

Annex 3.2 Results of the Factory Survey

a. Industrial Waste Management (IWM)

a.1 Waste Separation

Q.1. Are non-Hazardous waste (non-HW) and Hazardous waste (HW) discharged separately from your factory?

Q.1	Answer	%
1. Yes, 100% (Go to Q.3)	126	58.6
2. Yes, partly (Go to Q.3)	24	11.2
3. No (Go to Q.2)	65	30.2
Total	215	100.0

Q.2. What is the reason why these wastes are not separated? (Plural answers are allowed and Base of answer is 65.)

Q.2 Base = 65 factories	Answer	%
1. We don't know the difference between non-HW and HW.	7	10.9
2. The volume of waste is too small to separate.	5	7.8
3. The production process makes it difficult to separate non-HW and HW.	0	0.0
4. The collection service does not require to separate non-HW and HW.	2	3.1
5. It is troublesome and waste of time to separate non-HW and HW.	3	4.7
6. It seems unnecessary to separate Non-HW and HW.	1	1.6
7. It is difficult to separate non-HW and HW.	5	7.8
8. Even though non-HW and HW are separated, there are no ways to utilize them.	6	9.4
9. HW is not generated in our factory.	52	81.3
10. Others	0	0.0
Total	86	---

Finding 1

The replies for Q1 and Q2 indicate 6.0% (65 - 52 = 13) of factories do not separately discharge non-HW and HW. The reasons of no separation other than "no generation of HW" are in the following order:

1. Don't know the difference between Non-HW and HW. 3.3% of total
2. No ways to utilize non-HW and HW. 2.8% of total
3. Difficult to separate non-HW and HW. 2.3% of total
4. Volume of waste is too small to separate. 2.3% of total

However, 17.2 % ($13 + 24 = 37$) of factories discharge mixed wastes of HW and non-HW.

The tables below present breakdowns of the answer 2 of Q.1 and 7 of Q.2 respectively.

Q.1 "2.Yes, partly." Base = 24 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G03			1	1 (14%)
G04			1	1 (14%)
G05			1	1 (13%)
G06			1	1 (11%)
G07		1		1 (14%)
G08			1	1 (14%)
G09			1	1 (20%)
G10			1	1 (14%)
G11	1			1 (17%)
G12	1			1 (17%)
G15		1		1 (13%)
G16		1		1 (17%)
G17		2		2 (33%)
G20			2	2 (25%)
G21		1		1 (20%)
G25		1		1 (10%)
G27		1	1	2 (25%)
G28			1	1 (17%)
G29			1	1 (14%)
G31			1	1 (17%)
G32		1		1 (20%)
Total	2	9	13	24 (11%)
Ratio	2 / 30 =6.7%	9 / 85 =10.6%	13 / 100 =13.0%	24 / 215 =11.2%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

Q.2 "7." Base = 5 factories	
Factory Study Code	Classification of Factory by Number of Employee
G03	2. 51-200
G12	3. >200
G12	1. <50
G14	3. >200
G14	2. 51-200

The above two tables indicate there is some difference observed in the scale of factories regarding separate discharge of non-HW and HW and larger scale of factory more strictly conduct separate discharge.

Q.3. Is non-HW generated at the production process separated from that generated at other sections such as office in your factory?

Q.3		Answer	%
1. Yes, 100%	(Go to Q.5)	162	75.4
2. Yes, partly	(Go to Q.5)	42	19.5
3. No	(Go to Q.4)	11	5.1
Total		215	100.0

Finding 2

The replies for Q3 indicate 24.6 % (42 + 11 = 53) of factories do not strictly separate non-HW generated at the production process from domestic/office waste. The table below presents breakdowns of the answer 2 and 3 of Q.3.

Factory Study Code	Q.3. "Answer 2. Yes, partly" Base = 42 Factories				Q.3. "Answer 3.No" Base = 11 Factories			
	Classification of Factory by Number of Employee			2 Total	Classification of Factory by Number of Employee			3 Total
	1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01		1		1 (14%)				
G02	1	1		2 (33%)				
G03			2	2 (29%)		1		1 (14%)
G04			1	1 (14%)				
G05							2	2 (25%)
G06			1	1 (11%)				
G07	1	2		3 (43%)	1		1	2 (29%)
G08		1	1	2 (29%)				
G09			1	1 (20%)				
G10			2	2 (29%)				
G11		3		3 (50%)				
G12	2		1	3 (50%)		1	1	2 (33%)
G14						1		1 (17%)
G15	1	2		3 (38%)			1	1 (13%)
G16	1			1 (17%)				
G17		1		1 (17%)				
G18		2		2 (40%)				
G19		1		1 (20%)	1			1 (20%)
G20			1	1 (13%)				

G21		1	1	2 (40%)				
G24			1	1 (17%)				
G25		2	1	3 (30%)				
G27		1	1	2 (25%)				
G29			2	2 (29%)		1		1 (14%)
G31			1	1 (17%)				
G32	1			1 (20%)				
Total	7	18	17	42 (20%)	2	4	5	11 (5%)
Ratio	7/30 =23.3%	18/85 =21.2%	17/100 17.0%	42/215 =19.5%	2/30 =6.7%	4/86 =4.7%	5/100 =5.0%	11/215 =5.1%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is no significant difference observed in the scale and types of factories regarding separation of non-HW from production process and domestic sources.

Q.4. What is the reason why your factory does not separate them? (Plural answers are allowed and base of answer is 11.)

Q.4 Base = 11 factories	Answer	%
1. The volume of wastes is too small to separate.	6	54.5
2. The production process makes it difficult to separate them.	1	9.1
3. The collection service does not require to separate them.	2	18.2
4. It is troublesome and waste of time to separate them.	2	18.2
5. It seems unnecessary to separate them.	4	36.4
6. It is difficult to separate them.	2	18.2
7. Even though Non-HW and HW are separated, there are no ways to utilize them.	4	36.4
8. Others	0	0.0
Total	21	---

a.2 Waste Generation

Q.5. How many tons of IW (non-HW/HW) is generated in your factory per year?

The table below summarizes the number of factories that replied this question.

Items	Nos. of Factories	Rate to 215 (%)
Number of Factories Surveyed	215	100
Number of Factories with Valid Replies	206	96
Number of Factories with No Replies	7	3
Number of Factories with Invalid Replies	2	1
Number of Factories with Non-HW	187	87
Number of Factories with HW	134	62

Number of Factories with HW/Non-HW	115	53
Number of Factories with only Non-HW	62	33
Number of Factories with only HW	19	9

206 factories (96%) of factories gave the replies on the above question. The breakdowns of replies are 469 wastes from 187 factories (87%) for non-HW and 272 wastes from 134 factories (62%) for HW. Annual generations of non-HW and HW at the replied factories are 118,904 ton and 27,349 ton respectively. Those are summed up according to study factory code and waste code of both non-HW and HW and tabulated in the tables below. Then the team used these data for the estimation of current IW generation in the study area.

