

Waste Reduction with Citizen's Participation Ube City

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Outline

In order to reduce the amount of substances emitted into the environment such as dioxin, the emission standards for substances that originate in waste incineration have been reinforced. Since the goal of reduction of domestic waste was set at the same time, Ube city had to renew the incinerators and reduce the amount of waste by December 1st, 2002 by which time the laws were to go into effect. Additionally, because the reduction of waste involves changes in waste sorting and collection methods, the provision is that cooperation from the residents is essential.

The text

1 Outline of Ube city

The population of Ube city is about 175,000 and it has been growing sideways. Ube city stands in the south-east part of Yamaguchi prefecture and fronts the sea of Seto. Its size is about 210 km². Ube has a mild climate with little rain, characteristic of a Setouchi-style climate. The city of Ube grew out of a rapidly developed coal mining industry and now Ube has become a chemical industrial city. With these industrial developments, we have had serious industrial pollution, especially air pollution. We made efforts to overcome the pollution through the collaboration of business, local government, academics, and citizens. With our theme of "a city of greenery, flowers, and sculptures", we are trying to make our city more environmentally friendly.

2 Waste disposal in Ube city

In Ube city, waste had been disposed of in a landfill on the seashore since 1955, but in 1975 a waste incineration plant (furnaces 1 and 2: burning capacity 105t/24h×2 machines) was set up, at which time the incineration of the burnable waste started. At the same time, sorting of the waste began (burnable and non-burnable waste). Subsequently, the furnace number three (burning capacity 120t/24h) was additionally installed in 1991 due to the increase in the amount of waste and the decline of the two old incinerators' burning capacity. As for the non-burnable waste, a Recycle Plaza was constructed in 1995 where crushing and sorting was conducted, and the reduction and recycling of waste started. Additionally, in conjunction with the operation of the Recycle Plaza, the sorting of waste was changed to the following: burnable, non-burnable, recyclable (bottles, cans), hazardous, and bulky waste. Moreover, waste reduction was put into practice by sorting and collecting Koshi (used paper) and PET bottles.

3 The renewal of the waste incinerating furnace

In order to reduce the amount of dioxin in the environment that is generated by incineration of the waste, a "Law Concerning Special Measures against Dioxins" was enacted (July, 1999). The old furnace 1 and 2 were remodeled and furnace 3 was updated to satisfy incinerator emission levels as required by the above mentioned law.

< Waste incinerating furnaces in Ube city >

	Activation year	Processing capacity	Furnace type
Furnace 1	1975	105t/24h	Total continuous burning type (Stoker furnace)
Furnace 2	1975	105t/24h	Total continuous burning type (Stoker furnace)
Furnace 3	1991	120t/24h	Total continuous burning type (Stoker furnace)
	Total	330t/24h	

<Table 3-1>

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<Exhaust gas standard>

(Unit: ng-TEQ/m³N)

Areas of specified facility	Incineration ability	Standard of new facility	Standard of existing facility Jan. 15 2001-Nov. 30, 2002	Standard of existing facility Dec. 1, 2002
Waste incinerators (C \geq 50Kg/h)	C \geq 4t/h	0.1	80	1
	2t/h \leq C \leq 4t/h	1	80	5
	C<2t/h	5	80	10

<Table 3-2>

* There is a prescribed grace period dependant on burning capacity.

* The exhaust water is applied at 10pg-TEQ/l (from January 15th, 2003), ash dust and incineration dust at 3ng-TEQ/g (from December 1st, 2002).

4 Investigation of processing capacity of waste incinerating facilities

(1) The necessity of waste reduction

a. As shown below, the national government has established the goal reduction amount in the domestic waste to be achieved by the year 2010, based on “the Basic Guidelines for Promotion of Measures against Dioxins” of September 1999.

- In contrast to the year 1996 “a 5% reduction of emission”,
“an increase of recycling and reuse from 10% to 24%”,
“reduction by half in the final disposal”.

b. Yamaguchi Prefecture has developed “Yamaguchi Prefecture Proposal for Promotion of Waste Reduction” (March, 1998).

