud-speaker for the whole town, one policeman in charge of everything, and fish-cooking in one family makes half of the town having fish smell".

In 1987, Weihai, a prefecture level city was founded. Three down level cities are under its jurisdiction; the total area is 5436 square kilometers, with a population of 2.47 million. Weihai has 986km coastline with attractive beaches, beautiful landscape, numerous historic sites and pleasant climates. The GDP was only 3.4 billion in 1987, mainly from fisheries and light industries, the environmental quality is one of the best in China, and these made Weihai a famous tourist city.



During that time, the reform and open up policies in China were just took effect, China is getting on the fast development track. Weihai As a new developing coastal city, enjoy all the preferential policies and a unique location, a rapid development for the city and economy is obvious. In 2005, compared with the foundation of Weihai city in 1987, developed urban area grow from 13.1 to 82 km²; urban population grow from 233,000 to 462,000; GDP grow from 3.42 billion to 116.98 billion. The GDP growth rate is 21.68 % annually. The rapid development also brings high pressures on the environment, especially the solid waste.

Before 1987, the city is small, the quantity of solid waste is small, and its problem is not obvious. In 1990, we selected a landfill site; it is a shallow but bit hole, created by sand evacuation. Its geological condition is good and no sensitive environment around that

area, especially the downstream groundwater. We think it can be use for 15 years. But along with the rapid increase of urban population and industries, the municipal and industrial solid waste increased quickly, we had no sorting regulation during that time, so all the solid waste gone to that landfill site, the volume of the site be used very quickly. In 1997, we found it only can last for another 4 years. We need a new landfill site. In that time, the solid waste problem became obvious in China, especially for the landfill site, the leakage pollution for the ground water, the landfill gas for the air pollution even explosion. Where to find the new landfill site? How to deal with its environmental problems? How long time it can last? Where is another one? We face a tough challenge.

We conducted a survey of the solid waste in Weihai. In 1997, the urban population in Weihai is 233, 000, the solid waste is 94, 000 tons, 1.1 kg/person, day. The contents of the waste as follows:

organic			inorganic			used material					
flora	fauna	total	brick& stone	dust & ash	total	paper	textile	plastic	metals	glass	total
49	10	59	3	28	31	3	1.5	4.5	0.5	0.5	10

From the contents, we fund most of the inorganic waste from construction waste that does not need to be transferred to the landfill site, can be reused or buried in easy method; most of the used material can be recycled as row material for some factories. The industrial solid waste gone the landfill site is free, that is not reasonable, the enterprises should pay for their pollution. In this regard, our solid waste management system needs to be reformed.

2. Goals

What is the goal of our solid waste management system? To identify this, we sent several delegates went other cities and abroad to do investigation and study; consulted with experts from research institutes and universities; distributed questionnaires to the citizens to collect their opinions. We realized the best way to deal with the solid waste is 3R: reduce, reuse, and recycle. according the situation in Weihai, the suitable way to deal with the discharged solid waste is the sanitary landfill.

So the goals of the solid waste management in Weihai should be:

- 1) increase the public awareness for solid waste;
- 2) Reform the solid waste collection system;
- 3) Construct a sanitary landfill site.

3. Outcome Indicators and Action Steps

Goal 1, increase the public awareness for solid waste

Output indicators: the percentage of the citizens received environmental education; the percentage of citizens pay attention on the solid waste.

Action steps:

- 1) Open the environmental information, especially the solid waste situation to the public;
- 2) Stress the environmental education especially for women and children;

Goal 2, Reform the solid waste collection system

Output indicators: different solid waste are sorted and treated properly.

Action steps:

- 1) Separate the construction solid waste, reuse it as much as possible;
- 2) Reduce the industrial solid waste and charge fees for it to the landfill site;
- 3) Construct a incinerator for medical waste;
- 4) Create a convenient condition to encourage housewives sorting in home;
- 5) Setup the second hand goods fair;
- 6) Issue solid waste management regulation

Goal 3, Construct a sanitary landfill site

Output indicators: the landfill site constructed and meets the environmental standard.

Action steps:

- 1) Do the feasibility study of the new landfill site;
- 2) Pass the environmental impact assessment;
- 3) Construct;
- 4) Operation.

4. Implementation Process

We started our solid waste management reform from increasing the public awareness on environment. We setup an environmental program on TV and radio, a column in the newspaper Weihai Daily; publish the environmental knowledge, environmental law and good practices. Children are our future; they also can make big influence to their families and the society. We put much attention for environmental education in kidgardens, elementary schools, take environment as one of their basic classes; organize them participate in environmental protection actions. The effect is very well, now there are 34 elementary schools in Weihai got the honor of Green School from Environmental Protection Bureau of Weihai City or Shandong Province.