Non-HW

Factory Study Code	Q.5 Non-HW (unit : ton/year)													Total
	C01-01	C01-02	C02-01	C02-01	C04-01	C05-01	C07-01	C08-01	C09-01	C09-02	C10-01	C11-01	C12-01	
G01	85.2	15,070.0		13.9	903.6			5.2				0.5	2.7	16,081.1
G02			1.6	13.7	18.4	5.0	50.0	12.0					280.3	381.0
G03	5,000.0		3.6	13.2	73.0			16.0		4,685.0			660.8	10,451.6
G04				59.3	218.4	2,337.0		442.5				50.0	96.0	3,203.2
G05	1,760.0			50.0	790.0	124.3	0.1	0.1						2,774.5
G06				26.9	1.3	767.0		0.8				200.0		995.9
G07		600.3		4.6	74.4	182.5	12.0	2.5			12.0		1.5	889.9
G08			9,063.0	0.5				0.3				170.0		9,233.8
G09			4,455.0	13.5								145.0		4,613.5
G10			13,329.2	32.4				12.0				250.0		13,623.6
G11				1,027.0	83.0			23.0					1,470.0	2,603.0
G12				991.2	1.5			1.4				90.0	1.2	1,085.3
G13				15.0	37.0			17.0				20.0	30.0	119.0
G14			581.8	97.2	388.5	0.5	1,314.6	1.3			3.0			2,386.9
G15			158.4	49.5	1,071.7	2.8		6.0				3.7		1,292.1
G16			0.0	3.1		0.1		37.0	500.0	566.8	420.0		12.0	1,539.0
G17				24.0	24.0			11,908.0			6,000.0	36.5		17,990.5
G18			1.5	4.0		0.6		1,880.5						1,886.6
G19			15.0		1.5			688.0						704.5
G20			6.0	350.0	4.8	12.0		1,716.0						2,088.8
G21			72.0	145.0	6.0			2,308.8			36.0	422.0		2,989.8
G22				10.0				314.6				10.0		334.6
G23			2.0	1.2				392.4				15.6		411.2
G24					153.0			135.8				2.2		291.1
G25			16.8	157.2	386.6			1,611.8				900.0	1,200.0	4,272.4
G26				125.2	712.5			700.6		730.0	1.0	5.5		2,274.8
G27			17.9	218.1	70.3			289.0			5.0			599.3
G28				1.0	2.4	564.0	30.0	800.8		6.0	60.0		1.0	1,465.2
G29				15.1	3.0			61.9			29.7			109.7
G30		2.0	12.0	85.1	517.2	2.4		12.0				5.4		636.1
G31		553.6	1.6	910.6	57.6						10,000.0			11,523.4
G32				1.5	2.5			8.8						12.8
G33					6.0			28.6				5.0		39.6
Total	6,845.2	16,225.9	27,787.5	4,459.9	5,608.3	3,998.2	1,405.7	23,431.5	500.0	5,987.8	16,566.7	2,331.4	3,755.5	118,903.5

HW

Factory Study Code	Q.5 Hw (Unit : ton/year)																					Total			
	W01-01	W01-02	W02-01	W03-02	W03-03	W04-01	W04-02	W05-01	W06-02	W06-03	W07-01	W07-02	W07-03	W08-01	W08-02	W08-03	W09-01	W10-01	W11-01	W11-02	W12-01		W12-02	W12-03	
G01														0.4											0.4
G02														0.2					36.0	2.9					39.1
G03			540.0											40.0						80.0			6,000.0	6,660.0	
G04														58.5					3.0	14.0	2.1				77.6
G05												0.1	0.0						2.5				5.4	8.0	
G06														0.5											0.5
G07									0.7					0.0										4.4	5.1
G08									8.0					0.2						130.0		6.9	0.3	145.4	
G09														2.7									0.8	3.5	
G10									28.0					4.5					91.0		3.0	34.0	337.5	498.0	
G11									0.6														11.5	12.1	
G12														82.1								0.1	192.0	274.2	
G13					40.0		85.0		30.0				37.8			50.0	0.4		392.0		102.8	320.0		1,058.0	
G14													0.5	70.6		1.0								1.2	73.3
G15									10.0	90.0			192.0	32.0		96.0					180.0			600.0	
G16														0.1								4.0		4.1	
G17														948.0		2,401.5								3,349.5	
G18														2.0					30.0					32.0	
G19														23.4					4.1					27.5	
G20			14.4			1,200.0	3.6		35.8					100.4				24.0	18.0	5.0	435.6	120.0	249.6	2,206.4	
G21				55.0			6.0							85.5		1.2			35.0		4.0			186.7	
G22														6.9		50.0						127.5	0.8	185.2	
G23									1.2					37.8										39.0	
G24				0.5		168.0			2.0	49.0				7.0					24.0		28.9	0.0	6.4	284.9	
G25				12.0		85.0								4.0					7,165.1	720.0	140.0	371.0	165.1	8,662.2	
G26	98.0			5.0	120.0									10.2		10.0		36.0					120.0	389.2	
G27								50.0	8.0					103.1		28.8			870.0		161.0	284.0	10.0	1,514.9	
G28	14.2			0.2					134.0			36.0		2.3	1.5	2.2			26.0		57.0		12.2	285.6	
G29									14.0	5.0	75.0			4.3	85.0	1.0			36.0				0.0	221.3	
G30																			2.0			2.0	0.5	4.5	
G31														5.0										5.0	
G32									14.0					84.0		20.0			120.0					1.5	239.5
G33		12.0												2.4					112.0			120.0	0.5	246.9	
Total	112.2	12.0	554.4	72.7	160.0	1,453.0	94.6	50.0	285.3	95.0	124.0	36.0	230.4	1,718.1	86.5	2,561.7	0.4	60.0	8,966.6	951.9	1,114.4	1,389.5	7,119.7	27,349.4	

a.3 Storage

Q.6. Is IW stored inside your factory?

Q.6	Answer	%
1. Yes, 100%	142	66.0
2. No (Go to Q.10)	72	33.5
3. No Answer (Go to Q.10)	1	0.5
Total	215	100.0

Finding 3

33.5 % (72) of factories do not store IW inside their factories. The table below presents breakdowns of the answer 2 of Q.6.

Q.6 "Answer 2." Base = 72 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G01	1	3	2	6 (86%)
G02	2	2		4 (67%)
G03		2	2	4 (67%)
G04		1		1 (14%)
G05		1	4	5 (63%)
G06	1	1	3	5 (56%)
G07	2		1	3 (43%)
G08	1	2		3 (43%)
G09	1	2		3 (60%)
G10		2		2 (29%)
G11		1		1 (17%)
G12	1			1 (17%)
G14		2	1	3 (50%)
G15	2	1	1	4 (50%)
G16	2			2 (33%)
G17			1	1 (17%)
G18		2		2 (40%)
G19	1	1		2 (40%)
G20		1		1 (13%)
G22	1		1	2 (33%)
G23	1	1		2 (40%)
G24	1	1		2 (33%)
G25		3		3 (30%)
G26		1		1 (17%)

G27		1		1 (13%)
G28		2		2 (33%)
G29	1		1	2 (29%)
G30			1	1 (14%)
G31	1		1	2 (33%)
G33		1		1 (20%)
Total	19	35	18	72 (34%)
Ratio	19/30 =63.3%	35/85 41.2%	18/100 18.0%	72/215 33.5%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is significant difference in the scale of factories regarding storage of IW in the factory; i.e. the rate of factories that store their IW on-site increases in accordance with the number of employees.

Q.7. How do you store IW?

Q.7	Base = 142 factories	Answer	%
1. We mix them all together.	(Go to Q.9)	6	4.2
2. We store them separately.		136	95.8
3. We store only waste that can be reused/recycled.		0	0.0
Total		142	100.0

Q.8. Into how many categories are IW classified in your factory?

Q.8	Base = 136 factories	Answer	%
1. One category		2	1.5
2. Two categories		39	28.7
3. More than two		95	69.8
Total		136	100.0

Finding 4

66% (142) of factories replied IW is stored in their compound. 95.8 % (136) of 142 factories that store IW on-site separately store IW. 69.8 % (95) of 136 factories classify IW into more than two categories.

Q.9. What is the purpose of on-site storage of industrial waste?

Q.9	Base = 142 factories	Answer	%
1. Temporary storage before its collection by haulers.		133	93.7
2. Temporary storage for on-site reuse and recycling.		3	2.1

3. Temporary storage for on-site treatment and disposal.	4	2.8
4. Temporary storage due to no existence of proper treaters	0	0.0
5. Others	2	1.4
Total	142	100.0

Finding 5

The purpose of on-site storage of the 142 factories is mainly for temporary storage before collection (93.7%). The purposes of temporary storage for on-site reuse/recycling and for on-site treatment/disposal are very limited and 2.1% and 2.8% respectively.

a.4 Intermediate Treatment and Recycling

Q.10. Is IW treated on-site in your factory?

Q.10	Answer	%
1.Yes	32	14.9
2.No, all the IW are treated off site.	183	85.1
Total	215	100.0

Finding 6

14.9 % (32) of factories have on-site treatment of IW. The table below presents breakdowns of the answer 1 of Q.10.