<A target of waste reduction (Yamaguchi prefecture); extract>

Category	Actual result 1996	Prediction 2002	Prediction 2007
Amount of waste per person a day	1,096g	1,014g	932g
Recycling ratio	8.5%	15%	20%
Incineration ratio	76%	Reduce the amount of waste incineration. Promote thermal recycling	
Amount of landfill	180,000t	Reduce waste and landfill by recycling	

<Table 4-1>

c. The amount of combustible waste discharged

<The amount of combustible waste discharged (Ube city)>

Unit: t/year

Year	Collection by city	Self-delivered	Total
1995	42,681	13,820	56,501
1996	39,798	15,256	55,054
1997	37,873	17,539	55,412
1998	38,735	18,894	57,629
1999	40,028	22,340	62,368

<Table 4-2>

* Combustibles were decreased when we started to collect *Koshi* (magazines, newspapers and cardboard) at the waste station in 1996, but now it shows a tendency to increase.

(2) The composition of combustible waste

According to the composition analysis, combustible waste largely contains vinyl, synthetic resin, paper, and fabric. Therefore, reduction of waste can be achieved by recycling plastic container & wrap and paper container-wrap in conjunction with the Containers and Packaging Recycling Law that would be thoroughly reinforced starting in the year 2000.

<The composition of combustible waste (Ube city)>

Unit: % (weight)

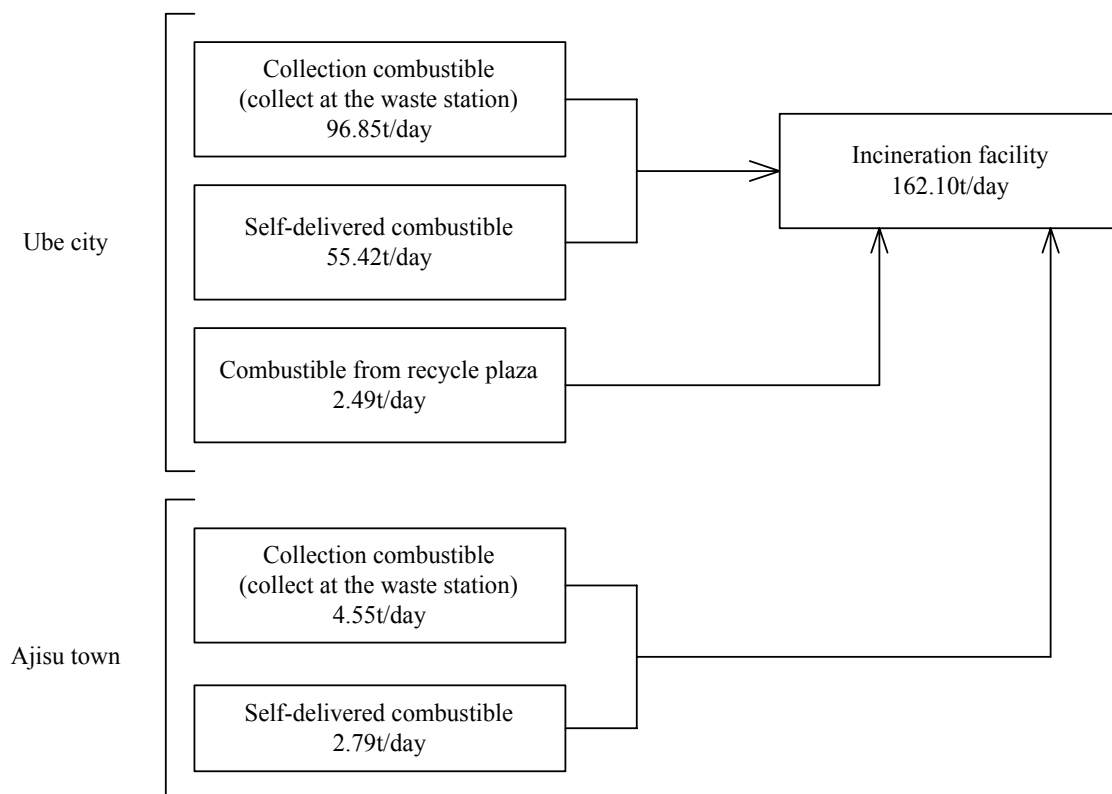
Year	Paper, fabric	Vinyl, Synthetic resin, etc	Tree, bamboo, straw, etc	Kitchen waste	Non-combustible	Other
1995	48.5	20.2	9.1	14.8	5.5	1.8
1996	48.0	21.5	9.9	11.0	5.4	4.2
1997	40.6	24.0	8.3	16.8	5.7	4.6
1998	42.0	21.8	9.1	10.2	12.2	4.7
1999	42.1	21.2	9.0	12.9	10.7	4.1

