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The Household Behavior on Solid Waste and Wastewater Management in Municipal Area with Cleanliness Policy Determined by Community

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***Abstract*—**The Bangnanglee Sub-district Administrative Office, Thailand had initiated a policy to environmental protection with encouraging household waste management in order to promote civil responsibility for domestic hygienic. This research studied the household behaviors on solid waste and wastewater management. A sample population of 306 families answered a questionnaire. The study showed that, on average, domestic activities had produced 1.93 kilograms of waste per household per day. It has been found that 79% of the households made several attempts to reduce their own amount of waste. 80% of the households stationed their own garbage bins. 71% managed their waste by selling recyclable products. As for the rest of the waste, 51% burned them, while 29% disposed their waste in the nearby public trashcans and other 13% have them buried. As for wastewater, 60% of the households disposed it into the sewage, whereas 30% disposed them right from their elevated house.

***Keywords*—**Environmental integrated management, environmental protection, household waste management.

I. Introduction

ISSUES of solid waste are currently affecting people's quality of life, as it breeds disease carriers, such as rats, cockroaches and flies. The moist organic leftovers also increase the number of germs that were contaminated within the waste and creates a disturbing smell. In addition, solid waste causes water and air pollution from the dust that occurs the process of collecting, transporting, and burning. Also, waste that is ignored or improperly disposed of, when exposed to rain, could pass wastewater, germs and toxin into the waters. According to the 2010 Thailand State of Pollution Report [1], the amount of total solid waste nationwide was 15.16 million tons, or 41,532 tons per day. Bangkok disposed of 8,766 tons of garbage daily, which equals 21% of the total figure. As for the area under District Administration Offices and Pattaya Municipality, there were 16,620 tons of waste per day or 40% of the total, while the area under Sub-District Administration Office produced 16,146 tons of garbage or 39% of the total number. The average rate of waste disposal was 0.65 kilograms per person per day [2].

The Bangnanglee Sub-District Administrative Office is situated in central Thailand, at Bangnanglee sub-district, Amphawa District, SamutSongkram Province in Fig. 1-3.This sub-district has 5.58 km2 of low-plain land with rivers and canals. Its population is 3,712 people from 850 households. Most people are committed to the agricultural profession, such as cultivating coconut, pomelo, lychee, and bananas, and to household industry such as producing coconut sugar. Others work in factories [3]. From observing the Bangnanglee neighborhood, neither public trashcans nor public waste management system were visible. After interviewing the sub-district administrators, it was found that the administrative office initiated a policy to promoting awareness and behavior of managing waste disposal and keeping their own household hygienic. Therefore, public trashcans and waste management system were not available in the Bangnanglee sub-district in Fig. 4.

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Fig. 1 Map of Thailand

Fig. 2 Amphawa Floating Market

Fig. 3 The Bang-nanglee Sub-District Administrative Office

Fig.4 Remove Trashcans

There are many definitions of waste or solid waste. Firstly, Shah (2000) [4] defined the term "Solid Waste" as any objects used in daily life that are discarded because they are no longer usable or wanted. Thus, they lost their value or utility." In a similar fashion, Yupadee Settapan (2001)[5] stated that "solid waste is unwanted debris, broken or deteriorated objects that must be rid of, or objects that ought to be disposed of or distributed, i.e. paper, leftover, glass bottles, plastic, animal remains, car debris etc." As for Suthira Tulayasathien and co. (2001) [6] gave a definition of "Solid Waste" as "unwanted objects, mostly solid substance, decomposable or not, including ashes, animal remains, animal dung, discarded rubble from buildings, fresh markets, factories, and animal farms." Department of Environmental Quality Promotion (2002) [7] defined "Waste" as "leftovers from human production and consumption".

It can be concluded from the definitions that "Waste" or "Solid Waste" are substances used in human living activities including ashes, animal remains, animal dung, and throwaway debris from residential buildings or other places, which are not needed by users, thus rendered worthless or useless for living.

A. Categories of Solid Waste

Department of Public Cleaning (1990) [8] has categorized Solid Waste as follows;

1. Garbage – food leftovers, meat, vegetable bits from cooking. These are decomposable, easy to decay and highly damp.
2. Rubbish – clothes, wood, grass, hay, glass, tiles, tires, metal. These can be either burnable or not burnable.
3. Ashes are debris from burning such as ashes from a cooker or from burning up coal, charcoal, or other flammable objects.
4. Street Refuse is gathered on the streets, alleys and other places. These include bits and pieces of fruits, leaves, bricks, pebbles, sand, paper, and plastic bags.
5. Dead Animals, like dogs, cats, or rats, are quickly decomposed and smelly.
6. Abandoned Vehicles are those out of order or broken, including their parts, i.e. tires, battery etc.
7. Industrial Refuse are refuse from production processes in factories. They could be of any substance, depending on the manufacturer and of any amount, depending on the size of the factory.
8. Construction Refuse are wood, cement, bricks, rocks, sand etc.
9. Demolition Refuse are from the demolition of buildings, such as old buildings or residences.
10. Hazardous Refuse are those that must be decomposed by a specific process, i.e. plastic, films, or mullock.

