

แนวทางการจัดการขยะอันตรายชุมชนในอำเภอเบตง จังหวัดยะลา  
Guideline of Community Hazardous Waste Management in Betong District,  
Yala Province, Thailand

จริยาภรณ์ มาสวัสดิ์<sup>1\*</sup> และจุฑามาศ แก้วมณี<sup>2</sup>  
Jariyaporn Masawat<sup>1\*</sup> and Jutamas Kaewmanee<sup>2</sup>

<sup>1</sup>สาขาการจัดการทรัพยากรธรรมชาติและสิ่งแวดล้อม คณะวิทยาศาสตร์เทคโนโลยีและการเกษตร 133 ถนนเทศบาล 3  
ตำบลสะเตง อำเภอเมือง จังหวัดยะลา 95000

<sup>2</sup>สาขาวิทยาศาสตร์สิ่งแวดล้อม คณะวิทยาศาสตร์เทคโนโลยีและการเกษตร 133 ถนนเทศบาล 3  
ตำบลสะเตง อำเภอเมือง จังหวัดยะลา 95000

<sup>1</sup> Department of Management of Natural Resources and Environment, Faculty of Science Technology and Agriculture, Yala Rajabhat University, Yala 95000, Thailand

<sup>2</sup> Department of Environmental Science, Faculty of Science Technology and Agriculture, Yala Rajabhat University, Yala 95000, Thailand

\*Corresponding author, e-mail: jariyaporn.ma@yru.ac.th

(Received: Jan 12, 2021; Revised: May 11, 2021; Accepted: May 28, 2021)

#### บทคัดย่อ

ขยะอันตรายต้องมีการจัดการที่ดีและเหมาะสม จึงจำเป็นต้องวิจัยเพื่อศึกษาพฤติกรรมของประชาชนและค้นหาแนวทางในการจัดการขยะอันตรายของชุมชนในพื้นที่อำเภอเบตง จังหวัดยะลา กลุ่มตัวอย่างที่ใช้ศึกษาประกอบด้วยประชาชนในพื้นที่ทั้งหมด 400 คน เก็บข้อมูลโดยใช้แบบสอบถาม และการจัดเวทีระดมความคิดเห็น โดยเชิญผู้มีส่วนได้ส่วนเสียจำนวน 34 คน ได้แก่ ตัวแทนประชาชน เจ้าหน้าที่องค์กรปกครองส่วนท้องถิ่น เจ้าหน้าที่องค์การบริหารส่วนจังหวัดยะลา และเจ้าหน้าที่สำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อม วิเคราะห์ข้อมูลเชิงปริมาณ โดยใช้สถิติร้อยละ และค่าเฉลี่ยสำหรับข้อมูลเชิงคุณภาพเป็นการวิเคราะห์เนื้อหาและเรียบเรียงเชิงพรรณนา ผลการศึกษาพบว่า ผู้ตอบแบบสอบถามมีความรู้ความเข้าใจเกี่ยวกับขยะอันตรายในระดับดี นอกจากนี้ยังพบว่าขยะอันตรายที่เกิดจากบ้านเรือนมากที่สุดเป็นหลอดฟลูออเรสเซนต์ หลอดไฟ ถ่านไฟฉาย แบตเตอรี่มือถือ ยาฆ่าแมลง สารปราบศัตรูพืช ยารักษาโรคหมดอายุ คิดเป็นร้อยละ 38.83 โดยมีปริมาณการทิ้งประมาณ 1-2 ครั้งต่อเดือน และไม่มีมีการคัดแยกก่อนทิ้ง คิดเป็นร้อยละ 61.75 มีวิธีการในการจัดการโดยการเผากลางแจ้ง คิดเป็นร้อยละ 34.25 ในส่วนทางเลือกการจัดการขยะอันตรายในชุมชน พบว่าประกอบด้วย 3 ทางเลือก ได้แก่ การอบรมให้ความรู้เพิ่มเติมกับประชาชน การจัดกิจกรรมสร้างแรงจูงใจให้ประชาชนเข้ามามีส่วนร่วม และการแยกถังขยะอันตรายออกจากขยะทั่วไป ซึ่งเมื่อผู้ทรงคุณวุฒิประเมินทางเลือกทั้ง 3 แล้วพบว่าทั้ง 3 ทางเลือกมีคะแนนใกล้เคียงกัน ดังนั้นจึงแนะนำให้ดำเนินการทั้ง 3 ทางเลือกไปพร้อม ๆ กันได้