Q.10. "Answer 1.Yes." Base = 32 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G01		1		1 (14%)
G02			1	1 (17%)
G03		1	1	2 (29%)
G04			4	4 (57%)
G08			2	2 (29%)
G11		1		1 (17%)
G13			2	2 (29%)
G14			1	1 (17%)
G16		1		1 (17%)
G17		1		1 (17%)
G19	1			1 (20%)
G20		1	1	2 (25%)
G22		2		2 (33%)
G25		1		1 (10%)

G26		1		1 (17%)
G27			3	3 (38%)
G28		1	2	3 (50%)
G29	1	1		2 (29%)
G32		1		1 (20%)
Total	2	13	17	32 (15%)
Ratio	2 / 30 =6.7%	13 / 85 =15.3%	17 / 100 =17.0%	32 / 215 =14.9%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is a tendency; the rate of factories that have on-site treatment increases in accordance with the scale, i.e. the number of employees.

Q.11. Are IW reused or recycled inside your factory?

Q.11	Answer	%
1. Yes	50	23.3
2. No, IW are not reused/recycled inside the factory.	165	76.7
Total	215	100.0

Finding 7

23.3 % (50) of factories conduct on-site reuse or recycling of IW. The table below presents breakdowns of the answer 1 of Q.11.

Q.11. "Answer 1. Yes" Base = 50 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G03		1	1	2 (29%)
G04			4	4 (57%)
G05			3	3 (38%)
G06		1	2	3 (33%)
G07		1	2	3 (43%)
G08		3	2	5 (71%)
G09			1	1 (20%)
G10			3	3 (43%)
G11		1	1	2 (33%)
G13			2	2 (29%)
G14		1		1 (17%)
G15	1		1	2 (25%)
G16		1		1 (17%)

G17		1		1 (17%)
G19	1			1 (20%)
G20			2	2 (25%)
G21		1		1 (20%)
G22		1	1	2 (33%)
G25	1		1	2 (20%)
G26			1	1 (17%)
G27		1		1 (13%)
G28		1	1	2 (33%)
G30		1	1	2 (29%)
G31			1	1 (17%)
G33	1	1		2 (40%)
Total	4	16	30	50 (23%)
Ratio	4 / 30 =13.3%	16 / 85 =18.8%	30 / 100 =30.0%	50 / 215 23.3%

(Note) The figure in parenthesis is of percentage to total factories of a Factory Study Code.

The above table indicates there is a tendency; the rate of factories that have on-site reuse or recycling of IW increases in accordance with the scale, the number of employees.

Q.12. Are there any plans to reuse/recycle IW generated in your factory?

Q.12	Answer	%
1.Yes, 100%	22	10.2
2.No (Go to Q.14)	184	85.6
3.I don't know / i don't have data	9	4.2
Total	215	100.0

Finding 8

10.2 % (22) of factories have on-site reuse/recycle plan of IW. The table below presents breakdowns of the answer 1 of Q.12.

Q.12. "Answer 1.Yes" Base = 22 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G02		1	1	2 (33%)
G03		1	1	2 (29%)
G04			2	2 (29%)
G06		1		1 (11%)

G07		1		1 (14%)
G13			1	1 (14%)
G17		2		2 (33%)
G24			1	1 (17%)
G25			2	2 (20%)
G26		1	1	2 (33%)
G27			2	2 (25%)
G28			1	1 (17%)
G30		1	1	2 (29%)
G33			1	1 (20%)
Total	0	8	14	22 (10%)
Ratio	0 / 30 =0.0%	8 / 85 =9.4%	14 / 100 =14.0%	22 / 215 =10.2%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is a tendency; the rate of factories that have on-site reuse/recycling plan of IW increases in accordance with the scale, the number of employees.

Q.13. What types of IW do you plan to reuse/recycle in your factory?

Q.13 Base = 22 factories			
Factory	Type of IW	Recycle	Reuse
G02	Candy and Gum		1
	Sugar		1
G03	Sludge from WWTP		1
	Yeast		1
G04	Cotton from comber		1
	NaOH		1
G06	Waste oil		1
G07	Animal skin		1
G11	Plastic	1	
G15	Plastic tablet	1	
G17	Steel Scrap	1	
	Used oil		1
G24	Plastic silica 90%	1	
G25	Plastic	1	
	Solder scrap (Pb)	1	
G26	Iron scrap	1	
	Plastic (PVC)	1	
G27	Iron scrap	1	
	Plastic sheet	1	
G28	Chemical solution		1
G30	Scotchbite and sandpaper		1

G33	Chemical container in factory		1
Total		10	12

a.5 Collection

Q.14. Who collects wastes generated in your factory? (Plural answers are allowed and Base of answer is 215.)

Q.14	Base = 215 factories	Answer	%
1. Private company contracted by us.		116	54.0
2. Private company contracted by municipality		5	2.3
3. Municipality		46	21.4
4. Others (Pho Kha Khong Kao (General receivers))		107	49.8
5. Others		17	7.9
6. No collection service		5	2.3
Total		296	---

Finding 9

The results indicate the most common collection service provider is private company contracted by factories (54%), followed by general receiver (50%) and municipality (21%).

Q.15. How many times per week does collector come to your factory to pick them up?

This question was asked to the interviewees who answered 1, 2, 3 and 4 to Q.14 respectively.

Q.15	Q.14 Answer 1.		Q.14 Answer 2		Q.14 Answer 3		Q.14 Answer 4	
	Answer	%	Answer	%	Answer	%	Answer	%
1. Every day	8	6.9	1	20.0	9	19.6	7	5.6
2. 3 - 6 times a week	7	6.0	1	20.0	7	15.2	3	2.4
3. 1 - 2 times a week	10	8.6	1	20.0	26	56.5	24	19.4
4. 2 - 3 times a month	16	13.8	0	0.0	1	2.2	14	11.3
5. Once a month	22	19.0	0	0.0	0	0.0	22	17.7
6. 2 - 10 times a year	23	19.9	1	20.0	2	4.3	18	14.5
7. Others	5	4.3	0	0.0	1	2.2	2	1.6
8. Irregular	21	18.1	1	20.0	0	0.0	31	25.1
9. No Answer	4	3.4	0	0.0	0	0.0	3	2.4
Total	116	100.0	5	100.0	46	100.0	124	100.0

Finding 10

The above table indicates municipal collection service is more frequent than private one.

a.6 Off-site Treatment and Reuse/Recycling and Disposal

Q.16. Do you know how IW discharged from your factory are treated/disposed of?

Q.16	Base = 215 factories	Answer	%
1.Yes, 100%	(Go to Q.18)	207	96.3
2.No	(Go to 0)	5	2.3
3.No Answer	(Go to 0)	3	1.4
Total		215	100.0

Finding 11

Almost all (96.3 % (207)) factories answered they know off-site treatment/disposal of their IW. The table below presents breakdowns of the factories that do not have knowledge of their IW after discharge; i.e. answer 2 and 3 of Q.17.

Factory Study Code	Q.16. "Answer 2.No" Base = 5			Q.16. "Answer 3.No Answer" Base = 3		
	Classification of Factory by Number of Employee		Total	Classification of Factory by Number of Employee		Total
	2.51-200	3.>200		2.51-200	3.>200	
G01	1		1 (14%)			
G04		1	1 (14%)			
G07					1	1 (14%)
G08				1		1 (14%)
G14				1		1 (17%)
G15	1		1 (13%)			
G21	1		1 (20%)			
G30	1		1 (14%)			
Total	4	1	5 (2%)	2	1	3 (1%)
Ratio	4 / 85 =4.7%	1 / 100 =1.0%	5 / 215 2.3%	2 / 85 =2.4%	1 / 100 =1.0%	3 / 215 =1.4%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is no significant tendency with the scale of factories, the number of employees.

Q.17. If you know, please enter method of off-site disposal (treatment, reuse/recycling, or disposal) and responsible company or person according to the classification of IW in the following table.

207 factories replied the question. The results are summarized in the tables below in accordance with study factory code and waste code respectively. The results are used for the estimation of IW flow.