B. Effects of Solid Waste

The problems of the increasing amount of solid waste and hazardous refuse in a community and the inability to collect and dispose of solid waste effectively causes many negative environmental impacts[9].

1) Effects on Water Supplies

1.1) Contamination of water due to decomposed organic waste, which are food leftovers, grass and leaves, dead animals and their dung etc.

1.2) Rivers and canals gathering indecomposable waste such as plastic bags, glasses and other canned products.

1.3) Contagion of diseases from water caused from accumulating decaying solid waste.

1.4) Accumulation of toxins contaminated from solid waste or hazardous refuse from households or farms, i.e. pesticide's cans.

1.5) Contamination of water with various matter so it becomes unsafe to utilize.

1.6) Clogged urban sewers or drain causing floods from garbage blocking water flow.

1.7) Unpleasant scenic watercourse and damage to tourism industry.

2) Effects on Air Quality

2.1) Smog from open burning of waste or agricultural refuse.

2.2) Disturbing smell from piles of solid waste left on the ground or below-standard burial place, which could negatively affect the health of people living nearby.

2.3) Emission of hazardous gas, such as CO_2, CH_4 and H_2S that harm people and the environment if not handled properly.

2.4) Ashes from cremating hazarding waste that spread in the air, which include heavy metal and Dioxin particles.

2.5) Particles spreading from piles of solid waste causing respiratory problem for people in the neighborhood.

3) Effects on Land

3.1) Turning land into a waste burial place prohibits its use for other practices, especially for agriculture

3.2) Soil contamination due to the absorption of polluted water.

3.3) Buried hazardous refuse, i.e. Battery refuse, Fluorescent bulbs etc., increase the level of heavy metals in the soil, which has negative impacts on the soil ecology.

4) Effects on the Quality of Underground Water

4.1) Contamination of underground water around the area of waste mound or burial ground causing the water to become risky for consumption.

4.2) Garbage containing hazardous waste could transmit heavy metals through to the underground water.

C. The Concept of Waste Management

Waste management is an activity involving management from the origin to the final disposal process. These activities include control on waste disposal, collecting, sorting, transforming, transporting, transferring with a hygienic procedure and recycling. The whole process must be operated under regulations, which respect for human hygiene, landscape, and the environment. Also, it has to be economically, environmentally and socially appropriate. (Pattana Moolpruek, 1996)[10].

Therefore, effective waste management needs participation from related sectors. Citizens are obliged to sort out their waste before disposal and gather them in a designated place, to facilitate collection. Related agencies must operate their tasks properly according to the academic standard of waste management. Various concepts of waste management are discussed by scholars as follows.

Anat Thapinta (2010) [11] categorized 4 types of community waste management system as;

1) Waste disposal – an activity in which a disposer believes an object is unusable and thus disposes it. This activity is vital in the system as the amount of waste is directly related to the cost of disposal.

2) Waste management from the origin. This deals more with waste in residential areas, since there is a variety of elements produced from households. Particularly in crowded neighborhoods, there is not enough space to gather waste, or even if there is, they need to be rid of quickly; otherwise the waste will rot and smell, which could affect residents' hygiene. Therefore, it is crucial to design trashcans with proper size and shape for the purpose of gathering.

3) Collecting is an activity of gathering waste from trashcans and transporting it to a waste ground. Urban waste transportation system is complicated. For example, choices of waste trucks, routes organization, decision on suitable transport grounds etc.

4) Final disposal is the most popular, since it costs the least. A clean waste burial can rid 100% of waste. However, the disadvantages are requirement for large space that could be opposed by nearby residents, and if poorly executed, it could cause negative impacts on soil and water from the waste water leakage.

World Bank Report (1994)[12] on " Solid Waste Management at Community Level" stated that the amount of municipal waste depended on industrial level and municipal income. Urban waste consisted of various types of elements – paper, plastic, fabric, metal, glass and domestic organic products – from residences, shops, and markets. These differed according to season, location, way of life, cuisine, standard of living, and business activities. Used product packages tended to increase in developed area, already reaching 30% in the USA.

Thaniya Kaosol (2009)[13] studied on "Sustainable Solutions for Municipal Solid Waste Management in Thailand" and reported that the amount of solid waste in municipal Thailand, a developing country, was 0.3 – 1.44kg per person per day. The figures differentiated due to geography, season, income, family size, living pattern, consumption pattern and regulations. Solid waste in municipal areas are 48% organic, 15% paper, 14% plastic, 5% glass, 4% metal and 14% of other substance. Urban waste and suburban waste are different because of income gap, way of living and population.

Jagdish C. Kuniyal Arun P. Jain and Ardhendu S. Shannigrahi (2003)[14] published a study on "Solid Waste Management in Indian Himalayan Tourists Treks: a case study in and around Valley of Flowers and Hemkund Sahib" and found that of all the garbage disposed by tourists, 96.3% are reusable or recyclable. These are 68% plastic bottles, 26% plastic, and 2% metal. And so the pre-trekking orientation or briefings are very significant factor in effective waste management.

