



## KNOWLEDGE, ATTITUDES AND PRACTICES TOWARD TOXIC AND HAZARDOUS SUBSTANCES: THE CASE OF SELECTED COMMUNITIES IN BULACAN, PHILIPPINES

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**Abstract** - Meycauyan City and Marilao in Bulacan, Philippines were listed as two of the most polluted cities in the developing world due to the industrial wastes haphazardly dumped into the Meycauyan, Marilao and Obando River System (MMORS) (Blacksmith Institute, 2007). For decades, these towns were known for beautiful jewelries and fine leathers. However, in recent years, these areas had become the biggest producers of the used lead acid battery (ULAB) in the country and in Southeast Asia. The presence of industries producing poisonous substances is believed to have contributed much to the heavy pollution of toxic materials in these communities and their river systems. This study was conducted to determine the knowledge, attitude and perception of the people in Meycauyan and Marilao towards toxic and hazardous substances present in their respective communities.

A survey using a structured interview schedule was conducted to gather data. Results showed that the respondents were aware of the toxic substances that can harm their community and their environment. Many of them associated their diseases to their exposures to the chemicals and fumes from the industries mentioned. However, they have undecided attitude and perception towards these industries since they recognized the economic benefits of these industries to their families and to the community people as well. While the local government units concerned and other civil society groups have started to work together to address this pressing problem, identifying the knowledge, attitudes and behavior of the community people towards this pressing problem is deemed very important.

*Key words: knowledge, attitude, perception, toxic and hazardous substances*

### INTRODUCTION

Environmental pollution is one of the leading causes of deaths worldwide. Cornell University scientists claimed that 40 percent of deaths worldwide were caused by water, air and soil pollution (Cornell University, 2007). World Health Organization and World Bank (2001) revealed that over one billion people were directly affected by pollution related-issues in the developing world. In the Philippines, the Marilao,

Meycauyan and Obando River System (MMORS) is home to hundreds of thousands of people and to numerous industries like leather tanning, gold smelting and used lead acid battery recycling. Most of these industries dump their untreated wastewater into the river. Earlier studies revealed that leather tanning and gold smelting industries boomed in the 70's. The wastes generated from these industries are believed to have contributed heavily on the pollution of the MMO River.

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Results of initial assessments done by the MMORS Research and Pollution Intervention Project showed that heavy metals from industries, human sewage and animal wastes were the major pollutants of the river. Substantial contamination came from small scale lead recycling facilities along the river in Meycauayan, tanneries that dump untreated chromium into the river, as well as the various heavy metals used in gold smelting and jewelry processing.

The river feeds directly into the Manila Bay. Its effluents contaminate fishes and shellfishes in commercial fishing areas. Most residents rely on the river system as a source of domestic and agricultural water. Recognizing this problem, both government and non-government organizations (NGOs) already initiated actions to address the MMO river system problem. To date, a multi-stakeholder group with representatives from local NGOs, government, academe, and industry was formed to scope the extent of pollution, and design suitable responses for these environmental and potential health problems.

To provide empirical basis to solve the problems and issues of the MMO river system, there is a need to establish relevant baseline information on knowledge, attitude and practices of the residents toward the toxic and hazardous substances present in their communities. The information gathered could help formulate a more effective and relevant information and education campaign and environment management projects that could help mitigate these problems through increased participation and engagement from the community members..

This study aimed to determine the knowledge, attitudes and practices of selected communities in Marilao and Meycauayan toward toxic and hazardous substances from the lead, gold smelting and leather industries in the study area.

Specifically, it aimed to:

1. describe the socio-demographic characteristics of the respondents;
2. determine the respondents' awareness of the existence of pollution caused by toxic and hazardous substances pollution in the study area;
3. determine the attitude of the respondents toward toxic and hazardous substances pollution as well as toward the lead, gold smelting and leather industries in the study sites;
4. identify practices associated with toxic and hazardous substances pollution from the lead, gold smelting and leather industries in the study area; and,
5. formulate recommendations to address the pollution in the area.

## **METHODOLOGY**

### **Locale of the Study**

The study was conducted in Meycauayan City and Marilao, Bulacan. Meycauayan City is a first class city in the Philippines with a population of 196,569 (National Statistics Office, 2007). It is located about 19 km north of Manila and about 22 km south of Malolos City, provincial capital of Bulacan. It is bounded by the town of Marilao to the north, Valenzuela city to the south, Caloocan City to the east and Obando to the west. Marilao, on the other hand is about 20 km northwest of Manila. It is bounded on the north by Bocaue and Sta. Maria, on the south by Meycauayan City, on the east by San Jose del Monte, on the west, by the municipality of Valenzuela. The population is 160,452 (NSO, 2007).

### **Sampling**

Nine barangays were purposively selected as the study site. They were chosen since most of the industries were

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concentrated in these areas. Systematic sampling with random start was used to select the respondents per barangay. The household head was selected as the respondent of the survey. In cases wherein the household head was not present during the visit, the enumerator interviewed another member of the household who was in a position to answer the questionnaire items or just schedule a second visit. Table 1 shows the number of households and sampling size of the study.

## RESULTS AND DISCUSSION

### The Industries in the Area

Gold smelting. The history of the gold smelting industry in Meycauayan is as old as the colonial past of the Province of Bulacan. The industry started during the Spanish colonial rule and until today, the province is known as the Jewelry Capital of the Philippines. There are 33 operating gold smelters identified in the city while seven gold smelters have already stopped their

Table 1. Number of households and sample size per barangay.