<Table 4-3>

According to a detailed analysis (November, 2000), household waste contains 1.2 to 3.0% paper containers-wrap and 8.3 to 12.8% plastic containers & wrap in the wet base. Also, directly collected waste contains 1.3 to 2.5% paper containers-wrap and 5.6 to 18.2% plastic containers& wrap. As well, directly collected waste contains 21.3 to 28.4% cardboard, which means that if the direct collectors are to completely sort *Koshi* (the used paper), the amount of combustible waste can be further reduced.

(3) The goal setting for waste reduction

Based on the composition analysis of combustible waste, the amount of waste was established by aiming at the reduction of garbage centered on containers-wrap. If the target year for the proposition is the year 2009 and the reduction of waste is conducted, then the amount of waste for incineration in Ube city is established at 154.76t/day. As a result, the amount of waste for incineration from both Ube city and Ajisu town had to be set at 162.10t/day.



The planned processing amount for the facilities in 2009 (target year for the proposition)

<Fig. 4-1>

(4) The planned processing amount for the facilities (The processing capacity of the incinerators)

It was decided as shown below in accordance with the standards from the Ministry of Health and Welfare (current Ministry of Environment) based on the setting of the target value (Maintenance plan submission in January, 2000).

Planned processing amount for the facilities $\lt; \text{Planned annual average processing amount} \div \text{Actual activation rate} \div \text{Adjusting activation rate}$

Planned annual average processing amount = 162.10t/day
 Actual activation rate = 280 days/year \div 365 days/year
 Adjusting activation rate = 0.96
 = 162.10t/day \div (280 days/year \div 364days/year) \div 0.96
 = 220.11
 Facilities maintenance magnitude/scale/size = 198t/day < 220.11t/day

(5) The model selection

During the investigation that considered renewing the incinerators, the most important factor was the prevention and reduction of effluents such as dioxin, ash dust and sulfur oxides. Even dissolving of ashes was considered. The model selection was finalized on the gasifying fusion furnaces through discussions of the Research Committee for Waste Disposal Processing Measures with consideration of the following points: 1) the measures against substances such as dioxin, 2) the effectiveness in dissolving of ashes, and 3) the use of the waste heat. Also, based on the consideration of the changes in the waste amount and the planned maintenance of the incinerators, the decision was made to incorporate 66t/day x 3 furnaces.

<Exhaust gas standard>

Item	Facility standard	National standard
Dust	$\leq 0.01\text{g}/\text{m}^3$	$\leq 0.04\text{g}/\text{m}^3$
Sulfur oxide	$\leq 10\text{ppm}$ (K value=0.05)	K value=2.34
Hydrogen chloride	$\leq 20\text{ppm}$	\leq about 430ppm
Nitrogen oxide	$\leq 50\text{ppm}$	$\leq 250\text{ppm}$
Dioxin	$\leq 0.05 \text{ n g-TEQ}/\text{m}^3$	$\leq 0.1 \text{ n g-TEQ}/\text{m}^3$

<Table 4-6>

5 Waste reduction measure

From December 1st, 2002, new incineration facilities were activated to help meet the new national guidelines for waste disposal.

<Numerical target of waste disposal (waste in Ube city)>

Category	1999 (actual result)	2002 (target)	2009 (target)
Collection combustible (collect at the waste station)	109.67t/day	96.31t/day	96.85t/day
Self-delivered combustible	61.21t/day	50.05t/day	55.42t/day
Combustible from recycle plaza	3.12t/day	2.49t/day	2.49t/day
Total	174.00t/day	148.85t/day	154.76t/day

<Table 5-1>

(1) Changes in waste sorting

As a waste reduction measure, Plastic containers & wrap and Paper containers·wrap were added to the recyclable waste category.