II. Objectives

1) To study people's behavior in household waste and wastewater management.

2) To study the pattern of utilizing household waste.

3) To study the problem of household waste and wastewater management in the Bangnanglee sub-district, Amphawa district, SamutSongkram province.

III. Methodology

This study used questionnaires as the main tool to collect data from 306 households from the residents of Bangnanglee sub-district during March-April 2011. In addition, information was also obtained by observation and in-depth interviews with leaders of families. The information obtained was then used to potentially support the quantitative data, which was assessed by the SPSS program.

IV. Results

The participants of the questionnaires were 51% female and 49% male. On average, they were 46.39 years of age with elementary education. There were workers and farmers. Just under half of the participants, 43.1 % were leaders of their families.

The study showed that, on average, domestic activities had produced 1.93 kilograms of waste per household per day. Most kinds of solid waste found were food leftovers, such as rice and snacks. Types of recycled waste that were found most were plastic bottles, glass bottles, cardboard boxes and paper. As for hazardous waste, packages of detergent and light bulbs were mostly found.

In terms of the activities causing wastewater from household, the study showed that they came from cooking, laundry, washing and showering. It has also been found that 79.1% of the households made several attempts to reduce their own amount of waste, such as reusing products before disposing them, using fabric bags instead of plastic ones and replacing chemical fertilizer with organic fertilizer. 80% of the households stationed their own garbage bins. 71.9% managed and utilized their waste by selling recyclable products, turning their solid waste into organic fertilizer. As for the rest of the waste, 51% was burned, 29.4% was disposed of in nearby public trashcans and 13% was buried. As for wastewater, 60% of the households disposed it into the sewage or their own wastewater tanks, whereas 30% was disposed from their elevated house on to the ground.

However, from interviews and observation, there were no disturbing waste mounds in public, but result from the questionnaires showed that households were most disturbed by the reproduction of animals with contagious diseases e.g. flies, cockroaches and rats. Other than that, there were also problems of an unpleasant smell and a dirty scenario. As for the problems of wastewater in particular were those of the spread of mosquitoes, bad smells and water clogging.

On the issue of waste management in the sub-district, 60% of residents still wish that each household manage their own waste. However, there are 40% of people who want the Bangnanglee sub-district Administration Office to take charge on this matter.

V. Conclusion

In terms of household waste and wastewater management, it was found that 80% of the households stationed their own garbage bins; 79.1% of the households made several attempts to reduce their own amount of waste ; 71.9% managed and utilized their waste to minimize the amount of waste to be disposed of. As for the rest of the waste of households, 51% was burned, 29.4% was disposed of in nearby public trashcans and the 13% was buried. As for wastewater, 60% of the households disposed it into the sewage or their own wastewater tanks, whereas 30% was disposed right from their elevated house on to the ground. As for utility from waste, it was found that residents sell recyclable products and turn solid waste into organic fertilizer. Waste and wastewater does not disturb the community as a whole, but there are several domestic difficulties such as the reproduction of animals with contagious diseases e.g. flies, cockroaches and rats. Other than that, there were also problems of an unpleasant smell and a dirty scenario. As for the problems of wastewater were the spread of mosquitoes, bad smells and water clogging.

VI. Discussion

1) Household solid waste and wastewater management in Bangnanglee sub-district, Ampawa district, Samut Songkram province was the policy initiated by the sub-district administration office. The study on the policy found that there was generally no solid waste problems in the area, which arose from the policy of not providing public trashcans or a collective waste management system. However, there were domestic issues from solid waste and wastewater – the spread of animals with contagious diseases, a disturbing stench, and a dirty scenario. These issues should be addressed by the concerned parties, i.e. authorities dealing with health and environment; so that these will be plans to educate the public on how to prevent these problems.

2) The study on domestic waste management showed that activities to reduce waste in households and to sort out waste before disposing, decreased the amount of solid waste. This is an important factor for the residents, as they are successful in managing their own solid waste. Other offices or municipalities should consider running a similar campaign in their own area to reduce and sort out domestic waste before disposal. Doing so could dramatically cut the burden and budget for the public sector on waste disposal.

3) The success in household solid waste and wastewater management was triggered from an administrative team planning to launch a campaign to educate people on the significance of solid waste management and its impacts on the community. The campaign was also to promote public awareness that all types of waste are utilizable, if sorted and managed properly.

4) Related parties, i.e. Department of Pollution Control, or Department of Environmental Quality Promotion, are advised to promote similar activities of Bangnanglee residents of solid waste and wastewater management with videos or other forms of media as tools to establish the best practice. It should represent the concept of this project, policy implementation, directions, processes, and practical ways to manage domestic waste with minimal spending and minimal materials. This policy was on excellent way to avoid the problems of excessive waste in the community and established sustainable and effective practices on community waste management.

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