1992 TRIPARTITE CONFERENCE

JAPAN ISSUES

September 2~4

Washington D.C.

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NAME OF JAPAN PVC ASSOCIATION ATTENDANTS
(TRIPARTITE CONFERENCE)

CHIEF DELEGATE

TOSHIAKI YAMAGUCHI Chairman TOSOH CORPORATION	President Japan PVC Association

DELEGATE

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TSUTOMU UEDA PVC Product Manager Plastics Division NIPPON ZEON CO., LTD.	Special Committee on Waste & Recycle, Member Sub-Committee on Overseas Relation

2. REGIONAL UPDATES JAPAN

By Masamitsu Hashimoto

REGIONAL UPDATES
JAPAN

For Tripartite Conference
Washington, D.C.
September, 2-4, 1992

By
Mitsumasa Hashimoto
Nippon Zeon Co., Ltd.
Chairman, International Committee
Japan PVC Association

Good morning, Ladies and gentlemen.
My name is Mitsumasa Hashimoto. I am from Nippon Zeon Co. and I am the Chairman of the International Committee of the Japan PVC Association, JPA.

We, the delegates from the JPA, are very pleased to have the first Tripartite Conference in the Capitol of the United States. We would like to thank the United States Vinyl Institute for their tremendous efforts, and the European ECVM for their positive support in making this meeting possible. We are very proud to be attending here.

Almost one year has passed since an exchange of opinions about PVC waste treatment was made with people of ECVM in Brussels. Also, about a half year has passed since a frank discussion was held with the representatives of the U.S. Vinyl Institute in Tokyo in order to set up this Tripartite Conference. Since then, the attitude of the public concerning environmental issues has not changed basically. If anything, the importance of environmental issues has grown to a global scale. Each individual as an inhabitant on this globe has to take responsibility in solving this largest remaining problem of the 20th century as soon as possible.

We believe that the participants of this Conference recognize this basic responsibility and the importance of the PVC waste problem, although it may be a small problem among the whole of environmental

issues. It is our wish to draw some meaningful conclusions from this Conference.

Now, I would like to report on the measures being taken on the PVC waste problem in Japan.

Although efforts are being made to reduce the volume of waste, the quantity of general city waste has been increasing, and is becoming a large social problem. Since most of the municipalities lack sufficient landfill space, about 74% of the total city waste of 133,000 tons/day is being incinerated. Further promotion of recycling in addition to reduction of waste volume is being awaited.

The Japanese government has enacted "The Resource Recovery and Recycling Promotion Law" in April, 1991 to urge the public for recycling activities by pointing to specific business areas and products as targets. Through this Law, the government, industries and general public are cooperating with each other to promote material recycling.

In addition, industrial waste is being handled by each business operator under the "Waste Disposal and Public Cleaning Law," which was revised in October 1991 to reinforce the responsibilities of the business operators. Before the revision, the responsibilities of businesses had to do just with an appropriate treatment of waste and the maintenance of the general living environment. The

revision added the responsibilities of control of waste generation as well as proper sorting, storage, transportation and recycling of waste. By this Law, the government, the industries and the public are called again to join together to promote waste treatment, because of the clear responsibilities shared between them.

JPA recognized the importance of the waste treatment issues and has been working on countermeasures since April, 1990. In November 1990, the Special Committee on Waste and Recycling was formed as an official function of JPA to positively seek effective measures of PVC waste treatment.

Furthermore, the Japan PVC Recycle Promotion Council was formed in October, 1991, to include, not only the resin manufacturers, but also the PVC product manufacturers, in order to further effectuate the waste treatment activities. The Council consists of JPA and several organizations related to PVC products: Japan PVC Pipe Association, Japan Rigid PVC Sheet Association and Japan Vinyl Goods Manufacturers Association. Mr. Yamaguchi, the Chairman of JPA, is also the Chairman of the Council. Mr. Matsui, the Executive Director of JPA, also acts as the Director of the Council.

The Council, through its operations of PVC recycling systems and PR activities, provides each individual company with specific information for waste treatment. It also plans and directs the development of technology and know-how, conducts R & D for new

applications of recycling and energy recovery systems, establishes more effective recycling methods, and works to spread correct information on PVC products.