**คำสำคัญ :** ขยะอันตราย การจัดการขยะอันตราย พฤติกรรมคัดแยกขยะ

#### Abstract

A good and suitable hazardous waste management needs to study the behavior of people to find suitable guidelines for hazardous waste management among communities in Betong District, Yala Province. A sample group of 400 people were asked to answer questionnaires and a brainstorming was held by inviting 34 key stakeholders; resident representatives and officials from the Local Administrative Organization, Yala Provincial Administrative Organization and the Office of Natural Resources and Environment in Yala. Quantitative data were analyzed by descriptive statistics while the qualitative data were analyzed by content analysis. Results showed that the respondents have a high-level understanding of hazardous wastes. The 38.83% of hazardous wastes from households were fluorescent tubes, light bulbs, batteries, mobile batteries, insecticides, pesticides, and expired medicines. On average, the

households dispose of hazardous wastes 1-2 times per month. The results show that 61.75 % of households do not separate hazardous wastes before disposal and burn them in open space 34.25 %. Three options proposed for Hazardous waste management included public training, creating incentives for people's participation and separating hazardous waste from general waste. As a consequence of getting similar scores, experts suggested that the three options should be implemented simultaneously by local administrative organizations under supervision of representatives of each community.

**Keywords:** Hazardous Waste, Hazardous Waste Management, Waste Separation Behavior

## Introduction

Population increases, lifestyle changes, and overconsumption behavior increase waste. Not only is the amount of waste been increasing, but the waste structure has also become more complicated and more challenging to treat (Mmerek *et al.*, 2016, p. 40). For instance, the amount of hazardous waste found in the community in Thailand was increased considerably. There were about 606,319 and 648,208 tons of waste in 2016 and 2018, respectively, which was a total increase of 41,888 tons within two years. The hazardous waste composed mainly consisted of electrical and electronic products (65%), while the remaining 35% are batteries, chemical containers, and spray cans (Pollution Control Department, 2018, p. 106). These hazardous wastes are usually discarded with regular household waste. Improper disposal of these waste can harm the environment and affect human health. For instance, dumping them into the drain or burning them can generate dangerous substances that pollute the water, land, and air, and from which humans can directly breathe, touch, or eat. Indirectly, the toxins diffuse the food chain and reach humans ultimately (Sinlapajaroen, 2019, p.27). To solve the problems, the local administrative organization (LAO) has been authorized to handle hazardous waste management in the community under the Public Health Act 1992, the Municipal Act 1953, the Subdistrict Council and Subdistrict Administrative Authority Act 1994, and the Determining Plan and Procedures in Decentralizations to the Local Administrative Organization 1999. LAO's primary responsibility was to collect and transport hazardous waste to the provincial hazardous waste collection center (Pollution Control Department, 2017, a). However, it appears that this management alone does not suffice; for example, there was still overuse of resources because there were no regulations to control and minimize the packaging design and production waste. There was also a lack of public awareness and mechanism to aid waste separation at the source (Pollution Control Department, 2018, p. 82). In response to this problem, the Pollution Control Department established the 20-year Master Plan for Prevention and Solution to Waste and Hazardous Waste (2018-2037). In the plan, various management guidelines had been proposed. The guidelines include product and packaging design for the environment, issuing of legislation to treat electrical and electronic wastes, strict control of imported electronic and plastic waste, charging fees for packages and products that were difficult to eliminate, and cancellation of chemical use in agriculture.