Barangay	Total no. of Households (HH)	Sampling Size
Saluysoy	3,913	248
Calvario	1,737	106
Tugatog	1,462	198
Bancal	2,992	153
Banga	769	39
Caingin	923	38
Patubig	1,070	101
Tabing Ilog	2,231	107
Sta. Rosa 2	1,024	13
TOTAL	16, 121	1,003

### Data Gathering, Encoding and Analysis

Data gathering was done through personal face-to-face interviews using a structured interview schedule. Data was encoded using the Statistical Package for the Social Sciences (SPSS) and MS Excel program. Simple statistical analysis tools such as measures of central tendency, percentages, frequency distribution tables, graphs, and charts were used in the data analysis and presentation.

operations (Meycauayan City Planning and Development Office, 2007). Mercury is commonly used in the smelting operation to separate gold from the impurities.

Leather tanning. Leather is made of animal skins or hides which have been chemically treated to preserve its quality and beauty. The chemical procedure is called "tanning". There are 31 registered tanneries in the city. Most of these tanneries use the process of chrome tanning.

Chrome or mineral tanning is a process wherein animal hides were treated and soaked with different chemicals tanned first in acid and salt then soaked into a chromium-sulfate solution. After the soaking, the animal hides will have to undergo several processes like flesh removal, hair removal, scudding and de-liming. In some of these processes, different chemicals and plenty of untreated wastewater were believed to be discharged directly to the inland waters. This perception was confirmed by the study conducted by Santiago et al. (1990) on the survey of leather tannery operations and wastewater management in Meycauyan, Bulacan. Their study revealed that tannery operators just impound or discharge untreated wastewater in the inland waters. One of the primary environmental risks of the industry is the use of chromium, which is known to be a toxic substance found in their wastewater.

Lead recycling. Lead is one of the most pervasive and hazardous contaminants present in consumer goods, products and manufacturing processes. With the advent of the Basel Convention, trading of used lead acid battery for recycling from developed to developing countries has been banned or regulated. Clean-ups of legacy pollutions caused by lead contamination is very expensive that even developed countries are having difficulties in doing major clean-ups. One of the major approaches is to establish proper lead recycling procedures in order to reduce exposing the workers and even nearby communities to lead pollution. .

In the Philippines, 23,000 tons of secondary lead is produced by the Philippine Recyclers Incorporated, the largest battery recycling plant in Southeast Asia. This accounts for nearly 70% of secondary lead produced by recyclers. Only 12,000 tons or 30% are produced by the informal, unregulated and unlicensed sector (Wilson, 2000). However, this sector employs thousands more than the regulated and licensed recyclers in the country. Informal or unregulated ULAB recyclers are usually

backyard smelters and re-conditioners. Identifying the exact number of workers from this sector is difficult since most of these are unregulated and unregistered.

#### Socio-demographic Characteristics of the Respondents

There were a total of 1,003 respondents interviewed; 354 for the gold smelting; 428 for the tannery; and 221 for the lead recycling industry. Majority of the respondents were female (58%), married (70%), and Catholic (91%). A little more than one-fourth of the respondents (25.5%) were relatively young (26-35 years old). In terms of educational attainment, 35% of the respondents were high school graduate and almost all of the respondents (99%) had some formal education background. In terms of occupation, almost one-fourth of the respondents (21.6%) were business owners or entrepreneurs; 20% identified themselves as housewives with no regular source of income and few (15.6%) claimed to be unemployed. As to the respondents involved in the industries mentioned, six percent were involved in gold smelting; five percent were involved in the tanneries, while three percent claimed they work in lead recycling industries. As to their monthly income, majority (75%) of the respondents have monthly income of P 6,000.00 and below. Other socio-demographic characteristics of the respondents are shown in Table 2.

#### Socio-demographic Characteristics of the Respondents' Household Members

There were a total of 4,214 household members in the 1,003 households covered by the study. Majority of the household members were male (50.19%), within the age range of 36-55 years old (25.87%), single (52.37%), graduated from high school (25.79%), Roman Catholics (91.39%), and were unemployed (47.08%). Of the household members, few were involved in the gold smelting industry (3%), tannery (4%) and lead recycling (1%) industries. It consistently showed in the data

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gathered that more people were engaged in gold smelting and tannery industries than in the lead recycling industries. The top three household expenses were food, utilities, and education..

Their average monthly food expenses is Php 4, 675.16; P1,058 for utilities and Php 888.36 for education

Table 2. Socio-demographic characteristics of the respondents.