Among the activities of the Council, material recycling is the most important item. It should be noted that, in Japan, about 40% of agricultural vinyl film (more than 40,000 tons/year) is being recycled. In addition, we are working on the recycling of more popular products in a demonstration plant to show the recyclability of PVC. Such products include PVC bottles and egg packs as well as wasted PVC pipes. We believe that these activities will help spread the notion that PVC is easily recyclable.

The next issue is incineration. In Japan, 74% of city waste is incinerated, but most of the industrial waste is disposed through landfills. Most of the PVC product waste is also landfilled. To solve this landfill problem, we have made a contract with an outside R&D firm to conduct simulations to facilitate the recovery of energy or useful resources out of industrial waste which contains high concentrations of PVC. Eventually, we are hoping to design a non-polluting incineration plant in near future.

Our public relations activities have been consistent and persistent. When a Japanese newspaper reported that PVC was a culprit of acid rain and, therefore, should be eliminated, we fought back to correct the misunderstanding. More recently, through the Council, we started providing the public with

information about global scale waste problems. In addition, we started publishing newsletters and pamphlets, taking part in exhibitions, and writing articles and advertising in newspapers, in order to spread correct knowledge on PVC products.

The PVC consumption in 1991 and 1992 in Japan is expected to decrease due to the recent recession; however, we have not seen large scale switching from PVC to other resins because of the environmental problems of PVC, although minor switching has been observed in packaging fields. It was also noted that the PVC-phobia by consumers seemed to have declined as compared to the last year. It is important to note that news from the U.S. and Europe has had a tremendous influence on the public perception of waste problems. It would be nice if we can spread correct information throughout the world by the close team work efforts of this tripartite group.

We believe that the PVC waste problems will be first handled by recycling, but the final solution must be through incineration. It is imperative to understand the necessity and importance of recycling, but, at the same time, the cost associated with recycling must be understood by the public. It will take time, but only a continuous effort will be effective in educating the public.

Before concluding my report, I would like to introduce to you Mr. Toyama who will succeed me as the Chairman of the International Committee of JPA. Please give him the same warm cooperation as you

have kindly given to me.

Thank you for your attention.

3. INCCINERATION OF MUNICIPAL WASTE AND WASTE PLASTICS

By Tsutomu Ueda

By Masayasu Suzuki

THE KEY ISSUE

(Incineration)

JAPAN

TRIPARTITE CONFERENCE

WASHINGTON D.C.

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September, 1992

INCINERATION OF MUNICIPAL WASTE AND WASTE PLASTICS

Japan PVC Association

Tsutomu Ueda
(Nippon Zeon Co.,LTD.)

Masayasu Suzuki
(Kureha Chemical Industry Co.,LTD.)

Ladies and Gentlemen, my name is Ueda. I am from Japan PVC Association, and wish to present to you the status of municipal waste and waste plastic incineration in Japan.

The waste plastics have become a major social problem in the advent of 1990's. The inherent merits of plastics such as their resistance against decomposition have created problems in turn, in the waste disposal issue.

Japan has no other choice than incineration for disposal of municipal waste due to its small national areas and yet smaller space for landfill of wastes, and consequently has come to possess uncomparably large number (1,900) of incineration facilities in advanced systems with excellent processing technologies. In U.S.A. and Europe, the treatment of municipal waste has primarily been dependent on landfill. However, in recent years, the locations for landfill have become scarce and the construction of incineration facility has become increasedly difficult due to the resistance from the residential people. Accordingly, recycling of waste plastics has been promoted actively.

Among the plastics, PVC has been subjected to various misunderstandings due to its content of chlorine in the molecular structures. However, as the result of various efforts to remove such misunderstandings, proper understandings of PVC have been gradually propagated of late. This paper attempts to explain the present status and future subjects of the municipal waste and waste plastics, especially PVC, incineration.

1. MUNICIPAL WASTE DISPOSAL IN U.S.A., EUROPE AND JAPAN:

TABLE 1 shows the municipal waste generation, the number of incineration facilities, the quantity of incinerated waste and the incineration ratio in U.S.A., Europe and Japan surveyed by Plastics Waste Management Institute in Japan. The incineration ratios out of the methods of municipal waste disposal are respectively 10 % in U.S.A., average 31 % in Europe and 72 % in Japan, which is remarkably high.