Betong was a large district in Yala province located at the southernmost part of Thailand, which borders Malaysia. It is a city with a high degree of business movement, as well as a diverse mix of cultures, customs, traditions, languages, and ethnicity. Betong was also famous for its beautiful mountainous landscape with good weather and natural fog throughout the year. As a result, Betong has seen many visitors from within the country and neighboring countries (Persaela *et al.*, 2015, pp. 44-45). The interviews with personnel at Yala Provincial Administrative Organization, who was responsible for collecting hazardous waste in Betong District, revealed that collection was done once a year and a

temporary waste storage site was at Bam Tanou Maerou in Betong. Currently, there was no other concrete management. Besides, there was no cohesive implementation of local government agencies whose responsibilities are related. Therefore, this study aims to explore the current situation of the amount of and people's behavior in hazardous waste management in the Betong District. The outcome of the study had appropriate guidelines for community hazardous waste management of Betong District, Yala Province, Thailand.

### Objectives

1. To investigate the situation of hazardous waste during October 2017 - December 2018 in Betong community, Yala Province.
2. To set out guidelines for hazardous waste management of communities in Betong District, Yala Province.

### Research Significance

1. The results of the current situation and the guidelines formulated from this study would enable LAOs to manage hazardous waste more appropriately, which will ultimately reduce the harm to the local environment and human health.
2. The research results can fill the information gap of hazardous waste generation by giving some insights on the situation, which can lead to better planning in the future.
3. The process of this research may raise awareness of the problem of hazardous waste in the study area and create more opportunities for participation in the management of hazardous waste in the community.