Characteristics	Industry Communities						Total	
	Gold Smelting		Tannery		Lead Recycling		No.	%
	No.	%	No.	%	No.	%		
<b>Sex</b>								
Male	161	45.48%	151	35.28%	110	49.77%	422	42.07%
Female	193	54.52%	277	64.72%	111	50.23%	581	57.93%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<b>Age</b>								
25 and below	43	12.15%	52	12.15%	23	10.41%	118	11.76%
26 – 35	82	23.16%	103	24.07%	71	32.13%	256	25.52%
36 – 45	89	25.14%	100	23.36%	53	23.98%	242	24.13%
46 – 55	62	17.51%	79	18.46%	34	15.38%	175	17.45%
56 and above	78	22.03%	94	21.96%	40	18.10%	212	21.14%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<b>Civil Status</b>								
Single	61	17.23%	60	14.02%	42	19.00%	163	16.25%
Married	243	68.64%	308	71.96%	155	70.14%	706	70.39%
Separated	20	5.65%	25	5.84%	8	3.62%	53	5.28%
Widow/er	30	8.47%	35	8.18%	16	7.24%	81	8.08%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<b>Educational Attainment</b>								
No education	2	0.56%	4	0.93%	0	0.00%	6	0.60%
Elementary Level	61	17.23%	30	7.01%	13	5.88%	104	10.37%
Elementary Graduate	57	16.10%	88	20.56%	37	16.74%	182	18.15%
High School Level	58	16.38%	64	14.95%	25	11.31%	147	14.66%
High School Graduate	93	26.27%	157	36.68%	102	46.15%	352	35.09%
College Level	43	12.15%	46	10.75%	24	10.86%	113	11.27%
College Graduate	30	8.47%	25	5.84%	15	6.79%	70	6.98%
Vocational	9	2.54%	13	3.04%	5	2.26%	27	2.69%
MS/PhD	1	0.28%	1	0.23%	0	0.00%	2	0.20%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<b>Religion</b>								
Catholic	333	94.07%	380	88.79%	197	89.14%	910	90.73%
Protestant	2	0.56%	0	0.00%	0	0.00%	2	0.20%
INC	8	2.26%	18	4.21%	10	4.52%	36	3.59%
Born Again	6	1.69%	7	1.64%	1	0.45%	14	1.40%
Jehovah's Witness	0	0.00%	2	0.47%	1	0.45%	3	0.30%
Muslim	0	0.00%	1	0.23%	0	0.00%	1	0.10%
Others	5	1.41%	20	4.67%	12	5.43%	37	3.69%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<b>Occupation</b>								
No work	48	13.56%	77	17.99%	32	14.48%	157	15.65%
Housewife	55	15.54%	105	24.53%	41	18.55%	201	20.04%
Table 2 continued....								
Worker in tannery/gold smelting	20	5.65%	21	4.91%	5	2.26%	46	4.59%

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<i>Classification</i>	Industry Communities						Total	
	Gold		Tannery		Lead			
	No	%	No	%	No	%	No	%
Factory worker	9	2.54%	7	1.64%	28	12.67%	44	4.39%
Private Employee	25	7.06%	46	10.75%	16	7.24%	87	8.67%
Public/government employee	6	1.69%	10	2.34%	6	2.71%	22	2.19%
Business owner/entrepreneur	94	26.55%	92	21.50%	31	14.03%	217	21.64%
Buy and sell/marketing	22	6.21%	4	0.93%	4	1.81%	30	2.99%
Others	75	21.19%	66	15.42%	58	26.24%	199	19.84%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%
<i>Income</i>								
0 to 6000	266	75.14%	336	78.50%	151	68.33%	753	75.07%
7000 to 13000	64	18.08%	68	15.89%	61	27.60%	193	19.24%
14000 to 20000	10	2.82%	15	3.50%	5	2.26%	30	2.99%
21000 to 27000	2	0.56%	3	0.70%	1	0.45%	6	0.60%
28000 to 34000	5	1.41%	5	1.17%	2	0.90%	12	1.20%
35000 to 41000	3	0.85%	0	0.00%	0	0.00%	3	0.30%
49000 to 55000	1	0.28%	0	0.00%	1	0.45%	2	0.20%
56000 to 62000	1	0.28%	0	0.00%	0	0.00%	1	0.10%
70000 to 76000	0	0.00%	1	0.23%	0	0.00%	1	0.10%
77000 to 83000	1	0.28%	0	0.00%	0	0.00%	1	0.10%
98000 and above	1	0.28%	0	0.00%	0	0.00%	1	0.10%
	354	100.00%	428	100.00%	221	100.00%	1003	100.00%

**Problems and Issues in the Barangay**

The most common problem identified by the respondents pertains to issues concerning the environment (77.97%). This is very evident specifically for communities with gold smelting industries where most (86.16%) of the respondents identified the said problem. This was closely followed by

economic problems (64.71%) and 29.11% for health (Table 3.). Campaigns on environmental rehabilitation and protection could maximize the increasing recognition of the community members on the environmental problems of their community.

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Table 3. Respondents' common problems encountered in the barangay.

Problems / Issues	Industries						Total	
	Gold Smelting		Tannery		Lead Recycling			
	n=354	%	n=428	%	n=221	%	n=1003	%
Environmental Problem	305	86.16%	334	78.04%	143	64.71%	782	77.97%
Economic Problem	235	66.38%	301	70.33%	113	51.13%	649	64.71%
Health Problem	114	32.20%	99	23.13%	79	35.75%	292	29.11%
Peace Problem	69	19.49%	77	17.99%	34	15.38%	180	17.95%
Educational Problem	40	11.30%	22	5.14%	10	4.52%	72	7.18%
Government Problem	21	5.93%	10	2.34%	7	3.17%	38	3.79%
Others	14	3.95%	6	1.40%	2	0.90%	22	2.19%

The top three diseases of the households identified include asthma (15.05%), heart problems (12.66%), and skin disorder (10.07%). Moreover, tuberculosis was commonly identified in the communities with lead recycling industries where 16.29% of the respondents identified it as one of the diseases in their household (Table 4).

The common form of medication was through consultation with a public doctor (73.88%); followed by self-medication (12.96%); and consultation with a private doctor (12.36%).