<Study Factory Code >

Q.17 Base = 207 factories						
Factory Study Code	Answer (1)	Answer (2)	Answer (3)	Answer (4)	Answer (5)	Total
G01			18	2		20
G02	3	4	14	6		27
G03	1	2	17			20
G04	1	1	19	4		25
G05	1		10	3		14
G06			17	4		21
G07		4	12	5		21
G08		2	12	2		16
G09		1	10			11
G10		2	17	4		23
G11		1	11	3		15
G12		4	10			14
G13	2	9	6		1	18
G14		8	11	1		20
G15		7	17	4		28
G16		2	8			10
G17		1	11	1	2	15
G18	2	1	9			12
G19		1	6	2		9
G20		9	18			27
G21	2	8	12	1		23
G22		4	11	1		16
G23	1	2	10	3		16
G24		12	14	1		27
G25	1	21	26	3		51
G26	2	11	13			26
G27		16	18	1		35
G28	3	13	18			34
G29		9	7	4		20
G30		5	9	2		16
G31			15			15
G32	1	3	10			14
G33		3	8			11
Total	20	166	424	57	3	670
Answer (1)	Transport and final disposal at municipal landfill by private subcontractor					
Answer (2)	Disposal by private subcontractor – Treatment and disposal method is not known					
Answer (3)	Reutilization by other parties, e.g. used at other factory as raw materials					
Answer (4)	Others (Transport and final disposal at municipal landfill by municipal officer)					
Answer (5)	Transport and final disposal by burning at Bang Pa-in Industrial Estate					

<Study Waste Code>

Q.17 Base = 207 factories						
Study Waste Code	Answer (1)	Answer (2)	Answer (3)	Answer (4)	Answer (5)	Total
C01-01			10			10
C01-02		1	10	1		12
C02-01	1	1	45	3		50
C03-01	1		69	6		76
C04-01	2	5	58	9		74
C05-01	1	2	24	4		31
C07-01		2	4	2		8
C08-01		5	111	1		117
C09-02	1		7			8
C10-01		6	2	2		10
C11-01	4	4	1	11		20
C12-01	2	6	7	2		17
W01-01		3	0			3
W01-02		1	0			1
W02-01		1	0			1
W03-02		5	2			7
W03-03		1	1			2
W04-01		4	0			4
W04-02		3	0			3
W05-01		2	0			2
W06-02	1	8	6	2		17
W06-03		3	0			3
W07-01		2	0			2
W07-02			1			1
W07-03		4	0	1		5
W08-01	1	22	41	3	1	68
W08-02		2	0			2
W08-03	2	6	1		1	10
W09-01		1	0			1
W10-01		1	1			2
W11-01	3	23	0			26
W11-02		2	2			4
W12-01	1	12	1	3	1	18
W12-02		14	4	1		19
W12-03		14	16	6		36
Total	20	166	424	57	3	670
Answer (1)	Transport and final disposal at municipal landfill by private subcontractor					
Answer (2)	Disposal by private subcontractor – Treatment and disposal method is not known					
Answer (3)	Reutilization by other parties, e.g. used at other factory as raw materials					

Answer (4)	Others (Transport and final disposal at municipal landfill by municipal officer)
Answer (5)	Transport and final disposal by burning at Bang Pa-in Industrial Estate

a.7 Future Management of IW

Q.18. How will the generation of IW change in your factory?

Q.18	Base = 215 factories	Answer	%
1. It (the volume of IW) will not increase so much.		103	47.9
2. It will increase due to the expansion of production, change of raw materials, etc..		27	12.6
3. It will decrease due to improvement of manufacturing process, change of raw materials, etc..		60	27.9
4. Others		25	11.6
Total		215	100.0

Finding 12

About half (47.9 % (103)) of factories answered IW will not increase so much and more than 1/4 (27.9 % (60)) replied decrease due to the improvement of on-site IWM. Only 12.6 % (27) replied, "increase". The following table presents breakdowns of the factories that replied, "increase" and "decrease"; i.e. answer 2 and 3 of Q.19.

Factory Study Code	Q.18 "Answer 2." Base = 27				Q.18. "Answer 3." Base = 60			
	Classification of Factory by Number of Employee			Total	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01		1	1	2 (29%)		1		1 (14%)
G02		1		1 (17%)		2	1	3 (50%)
G03							3	3 (43%)
G04							3	3 (43%)
G05							2	2 (25%)
G06	1			1 (11%)		1	1	2 (22%)
G07					1			1 (14%)
G08	1			1 (14%)		1	1	2 (29%)
G09		1		1 (20%)				
G10			1	1 (14%)			2	2 (29%)
G12					1	2		3 (50%)
G13		1		1 (14%)		2	2	4 (57%)
G14							3	3 (50%)
G15					1	3		4 (50%)
G16	1			1 (17%)	1		1	2 (33%)
G17						2		2 (33%)
G18					1	1		2 (40%)

G20			1	1 (13%)			2	2 (25%)
G21		2	2	4 (80%)			1	1 (20%)
G22							1	1 (17%)
G24						1	1	2 (33%)
G25		1	1	2 (20%)		1	4	5 (50%)
G26							2	2 (33%)
G27			3	3 (38%)			1	1 (13%)
G28			1	1 (17%)		1		1 (17%)
G29			1	1 (14%)		1	1	2 (29%)
G30			2	2 (29%)		1	1	2 (29%)
G31			2	2 (33%)	1	1		2 (33%)
G32	1			1 (20%)				
G33			1	1 (20%)				
Total	4	7	16	27 (13%)	6	21	33	60 (28%)
Ratio	4 / 30 =13.3%	7 / 85 =8.2%	16 / 100 =16.0%	27 / 215 =12.6%	6 / 30 =20.0%	21 / 85 =24.7%	33 / 100 =33.0	60 / 215 =27.9%

(Note) The figure in parenthesis is of percentage to total factories of a Factory Study Code.

The above table indicates there is no significant tendency in the answer of "increase" with the scale of factories, the number of employees. There is, however, significant difference in the scale of factories regarding the answer of "decrease"; i.e. the rate of factories that answered, "decrease" increases in accordance with the number of employees. This indicates larger factories have plans to decrease IW by improving their production processes, etc.

Q.19. Are there any future plans to reduce and recycle IW in your factory?

Q.19	Answer	%
1. No, basically we will apply the present management.	144	67.0
2. Yes, we intend to improve the present waste reduction and recycling system.	54	25.1
3. Yes, we have a specific plan to improve waste reduction and recycling system in our factory.	17	7.9
Total	215	100.0

Finding 13

Majority of factories (67 % (144)) will basically maintain the current IW management. The table below presents breakdowns of the factories that expressed "the intention for improvement but lack of specific plans of it" and have "specific plans"; i.e. answer 2 and 3 of Q.20.

Factory	Q.19. "Answer 2" Base = 54 factories	Q.19. "Answer 3" Base = 17 factories
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	Classification of Factory by Number of Employee			Total	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01			1	1 (14%)		1		1 (14%)
G02		2		2 (33%)			1	1 (17%)
G03			1	1 (14%)				
G04			3	3 (43%)			1	1 (14%)
G05						1	1	2 (25%)
G06		1		1 (11%)				
G07		1		1 (14%)		1		1 (14%)
G08	1		1	2 (29%)				
G09		1	1	2 (40%)				
G10			2	2 (29%)			1	1 (14%)
G12	1	1		2 (33%)				
G13		1	2	3 (43%)		1		1 (14%)
G14			1	1 (17%)				
G15	1	1	1	3 (38%)		1		1 (13%)
G16			1	1 (17%)				
G17		1		1 (17%)				
G18	1			1 (20%)				
G20		1	2	3 (38%)				
G21		1	1	2 (40%)			1	1 (20%)
G22			1	1 (17%)		1		1 (17%)
G23		2		2 (40%)				
G24			1	1 (17%)			1	1 (17%)
G25			4	4 (40%)			1	1 (10%)
G26		2	1	3 (50%)			2	2 (33%)
G27			4	4 (50%)	1			1 (13%)
G28		1	1	2 (33%)			1	1 (17%)
G29			1	1 (14%)				
G30			2	2 (29%)				
G31		1	1	2 (33%)				
Total	4	17	33	54 (25%)	1	6	10	17 (8%)
Ratio	4 / 30 =13.3%	17 / 85 =20.0%	33 / 100 =33.0%	54 / 215 =25.1%	1 / 30 =3.3%	6 / 85 =7.1%	10 / 100 =10.0%	17 / 215 =7.9%

(Note) The figure in parenthesis is of percentage to total factories of a Factory Study Code.