### Conceptual Framework

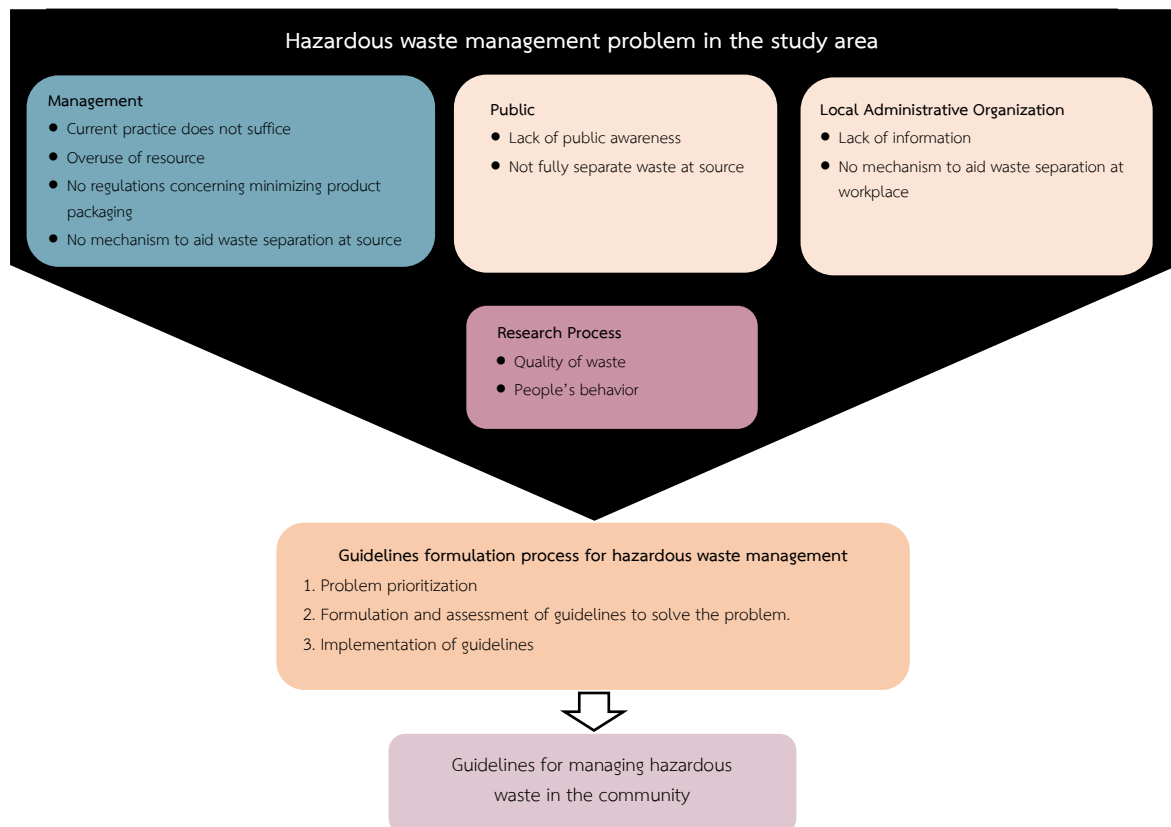


Fig. 1 Conceptual Framework

## Methodology

The research was carried out in two main stages.

### 1. The survey

The survey was done in October 2017-December 2018 to collect information on the types and quantities of hazardous waste, people's knowledge and behavior in the management of hazardous waste in the Betong district of Yala, Thailand.

#### 1.1 Determination of the sample size

The population in this study were the households in Betong district, Yala province, including Betong Municipality, Than Nam Thip Subdistrict Municipality, Yarom Subdistrict Administrative Organization (SAO), Noh Mae Raa SAO, and Aiyoweng SAO. The total number of households was 26,130. The sample size was calculated following Taro Yamané (1973, pp. 727-728)

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where n is the sample size, N is the total number of the population, and e = 0.05 is the acceptable error.

$$n = \frac{26,130}{1+[26,130 \times (0.05)^2]} \quad (2)$$

$$n = 393.94 \quad (3)$$

Therefore, the sample size in this study was 400.

#### 1.2 Sampling method

The stratified sampling method was used to determine the proportion of samples in each LAO (Table 1). Households in each LAO were then selected by convenience to cover the representative household with age over 20 years in every alley.

**Table 1** Calculation of the sample size

LAO	H	CPP	SS
1. Yarom Subdistrict Administrative Organization	4,274	$\frac{400 \times 4,274}{26,130}$	65
2. Tanoamaeroa Subdistrict Administrative Organization.	4,375	$\frac{400 \times 4,375}{26,130}$	67
3. Iyerweng Subdistrict Administrative Organization	4,644	$\frac{400 \times 4,644}{26,130}$	71
4. Tannamthip Subdistrict Municipality	1,740	$\frac{400 \times 1,740}{26,130}$	27
5. Betong Town Municipality	11,097	$\frac{400 \times 11,097}{26,130}$	170

Note: LAO: Local Administration Organization, H: Household (Yala Provincial Statistical Office, 2017), CPP: Calculating the population proportion, SS: Sample Size



### 1.3 Research Instruments

A structured questionnaire and unstructured interview were constructed by the researchers to collect quantitative data. They were divided into three parts:

Part 1 comprises ten questions, including both open-ended and closed questions. The questions are designed to collect personal information including gender, age, marital status, occupation, duration of occupation, number of household members, average monthly income, education level, housing characteristics, and living status.

Part 2 has ten closed-ended questions to explore the respondent's understanding of hazardous waste in the community, such as meaning, quantity, type, management, and disposal.

Part 3 was designed to collect data on the quantity of hazardous waste and people's behavior in its management through multiple choices.

The questionnaire was reviewed by three experts in the field of environmental management before administering to the respondents.

### 1.4 Data analysis

Descriptive statistics analysis was carried out using a statistical software to report the mean, standard deviation, and percentage of the quantitative data.

## 2. Group discussion

Group discussion was organized by inviting 20 representatives who agreed earlier when responding to the questionnaire at the first stage to participate in this activity: 14 government officials (10 from local administration organizations, two from Yala Provincial Administrative Organization, and two from the Office of Natural Resources and Environment in Yala). There were three steps of this stage.