<Changes in waste sorting (domestic waste)>

	Waste sorting (before change)	Waste sorting (after change)
Collection by city	Combustible Non-combustible Recyclable (Bottles and cans) Hazardous (batteries, mercurial thermometer, lighters) Pet bottles Koshi (newspapers, magazines, cardboard)	<div style="border: 1px solid black; padding: 2px;"> * Combustible Mon/Wed/Fri (kitchen waste, etc) Collected once a month (clothes etc) </div> Non-combustible <div style="border: 1px solid black; padding: 2px;"> * Plastic container & wrap </div> Recyclable (Bottles and cans) <div style="border: 1px solid black; padding: 2px;"> * Paper container-wrap </div> Hazardous (batteries, mercurial thermometer, lighters) Pet bottles Koshi (newspapers, magazines, cardboard)
Self-delivered by citizens	Bulky waste Excess domestic trash Other (landfill)	Bulky waste Excess domestic trash Other (landfill)

* Private business trash is self-delivered by themselves.

* Categories newly started

(2) Change of city collection date

The collection day of combustible was divided into two areas, the zone collected on Monday, Wednesday, and Friday, and the zone collected on Tuesday, Thursday, and Saturday. Due to collection of plastic container & wrap and a five-day work week, collection days changed as follows:

<Change of collection days>

	Waste sorting (before change)		Waste sorting (after change)	
	Category	Collection date	Category	Collection date
Collected by city	Combustible	Collected three times a week Mon/Wed/Fri or Tue/Thu/Sat (specified for each area)	Combustible	Collected three times a week <div style="border: 1px solid black; padding: 2px;"> All of Ube *Mon/Wed/Fri (kitchen waste etc) </div>
		Collected once a month (collection day is specified for each area)	<div style="border: 1px solid black; padding: 2px;"> *Burnable (clothes, beddings etc) </div>	Collected once a month (collection day is specified for each area, either Tuesday or Thursday)
	Non-burnable		Non-burnable	
			<div style="border: 1px solid black; padding: 2px;"> *Plastic container & wrap </div>	Collected once a week (collection day is specified for each area, either Tuesday or Thursday)

	Recyclable (bottles and cans)		Recyclable (bottles and cans)	Collected once a month (collection day is specified for each area, either Tuesday or Thursday)
			*Paper container-wrap	
	Hazardous (batteries, mercurial thermometer, and lighters)		Hazardous (batteries, mercurial thermometer, and lighters)	
	Pet bottles		Pet bottles	
	Koshi (newspapers, magazine, cardboard)		Koshi (newspapers, magazine, cardboard)	

* Newly started

(2) Designated bags

Combustible waste which is collected on Mon/Wed/Fri is required to be in a designated bag (see-through or transparent bag) from November 2002. The size of plastic bag ranges from large 40L, medium 20L and small 10L.

6 Requests for assistance from the citizens

(1) Request for assistance for the changes in waste sorting.

Briefing sessions were held for the citizens regarding the changes in waste sorting and the collection dates.

- PR Posters, brochures, distribute category listed in order of the Japanese characters, public information, circulation, city website
- Briefing sessions It was held about 340 times between May and December in 2000 (within 8 months)
- Garbage sorting start October, 2000

(3) Implementation of the pilot project

In order to understand the amount of collection, to verify the system of collection, and to research the conditions of sorting, the pilot project was conducted for 3 months from July to September, 2000 in two districts in the city with the cooperation from the residents.

- The result of implementation of the pilot project revealed that easier criteria of sorting were needed. Therefore, a chart of sorting criteria was compiled based on 300 items that were most frequently inquired about during the period of the pilot project, and each resident received a copy of the chart on which the items were listed in order of the Japanese characters.