**Respondents' Knowledge Toward Toxic and Hazardous Substances**

The respondents' identified the negative effects of the specific elements on human health (Table 5). In the gold smelting communities, the top elements identified for its negative effect on human health were muriatic acid (48.02%), silver (47.46%),

lime (47.18%), color paint (47.18%), thinner (47.18%), gas (46.05%), ammonium sulfate (46.05%), salitre (46.05%), and caustic soda (45.48%). According to the respondents, mercury could cause brain damage, weight loss, poisoning, and in toxic levels even death. It also causes water pollution, land pollution, and death of plants. Nitric acid could cause skin burns and lung problems when inhaled.

For the tanneries, the top elements were color paint (26.87%), ammonium sulfate (19.16%), salitre (19.16%), caustic soda (19.16%), sulfide (13.32%), and hexavalent chromium (10.98%). According to them, the negative effects to their health were the following: chromium- destroys the lungs; lead- lungs, asthma and difficulty in breathing; color paint – chest pains; thinner – dizziness; and senoro-poisonous. The negative effects to the environment however, were more general.

Table 4. Common sickness in the barangay and the households members as identified by the respondents.

Identified Sickness	Industries						Total	
	Gold Smelting		Tannery		Lead Recycling		n=1003	%
	n=354	%	n=428	%	n=221	%		
Barangay								
Cough/colds/fever	329	92.94%	360	84.11%	167	75.57%	856	85.34%
Others	46	12.99%	56	13.08%	18	8.14%	120	11.96%
Skin problems	43	12.15%	26	6.07%	7	3.17%	76	7.58%
Lung problems	29	8.19%	56	13.08%	67	30.32%	152	15.15%
Heart and blood problems	21	5.93%	18	4.21%	3	1.36%	42	4.19%
Dengue/malaria	12	3.39%	32	7.48%	12	5.43%	56	5.58%
Diabetes	5	1.41%	3	0.70%	3	1.36%	11	1.10%
Cancer	1	0.28%	1	0.23%	0	0.00%	2	0.20%
Household								
Asthma	56	15.82%	60	14.02%	35	15.84%	151	15.05%
Puso	55	15.54%	42	9.81%	30	13.57%	127	12.66%
Skin Disorder	45	12.71%	40	9.35%	16	7.24%	101	10.07%
Dengue	26	7.34%	40	9.35%	15	6.79%	81	8.08%
TB	25	7.06%	33	7.71%	36	16.29%	94	9.37%
Typhoid	9	2.54%	4	0.93%	2	0.90%	15	1.50%
Cancer	6	1.69%	6	1.40%	1	0.45%	13	1.30%
Pneumonia	4	1.13%	9	2.10%	2	0.90%	15	1.50%
Malaria	2	0.56%	3	0.70%	0	0.00%	5	0.50%
Leukemia	0	0.00%	1	0.23%	0	0.00%	1	0.10%

Lastly, for the lead recycling industries, the top elements identified for its negative effect on human health were lead (29.41%), color paint (21.72%), ammonium sulfate (21.72%), salitre (21.72%), caustic soda (21.72%), and sulfide (14.93%). This is consistent with the report of Suplido and Choon (2005) on the effects of lead exposure to children in Metro Manila, Philippines. Similar to the perception of the respondents on the effects of the elements on human health, many of the respondents have identified the negative effects of the elements to the environment. These include color paint (32.80%), salitre (29.21%), ammonium sulfate (29.11%), and caustic soda (29.01%). It should be noted on the gold smelting industries that the same elements identified for its negative effect to human health were the same elements identified for its negative effect on the

environment. These include muriatic acid (48.02%), silver (47.18%), lime (47.18%), color paint (47.18%), thinner (47.18%), gas (46.05%), salitre (46.05%), ammonium sulfate (45.76%), and caustic soda (45.48%).

This also applies to the tanneries and lead recycling industries where the same elements were still perceived to have negative effects on the environment. For the tanneries, the top elements identified are color paint (26.64%), salitre (19.16%), ammonium sulfate (19.16%), caustic soda (19.16%), sulfide (13.08%), and hexavalent chromium (9.81%). For the lead recycling industries, the top elements that were perceived by the respondents that have negative effects on the environment are lead (25.79%), color paint (21.72%), salitre (21.72%), ammonium sulfate (21.72%), caustic soda (21.72%), and 15% sulfide (Table 5).

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Table 5. Respondents' perceived effects of the toxic and hazardous substances to their health and environment