### 2.1 Problem prioritization

2.1.1 Information about hazardous waste in the community in terms of the meaning, categories, sources, management, impact, transportation and disposal of hazardous waste in the area of Yala province was provided by the environmental scholars from the Office of Natural Resources and Environment, Yala province and the Yala Provincial Administrative Organization to create mutual understanding.

2.1.2 Data collected from the questionnaires were presented to the participants to inform the current situation of hazardous waste disposal in the community and to add the missing issues or put forward more suggestions.

2.1.3 For problem prioritization, participants were divided into small groups based on their areas. They helped reflect on the problem and presented what they found to the group. After that, they voted to select the problem that should be first solved. Researchers drew a conclusion and presented the problems which were voted with the highest scores.

### 2.2 Formulation and assessment of guidelines to solve the problem.

2.2.1 To formulate the guidelines, participants, who were divided into small groups earlier, brainstormed and proposed guidelines to solve the problems and presented the proposed guidelines to the whole group.

2.2.2 To assess the guidelines, researchers collected data and other relevant evidence such as information of hazardous waste management of the community and local government organizations in the area etc. The data was submitted to three experts in the field of environmental management and economics to assess the guidelines, using criteria with the predetermined score and rating as shown in Table 2.

**Table 2** Criteria of guideline assessment for hazardous waste disposal in Betong district, Yala province

Criteria	Definition	Scoring
1. Effectiveness	Appropriate hazardous waste management in Betong District, Yala Province	high = 3, moderate=2, low = 1
2. Equality	Advantages for all stakeholders	All group stakeholders = 3 Some groups of stakeholders = 2 Only a specific group = 1
3. Feasibility		
3.1 Political	(a perception level that was realistic to support policies of local administrative organizations in Betong District, Yala Province) which was accepted by politicians or local administrative team as the proper choice	high = 3 moderate =2 low = 1
3.2 Administrative	Supported the budget, personnel, equipment and policy guidelines	
3.3 Implementative	Practical (low level of complexity and easy for implementation)	
4. Impact		
4.1 Environmental	Affecting the environment in terms of appropriate management of hazardous waste in Betong District, Yala Province	high = 3 moderate =2 low = 1
4.2 Economic	appropriately affecting economy (reduce expenses) of stakeholders in Betong District, Yala Province	
4.3 Social	Appropriately affecting a society (living, accommodation safety, job) in Betong District, Yala Province	
5. Cost	Cost of running the activities	Low cost = 3, moderate = 2, High cost = 1
6. Law	The laws and policies that enable the activities to continue. Law enforcement and supervision are provided. Records of regulations and policies are found	Yes = 1, No = 0

### 3. Implementation of guidelines

Researchers presented the guidelines assessed by the expert to the participants who attended the forum and jointly developed a guideline for actual practice in the area.

## Results

### 1. Descriptive analysis results

#### 1.1 Demographic characteristics of the respondents

The respondents were female (60.50% ), between 46-55 years old (29.00% ), married (67.50% ), graduated from primary school (21.25%), employed (48.00% ), and hold their occupation less than ten years (50.50%). The number of family members was 4- 6 (55.25%). The average household income was between 10,001-15,000 Baht per month (32.25%). Most of the respondents lived in a single-family house (89.75%), of which 77.50% were the owners.

#### 1.2 Type and amount of hazardous waste disposal

Household hazardous waste was categorized following the Pollution Control Department (2005, p. 4). Toxic wastes from homes such as fluorescent lamps, batteries, mobile batteries, insecticides, pesticides, and expired medicine account for 38.83% of the hazardous waste. Flammable wastes such as paint sludge, used sprays cans, lubricant, used oil filter, wood polishing liquid, and lacquer account for 20.31%.