Open the environmental information. Through TV, radio and newspaper, we broadcast the air quality currently and the prediction for tomorrow; we established a website, www.whep.gov.cn, public can get the environmental regulations, standards, statistics and environmental qualities from it. We opened the mayor's mail box, mayor's hotline 12345, environmental hotline 12369, to answer the questions, receive the claims about the environment.

Households are the main source of the municipal solid waste, housewives are the important players in solid waste management. We encourage local communities to organize housewives participate in various environmental activities, to share their experience on solid waste sorting, visit the landfill site, increase their awareness on solid waste.

Now almost all the residents received environmental education, put environment especially solid waste as one of their top concerns.

Separate construction solid waste from municipal solid waste. After 1990, Weihai is on the fast track of development, you can see the construction tower elevators everywhere, old building were demolished, new buildings were decorated, that create big mount of solid waste. Before the solid waste management reform, all the construction solid waste goes into the landfill site that not only increased the transportation cost, but also occupied the volume of the site that is a precious resource. We issued a regulation, encourage the constructors reuse the solid waste in the construction site as much as possible; selected some construction sites that need the solids to fill their base, let others transfer the solid to these sites, the receivers pay some money to the transfers. Otherwise, if they transfer the construction solid waste to the landfill site, they will be charged. In this case, you never see the construction solid waste appear in the landfill site again.

Encourage the enterprises to reduce, reuse and recycle the industrial solid waste. According the industrial structure in Weihai, the main solid waste is the slag and fly ash from the heating & power plants that use coal as fuel. We give them some preferential policies such as reduce their tax, let them use the slag and ash to produce bricks for construction; in the same time, raise the tax on bricks that use raw materials such as loess. Now the slag and fly ash can make money, even be exported abroad; use loess produce bricks are prohibited. For the food processing solid waste, we encourage them use it for aquacultures and husbandry; for the textile and garments industries solid waste, we encourage them use it to reproduce fiber; for the dangerous waste, the producers must follow the law, ask the agents who have the treating license to deal with it. In the same time, we charge fees for the enterprises that send the solid waste to the landfill site. In this way, we reduced the percentage of the industrial solid waste into the landfill site from 10 % in 1997 to 1% in 2005.

Constructed an incinerator to treat the medical waste. Medical waste treatment is one of the top concerns of public in recent years, especially after the SARS spread in China in 2003. Weihai constructed an incinerator for the medical waste in 2000, before that time, the medical waste was treated by the hospitals individually, because their

facilities were outdated, lack maintenance and management, and near residents, caused severe environmental problems. Some used medical plastic staff even leaked out for illegal reuse that harmed public health and environment. Weihai government choose a stock-cooperate company in charge of the medical waste treatment, granted a piece of land and parts of fund for the investment, issued a regulation let the company to collect fee from the hospitals, RMB 2 Yuan /bed, day; that is the number one in Shandong Province. Now the company operated very well.

Encourage households sorting solid waste at home. Households are the main source of the municipal solid waste, sorting must begin from home. China is a developing country and shortage in nature resources; most of the households have the habit to sort the waste at home, sale to collectors, one reason is save resources, another is can make money. But these years some people get rich, they ignore the little money; just throw the reusable things away. To encourage the households sorting solid waste at home, at beginning, we distributed garbage bags into the households, in black color and white color, means not reusable and reusable; now most households just use the used plastic bags sorting the waste.

China is over population, these years so many farmers flow into cities to explore their future, but that is not easy for them, because they lack education, lack skills, some are just wander on the street, try to find some valuable things in garbage trunks, sale it for living. In some cities the authorities forbid the collectors into the resident area, think that is not safe. We considered that they are also legal citizens, allowed them into the resident area to collect the usable waste that makes the households easy to sale their reusable things from sorting.

From sorting, the paper, paperboard, plastic and steel, the collectors can sale them to factories which use them as row material. In China, because the shortage of nature resources, producers can reduce their cost if they use recycled materials. For the used electric appliances and furniture, we established second-hand goods fairs; the collectors can sale and resale the staff in those places. Now the solid waste becomes an industrial chain in Weihai.

Improve the solid waste collection facilities.

In early 1990s, we put open steel containers in the resident area, use lifter to pour the waste into collect truck, then transport to landfill site. But this operation causes odor and dust problems, especially in windy days. In 1997, we began to use plastic tank with cover, use sealed truck with compressor and lifter designed suite for the plastic tank. It can operate machinery and automatically. Now the environmental problem is much smaller.



Issue the municipal solid waste management regulation. Before 1999, there is no special regulation for the municipal solid waste management, the items concerned about that is merged in other regulations, so is difficult to carry it out. In 1999, Weihai government decided to issue a regulation special for the municipal solid waste management. We organized a team, done an investigation, prepared a draft, consulted with the residents, entrepreneurs and experts, finally issued it. In this regulation, we identified the domestic solid waste, the construction solid waste, the industrial solid waste and the medical waste; identified the organizations who responsible for the different waste; regulated the sorting and collection system and treatment method. Now the municipal solid waste management is the law everybody must follow.