The above table indicates there is significant difference in the scale of factories in the both answer; i.e. the rate of factories that answered increases in accordance with the number of employees. This indicates larger factories have more intentions and plans to reduce and recycle IW on-site.

Q.20. Are there any future plans to improve treatment and final disposal system of IW in your factory?

Q.20	Answer	%
1. No, basically we will apply the present management.	202	93.9
2. Yes, we intend to improve present treatment and disposal system of our company.	8	3.7
3. Yes, we have a specific plan to improve treatment and disposal system in our factory.	4	1.9
4. No Answer	1	0.5
Total	215	100.0

Finding 14

Most of factories (93.9 % (202)) do not have plans to improve treatment and final disposal on-site. This indicates most of factories prefer to off-site treatment/disposal in future.

Q.21. How will a possible future rise in disposal cost of IW affect your factory?

Q.21	Answer	%
1. The present costs of waste disposal are not significant and an increase in disposal costs will have little impact on our business.	113	52.5
2. The present costs of waste disposal are significant and a substantial rise in disposal costs will affect the price of our products.	22	10.2
3. The present costs of waste disposal are very significant and a substantial rise in disposal costs will threaten our business.	18	8.4
4. No matter how expensive the disposal cost is, an improved waste management is necessary to obtain environmental image of products.	55	25.6
5. Others	6	2.8
6. No Answer	1	0.5
Total	215	100.0

Finding 15

More than half of factories (52.5 % (113)) replied there would be little impacts by the increase of disposal costs. But 18.6 % (22 + 18 = 40) replied it would be "significant or threat" and 1/4 (25.6 (55)) will "bear the cost for improvement of current IWM". The table below presents breakdowns of the factories that expressed "significant or threat" and "bear the cost for improvement of current IWM"; i.e. answer 2, 3 and 4 of Q.22.

Factory Study	Q.21. "Answer 2" Base = 22 factories	Q.21. "Answer 3" Base = 18 factories	Q.21. "Answer 4" Base = 55 factories

	Classification of Factory by Number of Employee		2 Total	Classification of Factory by Number of Employee			3 Total	Classification of Factory by Number of Employee			4 Total
	2.51-200	3.>200		1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01								2	2	4 (57%)	
G02	1		1 (17%)		1		1 (17%)				
G03	1		1 (14%)			2	2 (29%)		1	1 (14%)	
G04		1	1 (14%)			1	1 (14%)		1	1 (14%)	
G06	1		1 (11%)						2	2 (22%)	
G07						1	1 (14%)	1		1 (14%)	
G08									1	1 (14%)	
G09									1	1 (20%)	
G10									3	3 (43%)	
G11	1		1 (17%)		1		1 (17%)		1	1 (17%)	
G12	1		1 (17%)					1		1 (17%)	
G13	1		1 (14%)		1		1 (14%)		1	2 (43%)	
G14		1	1 (17%)						1	1 (17%)	
G15	1		1 (13%)		1		1 (13%)	1		1 (13%)	
G16								1	1	2 (33%)	
G18									2	2 (40%)	
G19									1	1 (20%)	
G20	1	1	2 (25%)							4 (50%)	
G21						1	1 (20%)		1	2 (60%)	
G22						1	1 (17%)		1	1 (17%)	
G24	1		1 (17%)						1	1 (17%)	
G25	2		2 (20%)			1	1 (10%)		2	3 (50%)	
G26	1	3	4 (67%)						1	1 (17%)	
G27		2	2 (25%)			1	1 (13%)	1	1	2 (25%)	
G28					1	1	2 (33%)		1	1 (17%)	
G29	1		1 (14%)			2	2 (29%)		1	1 (14%)	
G30						1	1 (14%)		2	2 (57%)	
G31								1	3	4 (67%)	
G32								1		1 (20%)	
G33		1	1 (20%)	1			1 (20%)		1	1 (20%)	
Total	13	9	22 (10%)	1	5	12	18 (8%)	6	15	34 (26%)	
Ration	13 / 85 =15.3%	9 / 100 =9.0%	22 / 215 =10.2%	1 / 30 =3.3%	5 / 85 =5.9%	12 / 100 =12.0%	18 / 215 =8.4%	6 / 30 =20.0%	15 / 85 =17.6%	34 / 100 =34.0%	55 / 215 =25.6%

(Note) The figure in parenthesis is of percentage to total factories of a Factory Study Code.

The above table indicates there is no significant tendency in the answer of "significant or threat" with the scale of factories, the number of employees (The rates of medium and large scale factories that answered 2 and 3 are 21.2% and 21% respectively.). There is, however, some difference in the scale of factories regarding

the answer of "bear the cost for improvement of current IWM"; i.e. the rate of large-scale factories that answered, "bear the cost for improvement of current IWM" is more than small/medium scale. This indicates large-scale factories will bear the increase of disposal cost in order to obtain environmentally friendly image of products if it improves current IWM.

b. Waste Exchange

Q.22. Is your factory interested in waste exchange program?

Q.22	Answer	%
1. Yes, very much.	54	25.1
2. Yes, to some extent.	120	55.9
3. No.	33	15.3
4. I don't know / I don't have data	8	3.7
Total	215	100.0

Finding 16

Most of factories, 81 % ("very much" 54 plus "to some extent" 120 = 174), expressed their interests on waste exchange program. The table below presents breakdowns of the factories that expressed "No interest" and "Don't know or have data"; i.e. answer 3 and 4 of Q.23.

Factory Study Code	Q.22. "Answer 3" Base = 33 factories				Q.22. "Answer 4" Base = 8 Factories		
	Classification of Factory by Number of Employee			3 Total	Classification of Factory by Number of Employee		4 Total
	1.<50	2.51-200	3.>200		2.51-200	3.>200	
G01		1	1	2 (29%)	1		1 (14%)
G02	1			1 (17%)			
G04			1	1 (14%)		1	1 (14%)
G05			1	1 (13%)			
G06			1	1 (11%)			
G07	1		1	2 (29%)			
G08		1		1 (14%)			
G09			1	1 (20%)			
G10		1		1 (14%)			
G11	1			1 (17%)			
G12	1		1	2 (33%)			
G13		1		1 (14%)	2		2 (29%)
G14		1		1 (17%)			
G15			1	1 (13%)			
G16	1			1 (17%)			
G18		2		2 (40%)			

G19	1			1 (20%)			
G20		1	1	2 (25%)			
G21		1		1 (20%)			
G22			1	1 (17%)			
G24			1	1 (17%)			
G25		1		1 (10%)	1		1 (10%)
G28		1		1 (17%)			
G29	1			1 (14%)		1	1 (14%)
G30					1		1 (14%)
G31			2	2 (33%)			
G32	1			1 (20%)			
G33			1	1 (20%)		1	1 (20%)
Total	8	11	14	33 (15%)	5	3	8 (4%)
Ratio	8 / 30 =26.7%	11 / 85 =12.9%	14 / 100 =14.0%	33 / 215 =15.3%	5 / 85 =5.9%	3 / 100 =3.0%	8 / 215 =3.7%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is no significant tendency in the answer of "Don't know or have data" with the scale of factories, the number of employees. There is, however, some difference in the scale of factories regarding the answer of "No interest"; i.e. the rate of small-scale factories that answered, "No interest" is more than it of medium/large scale factories. The results indicate large/medium scale factories are more interested in waste exchange program.

Q.23. Is your factory now involved in any kinds of waste exchange program of either non-HW or HW?

Q.23	Base = 215 factories	Answer	%
1. Yes		163	75.8
2. No.		52	24.2
	Total	215	100.0

Finding 17

Most of factories (75.8 % (163)) are now involved in waste exchange program. The results are supported by the results of 1,014 factories survey on waste exchange database; 62.5 % (634) involved in the program. The table below presents breakdowns of the factories that replied, "No"; i.e. answer 2 of Q.24.