Wastes that react with water or air account for 18%. Corrosivity such as bleach, toilet cleaner, metal polish, rust remover, battery account for 17.37%. Lastly, the least dangerous type of wastes from households accounting for 5.49% were explosives such as fireworks and saltpeter of the hazardous wastes from homes. It was found that hazardous waste from households was discarded about 1-2 times per month.

### *1.3 Community people's knowledge and understanding of hazardous waste*

Out of all the respondents, 82.46% showed a high level of understanding of hazardous waste, with a score of 80%. The question that most respondents answered correctly was that fluorescent lamps, batteries, insecticides, pesticides, expired medication were classified as toxic hazardous wastes (95.5%). On the contrary, the question that most respondents answered wrongly was that mercury exposure might cause itching, numbness, sensory function disorders, shaking, and difficulty walking (49.5%).

### *1.4 Hazardous waste disposal behavior*

The result showed that 61.75% of the respondents did not separate hazardous waste before discarding. These wastes were still disposed of with general wastes. The other 38.25% separated hazardous wastes.

### *1.5 Hazardous waste sorting method*

Based on waste sorting data, 41.83% of the wastes are sorted and disposed of separately. Meanwhile, 37.91% of the hazardous wastes were sorted but put into the same bag with other wastes and 14.38% of the waste was sorted and disposed of at pre-assigned locations. Lastly, 5.88% of the hazardous wastes in the community are sorted and discarded on special days such as Mother's Day, Father's Day and Thai Environment Day.

### *1.6 Hazardous waste disposal methods*

Burning hazardous wastes together with other wastes accounted for 34.25% of the total disposal method, followed by dumping with general waste at 25.5%, dumping on the ground at 21%, burying in the soil at 19.25 %.

### *1.7 Type of hazardous waste before discarding*

Hazardous wastes that were sorted before discarding were batteries (19.26%), expired cosmetics (15.12%), and expired drugs (13.55%). Chemical cleaning liquids are the least type of hazardous waste that was sorted before discarding (2.76%).

## **2. Formulation of the guidelines for community hazard waste management**

*2.1 Problem prioritization.* Two problems of hazardous waste in communities were presented by the participants: unhygienic methods of waste disposal and disposal of hazardous waste with general waste.

*2.2 Formulation and assessment of the guidelines.* Three solutions were formulated: public training, creating incentives for people's participation, and separating hazardous waste from general waste (Table 3).

**Table 3** Guidelines and methods of problem solving

Guidelines for solutions	Detail	Total Scores (28)
Public training	Related scholars and officers such as environmental staff organize the public training to provide the knowledge of hazardous waste management in communities for 50 local volunteers of each area to pilot this project. The process will take place within one year then continue to expand the result.	26.00
Creating incentives for people's participation	Local administrative organizations hold the activities to motivate the people to participate in separating hazardous waste such as waste exchange to daily utensils. The activity will probably be monthly or weekly organized.	25.33
Separating hazardous waste from general waste	Local administrative organizations implement the plan of 2020 budget to purchase more hazardous waste bins and promote the project through channels such as a public address system, on-line media, word-of-mouth, and village health volunteers so that people gain accurate knowledge of separating hazardous waste and sorting types of hazardous waste before disposing.	25.00

### 3. Implementation of guidelines

As a consequence of getting similar scores, experts suggested that the three options should be implemented simultaneously by local administrative organizations under supervision of representatives of each community as shown in Table 4.