TABLE 1: WASTE INCINERATION IN JAPAN, U.S.A. AND EUROPE (1986)

Country	Population (10^6)	Municipal Waste Generation (10^4 t/y)	Waste per Capita (Kg/y)	Number of Incineration Plant	Incinerated Quantity (10^4 t/y)	Incineration Ratio (%)
Japan	122	4.296	352	1.899	3.086	72
U.S.A.	232	14.300	618	157	1.430	10
Austria	6	160	270	3	35	22
Belgium	10	280	280	29	132	47
Switzerland	6	220	370	34	170	77
West Germany	60	1.900	320	47	650	34
Denmark	5	180	360	46	145	81
France	54	1.700	315	284	700	41
England	57	1.800	320	38	180	10
Italy	57	1.400	250	80	250	18
Holland	14	430	310	11	170	40
Sweden	8	250	310	23	140	56
Europe Total	277	8.320	300	595	2.572	31

NOTE: According to the report for 1990, the incineration ratio for U.S.A. was 14 %, while Europe Average was 33 %.

2. PROCESS LEADING TO INSTALLATION OF INCINERATION FACILITIES IN JAPAN:

The reasons for installation of so many incineration facilities in Japan are partly due to its small national areas, making landfill very difficult and no other choice but incineration as the effective method of bulk reduction, and the efforts to win the consensus of the residential people. According to the results of survey by questionnaire conducted by The Prime Minister's Office of Japan, about a half of the respondents expressed their agreement (including those with conditional consent) to the hypothetical question of waste treatment facility installation close to their residences.

TABLE 2: YES/NO FOR INSTALLATION OF A WASTE TREATMENT FACILITY

(Number of Respondents: 2,443)

YES	3.2 %
Conditional YES	41.2 %
NO	47.5 %
Reserved	8.0 %
Others	0.1 %

However, in almost all cases of actual project for installation of the incineration facility, objections are raised by neighboring residents. The reasons of their opposition are air pollution, odor, insufficient measures against public nuissances such as increased car traffics, and fear for adverse effects on health. If the actions taken by the local government, etc. in such event are proper, no serious dispute takes place under normal circumstances, and negotiations on the measures to prevent pollutions, compensations, and the construction conditions for beneficially facilities for the local community will proceed.

On the contrary, if the terms and conditions proposed by the local government, etc. are not acceptable to the neighboring residents, disputes will escalate.

However, complete cancellation of the construction project itself would not be feasible even with a long period of opposition. Because, the generation of municipal waste is the results of day-to-day life of the residents themselves, and the waste treatment facility is indispensable for the life of people. Thus, both parties would have to find a reasonable ground of negotiations and construction of waste incineration facility is executed upon full consensus of the local residents after elapse of sufficient time in Japan.

3. STATUS AND FUTURE SUBJECTS OF WASTE PLASTIC INCINERATION:

The plastics production in Japan was about 12.6 million metric tons in 1990, and the amount of waste plastics was estimated to be about 5.5 million metric tons. Of the waste plastics, about 3.1 million metric tons were the domestic waste and about 2.4 million metric tons were the industrial wastes. 66 % of the waste plastics were incinerated, while 22 % were landfilled and 12 % were recycled. Majority of industrial waste plastics was landfilled, as the incinerator exclusive for plastics is scarce in number. The technical development of incinerator exclusive for plastics is an urgent issue of the day.

The problems associated with incineration of waste plastics are as follows:

① Combustion chamber will have to be designed properly, as plastics have high heat values, raise the temperature and cause damages inside the combustion chamber.

② The combustion speed of plastics is very high when compared with that of domestic municipal waste, and black smoke is generated by incomplete combustion resulting from shortage of air supply. Proper operational control will, therefore, be required.

③ Incineration of PVC generates hydrogen chloride gas which is highly corrosive to auxiliary equipments of the incinerator. The facilities must be designed and the operation must be controlled to maintain the surface temperature of the heat recovery facilities within the range of 150 ~ 300 ℃, in order to prevent the high temperature corrosion over 300 ℃ and the low temperature corrosion below 150 ℃.