Q.23. "Answer 2.No" Base = 52 factories				
Factory Study Code	Classification of Factory by Number of Employee			2 Total
	1.<50	2.51-200	3.>200	
G01			1	1 (14%)

G02	1	2		3 (50%)
G04		1	1	2 (29%)
G06			2	2 (22%)
G07	1		1	2 (29%)
G08		1	1	2 (29%)
G11		1	1	2 (33%)
G12	1			1 (17%)
G13		3	1	4 (57%)
G14		3		3 (50%)
G15		1	1	2 (25%)
G16	1		1	2 (33%)
G17		2		2 (33%)
G18		1		1 (20%)
G19	1	1		2 (40%)
G20			2	2 (25%)
G21		1		1 (20%)
G23		1		1 (20%)
G24			2	2 (33%)
G25		2	2	4 (40%)
G27	1			1 (13%)
G28		2		2 (33%)
G29	1	1	2	4 (57%)
G30		1	1	2 (29%)
G31			1	1 (17%)
G33			1	1 (20%)
Total	7	25	20	52 (24%)
Ratio	7 / 30 =23.3%	25 / 85 =29.4%	20 / 100 =20.0%	52 / 215 =24.2%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

The above table indicates there is no significant tendency in the answer of "No involvement in waste exchange" with the scale of factories, the number of employees.

Q.24. Are there any plans to introduce or expand the waste exchange program in the future?

Q.24	Answer	%
1. Yes	35	16.3
2. No.	146	67.9
3. I don't know / I don't have data.	34	15.8
Total	215	100.0

Finding 18

Most of factories (83.7 % (180)) do not have plans to introduce or expand the waste exchange program. The following table presents breakdowns of the factories that replied, "Yes"; i.e. answer 1 of Q.25.

Q.24. "Answer 1.Yes" Base = 35 factories				
Factory Study Code	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200	
G02	1	1	1	3 (50%)
G04			1	1 (14%)
G05		1		1 (13%)
G06	1		1	2 (22%)
G07		1	1	2 (29%)
G08			2	2 (29%)
G11		1		1 (17%)
G13			2	2 (29%)
G14		1		1 (17%)
G15		1		1 (13%)
G17		1		1 (17%)
G18		1		1 (20%)
G20			1	1 (13%)
G21			1	1 (20%)
G22		3		3 (50%)
G23		1		1 (20%)
G24			1	1 (17%)
G25		1	3	4 (40%)
G26			2	2 (33%)
G28			3	3 (50%)
G30			1	1 (14%)
Total	2	13	20	35 (16%)
Ratio	2 / 30 =6.7%	13 / 85 =15.3%	20 / 100 =20.0%	35 / 215 =16.3%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

There is a tendency in the scale of factories regarding the answer of "Yes"; i.e. the rate of factories that answered, "Yes" increases in accordance with the number of employees. The results indicate the rate of larger factories that have plans to introduce or expand the waste exchange program is more than it of smaller.

Q.25. Is there any IW that could be the target of waste exchange program in your factory?

Q.25	Answer	%
1. Yes	102	47.4
2. No, there is no IW that could be exchanged.	101	47.0
3. I don't know.	12	5.6
Total	215	100.0

Finding 19

About half of factories (47.4 % (102)) have wastes that would be possible IW for waste exchange program.

Q.26. What kind of measures do you think necessary to take in order to put the waste exchange program into practice? (Plural answers are allowed and Base of answer is 213.)

Q.26 Base = 213 factories	Answer	%
1. The legal framework (legislation and regulations of waste exchange program) should be established.	82	38.5
2. A public organization should control the system.	39	18.3
3. Subsidy programs or technical assistance should be introduced.	114	53.5
4. Information on quantity and quality of waste should be opened.	128	60.1
5. The current waste collection system is needed to improved.	51	23.9
6. The current transportation system is needed to improved.	39	18.3
7. Waste storage area is needed to secured.	62	29.1
8. I don't know.	22	10.3
9. Others	4	1.9
Total	541	---

Finding 20

For the promotion of waste exchange program the most important issue raised by the factories is, "Provision of information on quantity and quality of waste" (60.1 %), followed by, "Subsidy programs or technical assistance" (53.5%) and, "legal framework (legislation and regulations of waste exchange program)" (38.5 %).

c. Financial Matter

Q.27. How much is the rate of waste management cost in the production cost?

Factory Study Code	Descriptions	Nos. of Sample	% by Production Cost			Cost (Baht/year)		
			Ave.	Min	Max	Ave.	Min	Max
G02	Food (flour, sugar, tea, ice etc.)	2	0.01	0.01	0.02	48,000	48,000	48,000
G04	Textile, Thread, Fibre	4	0.09	0.01	0.30	660,750	5,000	2,448,000

G05	Textile product (Clothes, mats etc.)	1	0.02	0.02	0.02	24,000	24,000	24,000
G06	Wearing Apparel	3	0.05	0.01	0.12	9,200	4,800	12,000
G07	Hide, Fur, Footwear	1	0.08	0.08	0.08	2,400	2,400	2,400
G08	Woodwork (any or many items)	1	0.05	0.05	0.05	100,000	100,000	100,000
G09	Woodwork (bamboo, rattan, straw, cork etc.)	1	0.02	0.02	0.02	120,000	120,000	120,000
G10	Furniture	3	0.28	0.01	0.80	96,667	30,000	200,000
G11	Paper, Cardboard	4	0.14	0.001	0.50	9,555	1,020	24,000
G12	Printed matter	2	0.04	0.04	0.04	114,000	36,000	192,000
G13	Chemical matter, Petroleum	4	0.14	0.04	0.30	1,861,132	300,000	6,000,000
G14	Rubber	2	0.0008	0.0003	0.0010	3,548	96	7,000
G15	Plastic product	3	0.12	0.001	0.30	427,317	750	1,191,200
G16	Glassware, Ceramics, non-Metallic Matter	3	0.10	0.01	0.25	54,407	6,000	100,000
G18	Metal product (tools, appliances, household furniture, building interior etc.)	1	0.05	0.05	0.05	50,000	50,000	50,000
G20	Metal product (others)	3	0.10	0.002	0.22	1,046,663	5,636	1,660,000
G21	Machines (Engines, Turbines, Machinery)	3	0.02	0.01	0.03	366,467	27,000	1,000,000
G22	Machines (for producing metal or wood products)	1	0.07	0.07	0.07	1,350,000	1,350,000	1,350,000
G24	Machines (calculating machines, Accounting machines, Water pumps, air or gas compressors etc.)	2	0.03	0.001	0.06	28,000	6,000	50,000
G25	Electric product (Machines or Product under No.70, Radio set, Electric Instruments or appliances etc.)	3	0.21	0.06	0.50	1,732,000	300,000	3,698,000
G26	Electric product (Electric Equipment)	2	0.10	0.05	0.15	950,000	900,000	1,000,000
G27	Transportation machines (Ship, Trains, Streetcars, Cars or Trailers)	1	0.04	0.04	0.04	216,000	216,000	216,000
G28	Transportation machines (Motorcycles, Tricycles, Bicycles, Aircraft, Wheeled vehicles etc.)	2	0.05	0.01	0.08	240,430	192,000	288,860
G29	Precision machinery	2	0.20	0.02	0.37	1,306,612	500,000	2,113,223
G30	Others (Musical instruments, Sport, Toys etc.)	2	0.04	0.03	0.05	82,670	20,340	145,000
G33	Others (Stone, Watches or Clocks, Central waste treatment plant, Generating steam, salt etc.)	2	1.01	0.01	2.00	110,800	21,600	200,000
Total	---	58	0.13	---	---	499,214	---	---

Finding 21

The above table indicates each factory spend 499,000 Baht/year in average for IWM, which is equivalent to 0.13% of the production cost. However, when referring to these figures it should be noted on the following aspects:

- Only 27.0% (58) of factories gave the answers; and
- The annual IWM expenditure ranges between 96 to 6,000,000 Baht/year.

Q.28. How much do you pay for the Collection of IW to the collection company per year?