**Table 4** The implement plan for each option

Guidelines	Budget (one time/Baht)	Responsible persons within the department	Schedule Plan (Year)	Supervisors
Public training	21,700	1. Betong Municipality	Commencing on 2020 fiscal year (October 2019-September 2020)	Representatives of each community for example, community leaders
Creating incentives for people's participation	5,000	1.1 Division of Public Health and Environment 1.2 Division of Social Welfare 1.3 Division of Public Works 2. Sub-district Administrative Organizations of Tanohmaeroh, Aiyoweng, Tarnnamthip, and Yarom		
Separating hazardous waste from general waste	74,250	2.1 Office of the Chief Administrator		

### Discussion

People in Betong district had a good knowledge and understanding of hazardous waste. They knew the types of wastes and had the ability to classify hazardous waste, such as fluorescent lamps, batteries, mobile batteries, pesticides, and expired drugs in the toxic category. However, people did not separate trash by category before disposal and burn the hazardous waste along with general one. This finding was consistent with that of Kwanjit & Suchada (2014, p. 270). From their research, they found that hazardous waste in the community such as spray cans, household paint, used batteries, mobile phone batteries, expired medicines, and damaged neon tubes was less sorted than other types of waste and brought to dispose with general waste. Furthermore, according to the study of Suthida *et al.* (2013, pp. 263-264), the disposal of hazardous waste with general waste affected the management and caused chemical





contamination of soil and water. The related organization should therefore promote more knowledge about how to properly dispose of the waste to raise people's awareness of hazardous waste affecting people's health and quality of life.

The results also showed that the majority of household hazardous waste was toxic such as fluorescent lamps, lamps, batteries, mobile batteries, insecticides, pesticide, and expired medicines since they were household utensils and most of them worked as agriculturists. This finding was in accordance with what was found in Patraporn (2019, p. 64) and Charnsak (2012, p. 62) stated that most toxic waste was batteries and fluorescent lamps as they were household consumer goods used in daily life especially fluorescent lamps.

Three guidelines for waste disposal in communities -public training, creating incentives for people's participation, and separating hazardous waste from general waste- can be implemented simultaneously by local administrative organizations. Three guidelines are all feasible as they were suggested by stakeholders and their demand for handling the situation. These will also benefit the whole community and operation costs are not high. Moreover, local legislation under 2017 Constitution enables the local administrative organizations to have authority over the public cleanliness and environmentally-friendly and recycling methods of waste disposal. This includes running a campaign to broaden people's understanding and raise their awareness of lowering the amount of trash and separating different waste to recycle it at the early stage (Announcement of the Ministry of Interior 2017, p. 2).

Furthermore, according to Suree (1999, p. 57) studying hazardous waste disposal in Chiang Mai, stated that appropriate spread of knowledge about how to dispose of hazardous waste to people was one option enabling people to engage in dealing with the problem. This helped lower the amount of the hazardous waste at the early stage resulting in efficient and effective hazardous waste management. The finding was consistent with what the Pollution Control Department stated that enhancing knowledge of hazardous waste disposal especially waste separating at the beginning through different channels could attract people to this project and motivate them, including manufacturers to change consuming behavior. They would increasingly use environmentally-friendly and recyclable products, bringing about reducing, reusing and recycling the waste.

Nevertheless, the continuous implementation of plans is required since it encourages people to constantly perform this sorting activity which will result in becoming accustomed to sorting methods. On the contrary, people will not become confident about this activity if the project is not continually and seriously done, thereby hesitating over participation in the activity. Hence, changes have not been effected causing the unresolved problem. Furthermore, once the hazardous waste is sorted from the general waste, garbage trucks keeping different types of trash should be provided. This helps encourage the correct process of disposal and reduce the accusation that separation of waste is useless as the trash vehicles still collect and mix together all types of wastes.

### Conclusion and Suggestion

The situation of hazardous waste in the Betong district community was found that each household had a good level of knowledge and understanding. However in practice, most of them still discard hazardous waste together with general waste without sorting. The hazardous waste in each house was toxic waste. The amount of discarded waste was once or twice per month and eliminated by incineration. As for the hazardous waste management guidelines in the community, it was found that there were three approaches: training to provide additional knowledge to people, organizing incentives for the public to

participate and separating hazardous waste bins from general waste with the local government organization in the area as the main responsible for adopting the guidelines. However, this research is a survey of the community data situation and still lacks information on the relevant government agencies. Therefore, in order to obtain complete information, data from both sources should be collected. Furthermore, in formulating guidelines of hazardous waste management more effective, there should be a process for setting a target of each guideline before the process of defining and assessing guideline options. This would guide the operation and can set the options more comprehensively.