Elements	Industries						Total	
	Gold Smelting		Tannery		Lead Recycling		n=1003	%
	n=354	%	n=428	%	n=221	%		
Health								
muriatic acid	170	48.02%	0	0.00%	0	0.00%	170	16.95%
Silver	168	47.46%	0	0.00%	0	0.00%	168	16.75%
Lime	167	47.18%	0	0.00%	0	0.00%	167	16.65%
Color paint	167	47.18%	115	26.87%	48	21.72%	330	32.90%
Thinner	167	47.18%	0	0.00%	0	0.00%	167	16.65%
Gas	163	46.05%	0	0.00%	0	0.00%	163	16.25%
ammonium sulfate	163	46.05%	82	19.16%	48	21.72%	293	29.21%
Salitre	163	46.05%	82	19.16%	48	21.72%	293	29.21%
caustic soda	161	45.48%	82	19.16%	48	21.72%	291	29.01%
Sulfide	81	22.88%	57	13.32%	33	14.93%	171	17.05%
Mercury	54	15.25%	0	0.00%	0	0.00%	54	5.38%
Table 5 continued...								
Nitric acid	37	10.45%	0	0.00%	0	0.00%	37	3.69%
Senero	28	7.91%	0	0.00%	0	0.00%	28	2.79%
Copper	22	6.21%	0	0.00%	0	0.00%	22	2.19%
Lead	22	6.21%	30	7.01%	65	29.41%	117	11.67%
Manganese	18	5.08%	0	0.00%	0	0.00%	18	1.79%
Cyanide	17	4.80%	0	0.00%	0	0.00%	17	1.69%
sulfuric acid	15	4.24%	0	0.00%	0	0.00%	15	1.50%
Zinc	13	3.67%	0	0.00%	0	0.00%	13	1.30%
formic acid	13	3.67%	0	0.00%	0	0.00%	13	1.30%
Cadmium	8	2.26%	0	0.00%	0	0.00%	8	0.80%
Nickel	12	3.39%	0	0.00%	0	0.00%	12	1.20%
hexavalent chrome	9	2.54%	47	10.98%	0	0.00%	56	5.58%
Arsenic	8	2.26%	0	0.00%	0	0.00%	8	0.80%
Borax	8	2.26%	0	0.00%	0	0.00%	8	0.80%
Environment								
muriatic acid	170	48.02%	0	0.00%	0	0.00%	170	16.95%
Silver	167	47.18%	0	0.00%	0	0.00%	167	16.65%
Lime	167	47.18%	0	0.00%	0	0.00%	167	16.65%
color paint	167	47.18%	114	26.64%	48	21.72%	329	32.80%
Thinner	167	47.18%	0	0.00%	0	0.00%	167	16.65%
Gas	163	46.05%	0	0.00%	0	0.00%	163	16.25%
Salitre	163	46.05%	82	19.16%	48	21.72%	293	29.21%
Ammonium sulfate	162	45.76%	82	19.16%	48	21.72%	292	29.11%
caustic soda	161	45.48%	82	19.16%	48	21.72%	291	29.01%
Sulfide	80	22.60%	56	13.08%	33	14.93%	169	16.85%
Mercury	40	11.30%	0	0.00%	0	0.00%	40	3.99%
nitric acid	31	8.76%	0	0.00%	0	0.00%	31	3.09%
Cadmium	8	2.26%	0	0.00%	0	0.00%	8	0.80%
Manganese	18	5.08%	0	0.00%	0	0.00%	18	1.79%
Lead	18	5.08%	28	6.54%	57	25.79%	103	10.27%
Cyanide	16	4.52%	0	0.00%	0	0.00%	16	1.60%
Senero	16	4.52%	0	0.00%	0	0.00%	16	1.60%
Copper	15	4.24%	0	0.00%	0	0.00%	15	1.50%
Zinc	12	3.39%	0	0.00%	0	0.00%	12	1.20%
Nickel	13	3.67%	0	0.00%	0	0.00%	13	1.30%
sulfuric acid	13	3.67%	0	0.00%	0	0.00%	13	1.30%
formic acid	13	3.67%	0	0.00%	0	0.00%	13	1.30%
Borax	9	2.54%	0	0.00%	0	0.00%	9	0.90%
hexavalent chrome	9	2.54%	42	9.81%	4	1.81%	55	5.48%
Arsenic	8	2.26%	0	0.00%	0	0.00%	8	0.80%

Some of the environmental effects of these elements that the respondents identified were air, water, and land pollution, global warming, dirty river and death of plants/crops.

It can be noted from the data gathered that those living in the areas with gold smelting industries were more aware of the negative effects of the elements on human health and environment. Almost half of the respondents in this industry identified the elements mentioned above compared to the tanneries and lead recycling industries, wherein only around one-fourth of the respondents identified those elements. This can be attributed to three factors. First is the fact that there were relatively more respondents involved in the gold industry. Second is the nature of the regulated substances used in the industries. Those used in gold smelting requires active handling in the smelting process thus affecting the senses of people involved in smelting. These substances were also usually more visible and can be easily identified apart from other materials used in smelting gold. Their effects on human senses are also more immediate, even bringing pain or discomfort during the handling process. Third is the probable variation in the level of information, education and communication activities that government, industrial and non-government organizations have done in the past on toxic and regulated substances, with more materials and campaigns having been done towards informing people of the adverse health effects of substances used in gold smelting. The packaging of muriatic acid used in gold smelting for instance is more informative of the danger of the substance on health and environment than that of hexavalent chromium used in tanning.

#### Respondents' Attitude and Perception Towards Industries Presence in the Area

Aside from their knowledge on toxic and hazardous substances, the respondents were

also asked on the attitude towards industries in their area. Attitude is the affective character of people, measured in this study by a person's liking (positive), dislike (negative) or undecided (both positive and negative). The respondents were asked if they are in favor (positive), not in favor (negative) or undecided (both positive and negative) of the presence of these industries in their area. For the gold smelting, more than one-third (39%) have negative attitude towards it and very few (8%) have positive attitude towards the industry. Majority (53%) however, have both positive and negative attitude towards the presence of gold smelting in the area (Figure 1).

Similar to their attitude towards gold smelting, majority (60%) of the respondents have both positive and negative attitude towards jewelry-making operations. The same percentages were drawn for those who have positive (20%) and negative (20%) towards it (Figure 2).

Among the industries included in this study, the tannery has the most number of respondents who have both positive and negative attitude (71.03%) towards it. Tannery is one of the oldest industry in this area and many people have probably benefitted a lot from it. While they are aware of the environmental hazard this industry continue to cause to their health and their environment as shown in their river system, they cannot disapprove of its existence due to its economic contribution to their family and their community. Thus, their undecided attitude towards it. Some however, have negative (20.33%) and few (8.64%) have positive attitude towards it (Figure 3).