7 The waste sorting facilities development

(1) The processing facilities development along with the changes of waste sorting

a. The development of the compression baling facilities for waste consisting of plastic containers & wrap

- Compression baling facilities for waste consisting of plastic containers & wrap in Ube city
- Facilities capacity 12.5t/5h
- Facilities development cost 138,600,000 yen
- Construction area 520m²
- Facilities details Plastic compactor, binding machine, 6-side wrapping machine

b. The facilities for sorting waste consisting of paper containers & wrap

Storing facilities for waste consisting of paper containers & wrap

- Storing facilities for waste consisting of paper containers & wrap
- Equipment capacity 6.5t (per week)
- Facilities development cost 16,800,000 yen
- Facilities area 240 m²

8 Cooperation with citizens

(1) Education about how to separate the waste at the waste station

The city is carrying out a “Waste Reduction Promotion Member System” (volunteers). They educate people how to separate the waste and streamlining of waste. There are 1,090 members around each district.

(2) Waste reduction with citizen’s participation

- Group collection

Collecting items; koshi, old fabric, metals, and bottles

Bounty Amount of collection ¥5/per kg

Actual result (2002) Registered group 375 groups
Collection amount 6,360t (Koshi 90%)
Bounty ¥31,801,235

- Purchase expenses support for kitchen waste automatic processing container

Subsidy Electric container (2000~) ¥20,000 (up to one unit)

Non-electric container (1994~) ¥2,500 (1/2 of buying price and up to one unit)

Actual result (2002)

Electric container 281 units, the amount of subsidy - ¥5,552,939

Non-electric container 228 units, the amount of subsidy - ¥433,652

9 The effectiveness of the waste sorting

<The amount of combustible waste discharged>

Unit: t/year

Year	Collected by city	Self-delivered	Total	Compare with a previous year
2000	35,650	27,304	62,954	1.01
2001	33,023	29,548	62,571	0.99
2002	31,711	22,803	54,514	.087

<Table 9-1>

Category	December 2002 (Actual result)	2002 (Target amount)
Collection combustible (collect at the waste station)	75.55 t/day	96.31 t/day
Self-delivered combustible	59.15 t/day	50.05 t/day
Combustible from recycle plaza	3.09 t/day	2.49 t/day
Total	137.79 t/day	148.85 t/day

<Table 9-2>

* Due to the effectiveness of designated plastic bag from November, reduction in waste was achieved in December, 2002 when the new incineration facilities were activated.

<Container & wrap (Ube city)>

Unit: t/year

	Plastic container & wrap	Paper container-wrap	Total
2000	922	245	1,167
2001	1,927	546	2,473
2002	2,448	628	3,076

<Table 9-3>

As a result of the changes in the waste sorting system in October, 2000, the year 2001 produced 99% of the previous year’s waste. Continued recycling saw the year 2002 reduce waste to 87% of year 2001. The amount of the waste was 149t per day. This is below the reduction goal amount of 154.76t/day that was to

be achieved by constructing the new incinerating facilities. This waste reduction was achieved at the same time as the activation of the new incineration of waste was made possible.

10 The future approaches

(1) The maintenance of waste sorting with the cooperation from the citizens

- Suppression of waste amount will be aimed at by continuing to raise awareness and inspiration for thorough sorting

(2) Business waste reduction

- The recognition system for the excellent businesses (from 2003): by the use of the Ube city's public information and other means to support the effort to reduce waste of the businesses that actively cut down the use of plastic bags, suppress the amount of waste, and reuse the waste materials.

The number of recognized businesses (from 2003)

Eco-shop category 11

Business institution category 6

- The waste reduction proposal (from 2003): to establish the recycling/waste reduction proposal

The number of the business institutions 113

(3) The effective operation of the waste incinerating facilities

- The reduction measures of the supporting gas (kerosene)

The amount of the supporting gas (kerosene) has increased, since the waste caloric declined due to the sorting of the high caloric waste, such as the waste consisting of plastic containers & wrap. As an economizing measure for the cost, the operation of the incinerators is to be aimed at. (The average caloric value of the waste at the time of the planning of the incinerating facilities was 2,100kcal/kg. Currently, it is approximately 1,800kcal/kg.)

- The effective use of waste heat

Reviewing the amount of the evaporation from the waste heat boilers will increase the production of electricity.

- The effective use of materials such as slag

Melted slag and fly ash that are generated in incineration will be effectively used.