Constructed a sanitary landfill site.

The landfill site selection. Everybody knows we must have landfill site, but nobody wants the site beside himself or herself, that makes the site selection a hard work. The site should be located not far from the city because the transportation cost, nether near the city because the environmental problem; it's nearby should be no environmental sensitive subjects like residents, conservation area etc. especially groundwater usage. We asked the Qingdao Environmental Sanitary Research Institute to do the feasibility study. At beginning, we have three options. After compared with each other, Aishan is the best. It is a valley, 17 km away from the centre of the city, no residents and other environmental sensitive subjects within 1.5km, no groundwater usage downstream. Its geologic condition is very good; the base is granite rock, no cracks that makes the leakage polluting prevention much easier.

The environmental impact assessment. We asked No1 Ocean Research Institute of China to do the EIA. They conducted the air, water, noise quality monitoring, investigated the vegetation, the eco system, tested the penetration of the base, and distributed questionnaires to the residents. It seems everything is ok except the rejection of nearby villagers. They strongly protest the landfill site near their village, block the load, and lobby in front of city hall, though they are told there should be no problem according scientific prediction. At last the government paid higher compensation for their land and promised hires more people from the village then the villagers quit.

The leakage polluting prevention. We dig a ditch along the edge of the landfill site to prevent the outside rain water comes in; constructed a thick concrete dam to prevent the leakage penetrate out; constructed a treatment station to treat the leakage, built a special pipe transfer the treated leakage to a sewage treatment plant, then discharge. This system cost RMB 40 million.

The landfill gas collection. The gas



generated from the landfill site may cause air pollution, greenhouse effect, and even explosion if it not be collected and treated properly. We installed the pipes vertically and horizontally, collect the gas generated from the garbage, then sent it to an incinerator. Now we are studying to use it to generate electricity.

The landfill site began to construct in 1999, began to put in use in 2000, total investment is RMB 75 million. Its volume is 4.467million cubic meters, can serve for 26 years.

5. Action Output and Outcome

Since the solid waste management reform began, the effect is obvious. Now all the citizens especially the housewives and children in Weihai know the importance of the municipal solid waste management, pay more attention for the environmental protection; All the construction solid waste was reused as construction material or buried in bases of buildings, never go to the landfill site; Most of the industrial solid waste was reused, recycled; All the medical waste was incinerated. All the municipal solid waste was sorted, reused, recycled or landfilled properly.

Weihai got the awards of 1st National Sanitary City, National Model Cities for Environmental Protection, National Garden City, and National Excellent Tourist City. Weihai has twice got the International Award as the Best Practice for Comprehensive Management of the Living Environment by UN-HABITAT in 1996 and 2000; got the UN-Habitat Scroll of Honor Award in 2003. All these achievements have the contribution of the solid waste management.

6. Lessons Learned

There are two things need to be improved in the solid waste management in Weihai:

Public participation. Public participation in environmental protection in China is just beginning, though the item has appeared in some environmental laws and regulations, only a few are in practice. Public participation in solid waste management in Weihai still in a primary stage, most of them were just follow the market principle passively, they still lack the knowledge, lack the information, especially lack organization.

using market mechanism manage solid waste. The total investment for the landfill site is RMB 75million until now, that totally from the government revenue, the centre government gave RMB 21million soft loan, and we hope that will be remitted. The operation cost is about RMB 21.5/t; in 2005, we treated 217, 000 tons, the total cost is RMB 4.6 million; if plus the depreciation, the cost should be RMB 37/t, total is RMB 8 million. But now we only charge the industrial solid waste sent to the landfill site, RMB

50/t, the total amount in 2005 is only RMB 30, 000; for the municipal solid waste is free. So the solid waste management is a big burden for the government, not sustainable. We are thinking to charge the domestic solid waste. It should be, because that is not only can get some financial support, but also can encourage the residents to pay more attention for the environment.

The landfill odor prevention. At beginning we think it should be no problem for that because it is located 1.5km away from the village. But last summer, a special weather condition happened; the villagers strongly claimed the odor. During August 6 to 9 last year, the weather was very hot, the villagers opened the door and the window for cooling; from 9 to 10 pm, they smelled a disgusted odor. They blocked the road again; asked the government to solve the problem. We conducted an investigation, found those days there were no strong wind but a soft from south, which is not the right direction of the landfill site to the village. But 9 to 10 pm usually is the time for the strongest sea-land wind goes in the direction from land to sea that via the south of the village, the winds cooperated sent the odor to the village. The government consulted with experts, use plastic membrane covers the leakage storage tank, and the operation surface during night. But it is difficult totally eliminate the odor.