Likewise, in the lead recycling, majority (67.87%) of the respondents have both positive and negative attitude while some (23.98%) have negative attitude and positive (8.15%) attitude towards the industry (Figure 4).

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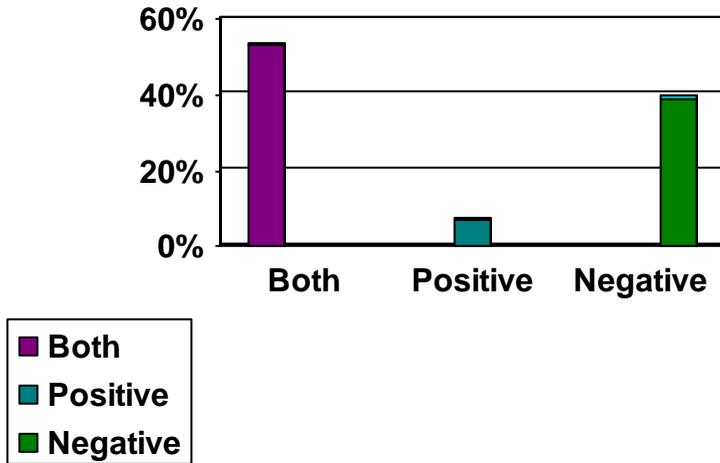


Figure 1. Respondents' attitude towards the gold smelting industry.

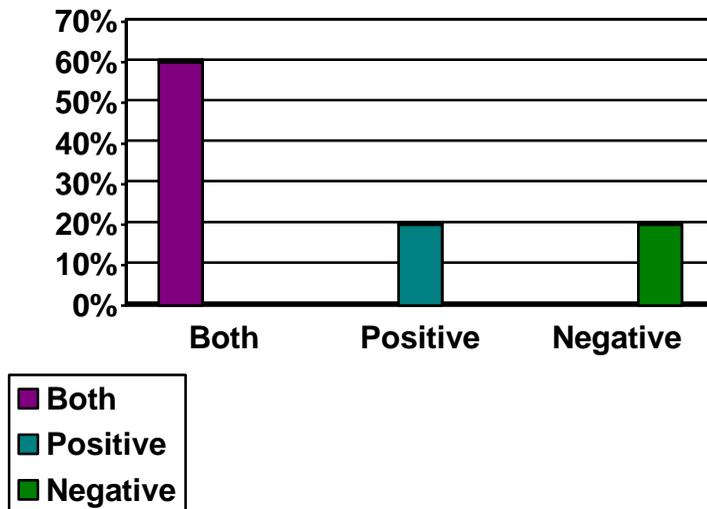


Figure 2. Respondents' attitude towards jewelry-making industry.

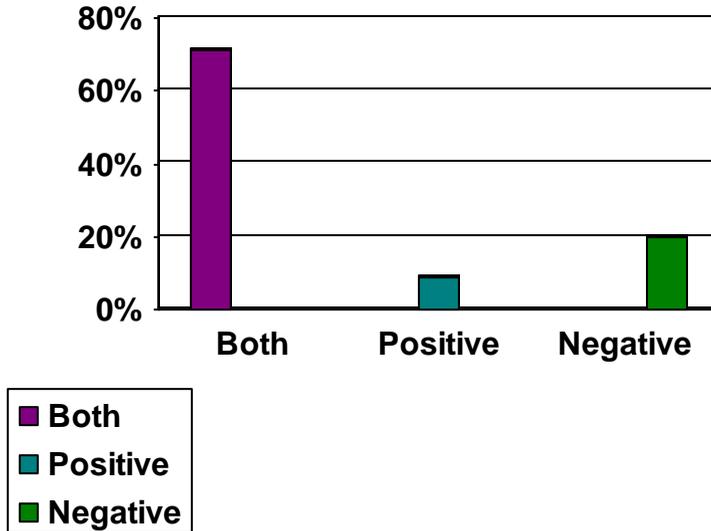


Figure 3. . Respondents' attitude towards tannery industry.

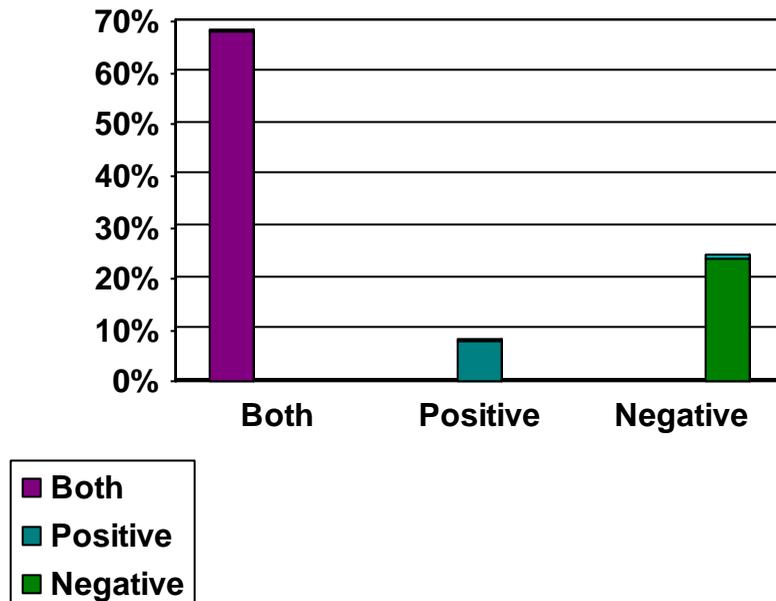


Figure 4. Respondents' attitude towards lead recycling industry.