Q.29 Base = 82 Factories								
Category of Employee	1. 1-50		2. 51-200		3. > 200		Total	
	Baht/year	Nos.	Baht/year	Nos.	Baht/year	Nos.	Baht/year	Nos.
Collector								

Municipality	20,200	5	18,689	9	31,636	9	24,083	23
Private Company	20,267	3	146,922	16	264,475	28	208,869	47
Private Company & Municipality	7,200	1	2,000,000	1	637,524	10	698,537	12
Total	18,778	9	173,806	26	299,261	47	228,698	82

Finding 22

The above table indicates

- The average expenditure of 82 factories, which is 38.1% to population (215), is 229,000 Baht/year.
- It might say the collection expenditure (which might include off-site treatment/disposal cost.) shares 60% of IWM cost (229,000/382,000).

Q.29. Please fill in the unit cost of collecting IW according to the type of IW in the following table.

The table below presents the results of the answers on 51 wastes obtained from 27 factories.

Study Waste Code	Type of IW Description	Unit Cost for Collection				
		Nos. of Sample	Ave.	Min	Max	Unit
C01-01	Dust of coconut fiber	1	75	75	75	Baht/ton
C01-02	Sheep skin	1	2,500	2,500	2,500	Baht/ton
C05	Piece of cloth and thread	1	3,000	3,000	3,000	Baht/ton
C07	Natural rubber	1	3,000	3,000	3,000	Baht/ton
C09-01	Ceramic	1	70	70	70	Baht/ton
C09-02	Glass scrap	1	1,480	1,480	1,480	Baht/ton
C11	Mixed waste	2	1,750	500	3,000	Baht/ton
	Mixed waste	1	3,000	3,000	3,000	Baht/trip
W01-02	Conc Acid	1	200	200	200	Baht/ton
W02	NaOH	1	5,000	5,000	5,000	Baht/ton
W03-02	Toxic salts	1	7,000	7,000	7,000	Baht/trip
W03-03	Nickle Sludge	1	878	878	878	Baht/ton
W04-02	CuSO ₄	1	5,000	5,000	5,000	Baht/ton
W06-02	Solvent, Organics compound	3	4,088	1,500	6,843	Baht/ton
W07-01	Polycarbonate resin, Polyurethane resin	1	6,843	6,843	6,843	Baht/ton
W07-03	Laminar plastic, Melamine resin	2	2,995	2,995	2,995	Baht/trip
W08-01	Emulsion oil, Engine oil	2	600	400	800	Baht/ton
W08-02	Trichloro ethylene	1	7,000	7,000	7,000	Baht/trip
W08-03	Emulsion oil, Aluminium rolling solution, Copper Rolling Solution	3	767	400	950	Baht/ton
W10	Pickling waste	1	565	565	565	Baht/ton

W11-01	Sludge (Heavy metal, Hydroxide, Phosphate)	8	4,871	200	8,220	Baht/ton
W12-01	Sand contaminated heavy metal	1	582	582	562	Baht/ton
	Chemical contaminated bag, Coating paper and plywood, contaminated cloth	5	5,167	2,995	7,000	Baht/trip
W12-02	Paint waste, Waste Sulfur, Paint sludge	3	4,597	585	8,226	Baht/ton
W12-03	Zinc dust, Sand, Dust	3	584	582	565	Baht/ton
	Broken fluorescent lamp, Dry cell, Chemical container	4	7,000	7,000	7,000	Baht/trip

Q.30. Are you willing to pay more for the collection of IW, if the quality of collection service is improved?

Q.30	Answer	%
1. Yes	49	22.8
2. No.	83	38.6
3. I don't know	27	12.6
4. No answer	56	26.0
Total	215	100.0

Finding 23

Only 22.8 % (49) of factories can accept increase of collection fee while 38.6 % (83) refuse. The table below presents breakdowns of the factories that replied, "Yes" and "No"; i.e. answer 1 and 2 of Q.31.

Factory Study Code	Q.30. "Answer 1.Yes" Base = 49 factories				Q.30. "Answer ".No" Base = 83 factories			
	Classification of Factory by Number of Employee			1 計	Classification of Factory by Number of Employee			2 計
	1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01		1		1 (14%)	1		1	2 (29%)
G02		1		1 (17%)		2		2 (33%)
G03			1	1 (14%)			1	1 (14%)
G04			1	1 (14%)		1	2	3 (43%)
G05		1	1	2 (25%)		1	2	3 (38%)
G06	1		4	5 (56%)		2	1	3 (33%)
G07	2	1	1	4 (57%)	1	1		2 (29%)
G08			1	1 (14%)	1	1		2 (29%)
G09						1	2	3 (60%)
G10			1	1 (14%)			3	3 (43%)
G11			1	1 (17%)	1	1	1	3 (50%)
G12	1	1	1	3 (50%)	1	1	1	3 (50%)
G13			1	1 (14%)		3	2	5 (71%)

G14						2	2	4 (67%)
G15	1	1		2 (25%)		2	2	4 (50%)
G16		1		1 (17%)		1		1 (17%)
G17		1		1 (17%)		3		3 (50%)
G18						1		1 (20%)
G19		1		1 (20%)	1	1		2 (40%)
G20						1	1	2 (25%)
G21			2	2 (40%)		1		1 (20%)
G22		1	1	2 (33%)	1			1 (17%)
G23		2	1	3 (60%)	1			1 (20%)
G24	1		1	2 (33%)		1	2	3 (50%)
G25			1	1 (10%)		2	2	4 (40%)
G26			2	2 (33%)		1	2	3 (50%)
G27			1	1 (13%)	1		3	4 (50%)
G28						2	2	4 (67%)
G29	1	1	1	3 (43%)		1	2	3 (43%)
G30		2	1	3 (43%)			1	1 (14%)
G31			1	1 (17%)			2	2 (33%)
G32		1		1 (20%)		1		1 (20%)
G33			1	1 (20%)	1	1	1	3 (60%)
Total	7	16	26	49 (23%)	10	35	38	83 (39%)
Ratio	7 / 30 =23.3%	16 / 85 =18.8%	26 / 100 =26.0%	49 / 215 =22.8%	10 / 30 =33.3%	35 / 85 =41.2%	38 / 100 =38.0%	83 / 215 =38.6%

(Note) The figure in parenthesis is of percentage to total factories of a Factory Study Code.

There is no significant deference observed in the rate of "Yes" to "No" in the scale of factories; i.e. the rates of small, medium and large are 70%, 46% and 68% respectively.

Q.31. How much does your factory spend annually for the internal treatment of IW?

Q.31		
Factory Study Code	Classification of Factory by Number of Employee	Internal Treatment Cost (baht/year)
G04	3. > 200	5,000
	3. > 200	2,400,000
G13	3. > 200	360,000
G20	2. 51-200	120,000
G25	2. 51-200	223,960
G27	3. > 200	700
G29	1. 1-50	600

G32	2. 51-200	93,600
Average		400,483

Finding 24

The above table indicates each factory spend 400,483 Baht/year in average for on-site treatment. However, when referring to this figure it should be noted on the following aspects:

- Only 3.7% (8) of factories gave the answers; and
- The annual on-site treatment expenditure ranges between 600 Baht/year to 2,400,000.

Q.32. Please fill in the unit cost of internal treatment for each type of IW in the following table.

Although the unit costs obtained are of ten (10) wastes from only 6 factories, those are presented the table below.

IW Code		Unit Cost for Internal Treatment		Remark	
Study Waste Code	Description			Factory Study Code	MOI code
C01-01	Waste from tree	Free	---	G01	005
C05	Textile	347	Baht/ton	G04	022
W06-02	Solvent	2,000	Baht/m ³	G13	042
W07-03	Polyester resin	706	Baht/ton	G13	042
W08-03	Mixed oil	2,000	Baht/m ³	G13	042
W08-03	Coolant oil	24	Baht/m ³	G27	077
W11-01	Treatment Sludge	7,000	Baht/ton	G20	064
W11-01	Sludge	2,545	Baht/ton	G25	072
W12-01	Contaminated waste	706	Baht/ton	G13	042
W12-02	2-Ethyl-Haxanol	2,000	Baht/m ³	G13	042

Q.33. How much does your factory spend annually for the final disposal of IW by himself?