### Acknowledgment

The authors are grateful to Yala Rajabhat University, Thailand, for the research budget, and the reviewers' valuable comments that improved the manuscript.

### References

- Boonyanupong, S. (1999). *A hazardous waste management in Chiang Mai*. (1 Ed). Chiang Mai University.
- Channawa, K., & Paileeklee, S. (2014). Solid waste management behavior of people in Tambon Naklang Naklang distric Nong-Bua Lamphu Province. *Khon Kaen University Journal of Community Health Development Quarterly*, 2(3), 265-271. (in Thai)
- Decharat, S. (2018). People participation in hazardous waste management in Pa-Payom District, Phatthalung Province. *Thaksin University Journal*, 21(3), 299-327. (in Thai)
- Ecological Alert and Recovery-Thailand (EARTH). (2011). Report of the expired mobile battery management situation survey in Thailand. *International POPs Elimination Network (IPEN) October 2010*. (in Thai)
- Mmerekki, D., Baldwin, A., Hong, L. and Li, B. (2016, October 19). *The Management Hazardous Waste in Developing Countries*. <https://www.researchgate.net/publication/309336776>
- Nateewattana, J., & Tienthavorn, V. (2017). Knowledge and attitude to waste reduction behavior of Mae Ka community, Muang District, Phayao Province. *Journal of Science and Technology*, 25(2), 316-330. (in Thai)
- Notification of the Ministry of Interior. (2017, 1 November). *Waste management 2017*. Government gazette, Issue 134 Part of Special 267, 2.
- Persaela, N., Sawatkeaw, N., & Persaela, W. (2015). Betong: the path to determination. *King Prajadhipok's Institute Journal*, 13(2), 41-46. (In Thai)
- Pollution Control Department. (2018). *Thailand State of Pollution Report 2018*. Style Creative House Co., Ltd. Thailand. (in Thai)
- Pollution Control Department. (2016). *National waste management master plan 2016-2021*. Ministry of Natural Resources and Environment, Thailand. (in Thai)
- Prasuwat, T., Jiradetprapai, S., Jiemwijak, D., & Dilokwutthisit, P. (2016). Participation waste management of local administration organization and country in Ban Laeng sub-district, Muang District, Rayong Province. *Research and Development Journal Humanities and Social Science*, 11(1), 45-60. (in Thai)
- Paonthong, S., Poum, A., & Sudsakorn, W. (2019). The Association between knowledge, attitude and household's waste management among people who live in Bangpao Tambon, Kantrang District, Trang. *Journal of Health Science and Community Public Health*, 2(1), 12-22. (in Thai)

- Sinlapajaroen, P. (2019). *Household Hazardous Waste Management of Nakhon Pathom city Municipality* [Master's thesis, Silpakorn University]. <http://ithesis-ir.su.ac.th/dspace/handle/123456789/2821>. (in Thai)
- Supornpokee, C. (2012). *Appropriate Administrative Model for Managing Household Hazardous Waste Management in Nakhonratchasima Province* [Master's thesis, National Institute of Development Administration]. <http://repository.nida.ac.th/handle/662723737/2916>. (in Thai)
- Tuprakay, R. S., & Tuprakay, S. (2011). Study of quantity, classification and management of household hazardous waste in nonthaburi province. *Suan Dusit University Journal of Research*, 4(1), 53-65. (in Thai)
- U-Tapan, S., Laemu, N., Paopongsawa, P., & Medhanavyn, K. (2013). A study of environmental contamination from hazardous waste and the community management. *Disease Control Journal*, 39(3), 258-265. (in Thai)
- Yala Provincial Statistical Office. 2017. *Yala Provincial Statistical Report*. Sukyang Rd., Sateng Muang Yala District Yala Province Thailand.