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The ambiguous attitude reflected by “undecided” responses which tended to dominate among the respondents regarding all industries is attributed to an economic – environment dichotomy in people’s lives. While the respondents recognize the possible hazards these industries may cause to them and their family members as well as on the environment, they also cannot deny that some of them benefit from these industries. They are, however, very much willing to participate in any activities that can help reduce the environmental hazards these industries may bring.

The respondents’ perceptions were measured through a series of statements regarding the industries concerned. Of the statements measuring their perceptions towards gold smelting, the respondents strongly disagree with the following statements: 1) Gold smelting industries does not affect the quality of air in the community (92.09%); 2) Gold smelting industries does not affect our health (91.24%); 3) Gold smelting industries does not affect the environment (89.55%); and 4) Gold smelting industries does not affect the river in the community (89.55%). Likewise, more than half of the respondents have agreed with the following statements: 1) Gold smelting industry is a big industry in our community (62.43%); 2) New technology could help the gold smelting industry (62.15%); 3) There is a need for new processes or industry practices in gold smelting (60.73%); 4) The gold smelting industry adds to the problem of pollution (60.17%); and 5) The gold smelting industry negatively affects the human health (58.47%).

This finding is consistent with the respondents’ attitude towards gold smelting industry. While they recognized the possible harm to their health and environment, they also think of its economic contribution to their community. They are however, willing to participate in activities that could lessen the environmental hazard to their environment. More than one-fourth of the

respondents said strongly agree to the following statements: 1) Local government must monitor activities that negatively affect the nature (44.63%); 2) I will join any efforts towards health improvement of residents in the city (32.49%); and 3) I will join any efforts to improve the environment in our barangay (32.20%).

The last two statements reinforced their behavioral intentions and commitment in joining any efforts to improve the health and environment quality of the area. Most of the respondents were born or have been staying in the community for more than 25 years and have no immediate plans of leaving the area. Thus, any efforts to improve their community are welcome.

As to their perceptions towards tannery industry, most of the respondents indicated that they strongly disagree with the following statements: 1) The tannery industry does not affect the environment (86.68%); 2) The tannery industry does not affect our health (85.05%); and, 3) The tannery industry contributes significantly to my and my family’s income (76.64%).

The first two statements showed that the respondents were indeed aware of the effects of the tanneries on human health and environment. This is consistent with the respondents’ opinion and issues of the industry’s negative effect to the environment particularly with the wastewater of tanneries haphazardly dumped in canals and river system in the community.

Moreover, the last statement reflects the sentiments of the respondents and the community on the economic benefits the industry brings to their family and to their community. More than half of the respondents agreed to the following statements: 1) Tannery is a big industry in our community (66.12%); 2) There is a need for new processes or industry practices in tanneries (62.15%); 3) I am interested in talks about protecting the health of workers in the industry (59.81%); and, 4) The tannery

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industry affects the human health negatively (59.58%)

The statements above showed that similar with the gold smelting industry, the tanneries in the area are well-established and contribute economically to the households around them. On the other hand, the respondents were aware that some aspects of the tanning process negatively affect their health and the other members of the community especially the workers who were directly exposed to the chemical substances used in leather tanning. Majority were interested to protect the health of these sectors. Thus, the local government and environmental organizations should involve the community people in implementing projects for the development of the area since most are willing to take part to such endeavors.

Likewise, the statements below wherein the respondents indicated strongly agree showed their willingness to join campaigns that will improve the health and environment quality of the area. They were also aware of the need to strengthen the efforts of the local government in monitoring activities that negatively affects the community as shown by the following statements: 1) Local government must monitor activities that negatively affect the nature (41.82%); 2) I will join any efforts towards health improvement of residents in the city (33.64%); and, 3) I will join any efforts to improve the environment in our barangay (32.48%).

As to the respondents from the lead recycling industry, most of the respondents indicated strongly disagree with the following statements: 1) The lead recycling industry contributes significantly to my family's income (89.14%); 2) The lead recycling industry does not affect health (88.69%); 3) The lead recycling industry does not affect the quality of air in the community (87.33%); and, 4) The lead recycling industry does not affect the river in the community (84.62%).

The first statement showed that majority of the respondents were not dependent with the lead recycling industry in their area. It is consistent with the previous discussion that there is only a minimal number of household members engaged in this industry. Moreover, the last three statements showed that the respondents were indeed aware of the negative effects of the industry on the health and environment of their barangay. This is consistent with the respondents' opinions and issues of the industry's negative effect to the environment and to their health. Almost half of the respondents strongly agree with the following statements below: 1) The lead recycling industry adds to the problem of pollution (52.04%); and, 2) The lead recycling industry affects the human health negatively (41.63%).

Likewise, more than half of the respondents agreed with the following statements: 1) Lead recycling is a big industry in our community (61.99%); 2) I will join any efforts to improve the environment in our barangay (59.73%); 3) I will join any efforts towards health improvement of residents in the city (58.82%); and, 4) I am interested in talks about protecting the health of workers in the industry (58.37%).

Most of the respondents were aware that even though lead recycling has negative effects on their health and environment, it is still a big and important industry in their area. However, they suggested that several interventions should be done to minimize the industry's negative effects. They were also willing to join any efforts to improve the health conditions of the community people, as well as work together towards a cleaner environment.