Q.33	Answer	%
1. I know.	36	16.7
2. No.	37	17.2
3. I don't dispose by myself	133	61.9
4. No Answer	9	4.2
Total	215	100.0

Q.34. Please fill in the unit cost of final disposal for each type of IW in the following table.

The team received the replies on 96 wastes from 36 factories and the table below presents the results of the survey.

Type of IW		Unit Cost for Collection				
Study Waste Code	Description	Nos. of Sample	Ave.	Min	Max	Unit
C01-01	Waste from tree	1	0	0	0	Baht/ton
C04	Burnt synthetic tire, XLPE plastic	2	1,836	1,672	2,000	Baht/ton
C08	Production scrap	1	9,000	9,000	9,000	Baht/ton
	Copper card	1	22,500	22,500	22,500	Baht/trip
C11	Mixed waste	3	4,718	154	11,000	Baht/ton
C12	Ash, Starch sludge	2	1,850	1,700	2,000	Baht/ton
W01-01	HCl deacid	1	743	743	743	Baht/ton
W01-02	Conc acid	1	700	700	700	Baht/ton
W02	NaOH	1	5,000	5,000	5,000	Baht/ton
W03-02	Battery, Circuit board, Heavy metal compound, Toxic salt	4	12,542	10,329	16,700	Baht/ton
W03-03	Nickel sludge	1	1,945	1,945	1,945	Baht/ton
W04-01	Chemical waste, Etching, Solder, Stripping	4	12,391	4,066	15,166	Baht/ton
W04-02	CuSO ₄	1	5,000	5,000	5,000	Baht/ton
W06-02	Organic compound, Paint waste, Solvent, Waste thinner	5	4,790	2,200	6,250	Baht/ton
W06-03	Formalin, Organic compound	2	4,400	4,000	4,800	Baht/ton
W07-01	Polycarbonate resin, Polyurethane resin	2	10,420	9,239	11,600	Baht/ton
W07-03	Laminate plastic, Melamine resin	2	1,400	1,400	1,400	Baht/ton
W08-01	Emulsion oil, Engine oil, Lacquer etc.	9	4,628	1,000	12,000	Baht/ton
W08-02	Trichloro ethylene	1	13,900	13,900	13,900	Baht/ton
W08-03	Aluminium rolling solution, Coolant oil etc.	4	4,588	1,350	6,500	Baht/ton
W10	Pickling waste	1	1,629	1,629	1,629	Baht/ton
W11-01	Sludge (Al, Hydroxide, Inorganic, Latex, Paint, Phosphate etc.)	17	5,842	700	16,700	Baht/ton
	Treatment sludge	1	22,500	22,500	22,500	Baht/trip
W11-02	Sludge (Heavy metal, Water treatment)	2	4,422	2,000	6,843	Baht/ton
W12-01	Chemical contaminated bag, Coating paper and plywood, Contaminated cloth, Oil contaminated fabric etc.	9	8,408	1,400	12,400	Baht/ton
W12-02	Sludge (Hydroxide, Paint), Mica sheet, Printed circuit board, waste sulfur	7	9,376	1,629	16,700	Baht/ton
W12-03	Battery cell scrap, Broken fluorescent lamp, Dust, Chemical container etc.	11	8775	1,629	13,400	Baht/ton

d. Evaluation of the Present IWM System

Q.35. Which of the following phrases best describes the present status of IWM in your factory?

Q.35	Answer	%
1. There are no problems with the present IWM. (Go to the end)	113	52.6
2. There are some problems with present IWM.	102	47.4
Total	215	100.0

Finding 25

About half (47.4 % (102)) of factories have some problems on present IWM. The table below presents breakdowns of the factories that replied, "Yes" and "No"; i.e. answer 1 and 2 of Q.36.

Factory Study Code	Q.35 "Answer 1" Base = 113 factories				Q.35 "Answer 2" Base = 112 factories			
	Classification of Factory by Number of Employee			Total	Classification of Factory by Number of Employee			Total
	1.<50	2.51-200	3.>200		1.<50	2.51-200	3.>200	
G01	1	3	3	7 (100%)				
G02	2	1		3 (50%)		2	1	3 (50%)
G03		2	4	6 (86%)			1	1 (14%)
G04		1	4	5 (71%)			2	2 (29%)
G05		1	3	4 (50%)		1	3	4 (50%)
G06	1	1	3	5 (56%)		1	3	4 (44%)
G07	2	1	1	4 (57%)	1	1	1	3 (43%)
G08	1	3	2	6 (86%)			1	1 (14%)
G09		2	1	3 (60%)	1		1	2 (40%)
G10		1	1	2 (29%)		1	4	5 (71%)
G11	1	1	2	4 (67%)		2		2 (33%)
G12	2	1	1	4 (67%)		1	1	2 (33%)
G13						4	3	7(100%)
G14		1	1	2 (33%)		2	2	4 (67%)
G15		2	2	4 (50%)	2	1	1	4 (50%)
G16	2		1	3 (50%)		3		3 (50%)
G17		6		6 (100%)				
G18		3		3 (60%)	1	1		2 (40%)
G19	2	1		3 (60%)		2		2 (40%)
G20		2	3	5 (63%)			3	3 (38%)
G21		2		2 (40%)			3	3 (60%)
G22	1	2		3 (50%)		2	1	3 (50%)
G23	1	2	1	4 (80%)		1		1 (20%)

G24	1	1	1	3 (50%)	1		2	3 (50%)
G25	1	2		3 (30%)		2	5	7 (70%)
G26		1		1 (17%)		1	4	5 (83%)
G27		1		1 (13%)	1	1	5	7 (88%)
G28		3		3 (50%)			3	3 (50%)
G29	1	1		2 (29%)		1	4	5 (71%)
G30		1	1	2 (29%)		1	4	5 (71%)
G31	1	1	2	4 (67%)			2	2 (33%)
G32	2	2		4 (80%)		1		1 (20%)
G33			2	2 (40%)	1	1	1	3 (60%)
Total	22	52	39	113 (53%)	8	33	61	102 (47%)
Ratio	22 / 30 =73.3%	52 / 85 =61.2%	39 / 100 =39.0%	113 / 215 =52.6%	8 / 30 =26.7%	33 / 85 =38.8%	61 / 100 =61.0%	102 / 215 =47.4%

(Note) The figure in parenthesis is of percentage to total factories of a factory study code.

There is a significant difference in the scale of factories that large-scale factories recognize more problems than medium and small scale.

Q.36. What kind of problems does your factory face now, concerning IWM? (Plural answers are allowed and Base of answer is 102.)

Q.36 Base = 102 factories	Answer	%
1. We do not know the difference between hazardous and non-hazardous waste.	13	12.7
2. We do not segregate hazardous from non-hazardous waste.	5	4.9
3. There is no or only limited services available for industrial waste treatment.	27	26.5
4. High cost of industrial waste treatment	30	29.4
5. Reuse and recycling of industrial waste is non-existent or limited.	14	13.7
6. Others	11	10.8
7. No Answer	2	2.0
Total	102	100.0

Finding 26

The most significant problem factories face now on IWM is "High IW treatment cost", followed by "No or limited services available for treatment" and "Lack or limited reuse and recycling of IW".

Q.37. What measures and actions do you think need to be taken to solve the above problems? (Plural answers are allowed and Base of answer is 111.)

In total 111 factories replied this question and 11 from those answered 1 of Q.36 and 100 from 2 of O.36.

Q.37 Base = 111 factories	Answer	%
1. Formulation and enforcement of relevant laws and regulations.	15	13.5
2. Guidance on proper IWM to the factories (generators).	61	55.0
3. Introduction of financial and economic incentives to promote proper IWM.	31	27.9
4. Preparation of the guidelines for proper IWM	56	50.5
5. Development of the waste reuse and recycle market	73	65.8
6. Development of the intermediate treatment facilities for industrial waste.	57	51.4
7. Development of the final disposal facilities for industrial waste.	43	38.7
8. Others	5	4.5
Total	341	---

Finding 27

The most significant measures and actions factories need to solve the problems on IWM is "Development of the waste reuse and recycle market", followed by "Guidance on proper IWM to the factories (generators)" and "Development of the intermediate treatment facilities for industrial waste".