## **CONCLUSIONS AND RECOMMENDATIONS**

Results of the study showed that while the respondents were very much aware of the environmental problems as shown by

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their responses on the most common problems identified in the barangay and the top three diseases they frequently encounter, they were still hesitant to blame the industries present in their area. This was reflected in all their responses on their attitude and perception on gold smelting, leather tanning and lead recycling. In all these industries, the respondents have generally both a negative and positive attitude and perception, with the tannery (71%) industry on top. This was followed by battery recycling (68%) and gold smelting industry (54%).

This was despite that only a small percentage (16%) of the respondents work directly in any of these industries mentioned. Similarly, a few household members (10%) of the respondents work in any of the industries included in the study. There was no data however, as to who were indirectly involved in the industries but benefit from it. Thus, the obvious ambiguousness of the respondents towards these industries can be understood since they are involved in these industries. Majority of the respondents and their household members indicated that their means of livelihood are either directly or indirectly connected with these industries. Understandably, even if they were aware of the possible dangers these industries may cause to their respective communities, they cannot just turn their back on them. They are, however, very much willing to participate in any information and education campaign to improve the health and environment quality of the area. They also recognized the need to strengthen the efforts of the local government in monitoring activities that negatively affect their respective communities.

In the light of these conclusions, the following are recommended:

1. A comprehensive review of the local policies and development plans of the two municipalities towards revision or additional policy formulation.

The local governments have the power to create ordinances that are expected to be followed by their constituents. If there is no policy yet to regulate the possible environmental polluters, they can formulate one. Furthermore, a barangay development plan (BDP) consistent to the local government code of the Philippines is prepared annually wherein all plans and programs of every barangay are reflected. If done seriously, a knowledge-based BDP is conceptually the best anchor of the municipality in preparing its yearly development and investment plans and programs. By including programs that look into the environmental concerns (through the Environment or Health Sector) in these development instruments, the concerned local governments will be more prepared in addressing these problems in the future.

2. Advocate for a more organized group of the industry players.

A more organized group can make a stronger stand on issues that affect their industries. Moreover, it will be easier for the local government units, starting in the barangay level, as well as local government officials to coordinate with the industries' local leaders. With an organized group, there will be a better coordination among various stakeholders. This will facilitate a convergence approach in responding to the complex problem of toxic and hazardous substances pollution. It is expected that eventually, this will pave the way to better living conditions for the community people. A report from Asian Development Bank (2009) stressed the importance of harmonious relationship of the key players to ensure a successful clean-up of the MMO River system.

3. Strengthen and capacitate the Water Quality Management Area (WQMA) board and council covering the MMORS.

In line with the provisions of the Clean Water Act of 2004, the project site is also part of the recently established Water Quality Management Area (WQMA) covering several cities concerned. A strong and capacitated WQMA council will provide the venue for sustained communications and efforts towards appropriate and effective policy and program implementations for long term solutions for the toxic and hazardous pollutants. With this policy base, implementation of ordinances on environmental concerns would be easier.

4. Intensify information and education campaign IEC and social mobilization efforts.

Since many of the respondents signified their willingness to join in the campaign towards better environmental condition, an intensive IEC should be conducted. An important aspect of IEC materials that must be developed is that it should be in multi-media so that it can have more reach and more people will be aware of such program. Hand in hand with the development of IEC materials must be a strong social mobilization component to capitalize on the willingness of the community constituents to participate in efforts toward long term and community-based solutions to the problem.

5. Improve the capacities of the health and environment sectors.

Aside from community IEC interventions, capability training for the health and environment sectors should also be conducted. These are the groups who deal directly with the community people who have environmental issues. Enabling these sectors to respond to the pollution and consequent health issues in the area will prove strategic in regulating the use and discharge of toxic materials, and in monitoring health impacts.

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### **Statement of Authorship**

Maria Emilinda T. Mendoza is lead author of this article based on the research project entitled “Knowledge, Attitudes, and Practices Towards Toxic and Hazardous Wastes of Community Members in Selected Communities in Meycauyan City and the Municipality of Marilao, Province of Bulacan” of which she was the Project Leader, and in whose capacity she drafted and finalized the research design, coordinated the data gathering and analysis, and consolidated the research report. As lead author, Prof. Mendoza initiated and finalized the writing of this article for publication.

Emilia S. Visco is co-author and was a member of the research team as Study Component Leader and was responsible for the design of the training for the field enumerators. As study component leader, Dr. Visco made major contributions to the discussion of the results of the study and served as internal content editor for the research report. She also prepared the draft of this article for publication.

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Carla Edith G. Jimena is co-author and was Study Component Leader in whose capacity she supervised the data gathering for Marilao, Bulacan and in charge of drafting the research discussion report for the said area. She was also very active in the encoding and processing of research data. As co-author, Prof. Jimena reviewed and commented on the draft of this article for publication.

Jennifer Marie S. Amparo is co-author and was a member of the research team as Study Component Leader in-charge of the data gathering for Meycauayan, Bulacan. She was also the lead supervisor in the encoding and processing of research data, and was responsible for the drafting of the research results and discussion for the area assigned to her. Prof. Amparo reviewed and commented on the draft of this article for publication.

Marlo D. Mendoza is co-author and was Project Leader of the action research entitled "Marilao, Meycauayan, Obando River System (MMORS) Integrated Research and Pollution Intervention" implemented through the UPLB-FI with funding from Blacksmith Institute. The Project included the KAP research as a component study. Prof. Mendoza reviewed and commented on the draft of this article for publication.

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