Alkali is used to remove hydrogen chloride in the exhaust gas. Caustic soda has a higher removal efficiency, but the running cost and installation cost become higher as well. Less expensive slaked lime has a lower removal efficiency and disposal of by-produced calcium chloride would pose a problem.

④ Heavy metal compound such as lead compound is used in some of the PVC products. Majority of these heavy metals remain in ashes. The ashes are landfilled under special control to isolate them from direct contact with soil or sea water. Furthermore, dust caught by the precipitator has been specified as the waste requiring special control in The Waste Disposal and Public Cleansing Law as revised in July, 1992, and their collection, transportation and disposal have been subjected to special control.

4. STATUS OF TECHNICAL DEVELOPMENT CONCERNING INCINERATION OF PVC:

The waste plastics contained in municipal waste are disposed by incineration without any problem, and hydrogen chloride generated from PVC is also sufficiently removed from the exhaust gas. Although the number of incinerators exclusive for industrial waste plastics is not many in Japan, one good example will be the industrial waste treatment facility in Ishikawa Prefecture, Japan. This is a facility to incinerate industrial wastes such as waste PVC from agricultural applications, other plastics, rubber and waste fibers, which are otherwise difficult to be burned by the municipal waste incineration facilities, along with sludge from the waste water treatment plants, having a continuous fluidized-bed combustion chamber with 10 metric tons per day of 16 hours capacity. The highest heat value of materials to be processed with the facility is 6,700 KCal/Kg. Dry system is adopted for the exhaust gas treatment, and slaked lime or calcium carbonate is used. The Japan PVC Association conducted incineration experiments with this facility for polyethylene, polystyrene and PVC in cooperation with Plastic Waste Management Institute. PVC was incinerated in mixture with polyethylene at the ratio of 1:9. Each of

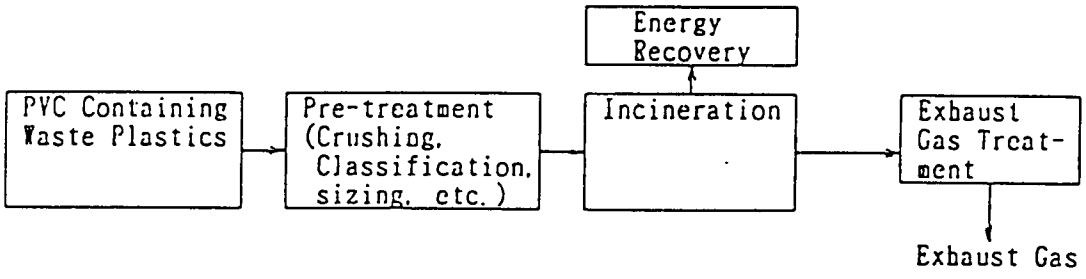
the abovementioned plastics could be incinerated in stable conditions and the removal rate of hydrogen chloride from the exhaust gas was sufficiently high. However, experiments on PVC mixes higher than 10 % could not be made.

Incineration of waste PVC generates hydrogen chloride and involves a number of problems to be solved. Recycling might be one of the methods of treating waste PVC. But, regardless of the number of recycling, the products will ultimately be disposed of as waste, and therefore, its treatment can not be totally eliminated. It will be rather necessary to develop technologies for positive incineration, including recovery of hydrogen chloride, of waste PVC.

Resource/Energy Recovery Working Group has been organized as one of the working groups with Japan PVC Recycle Promoting Council. Specifically, the working group is studying the recovery of hydrogen chloride generated from incineration of PVC containing wastes and the recovery of heat energy in the form of electricity, steam and hot water. Basic engineering of a pollution-free incineration plant has been worked out by taking these recoveries into consideration. FIG. 1 shows the two types of system flow now under study. One is the incineration type and the other is the gasification type.

FIG. 1: SYSTEM FLOW FOR RECOVERY OF RESOURCE/ENERGY FROM PVC CONTAINING WASTE PLASTICS

1) System Flow 1: Incineration Type



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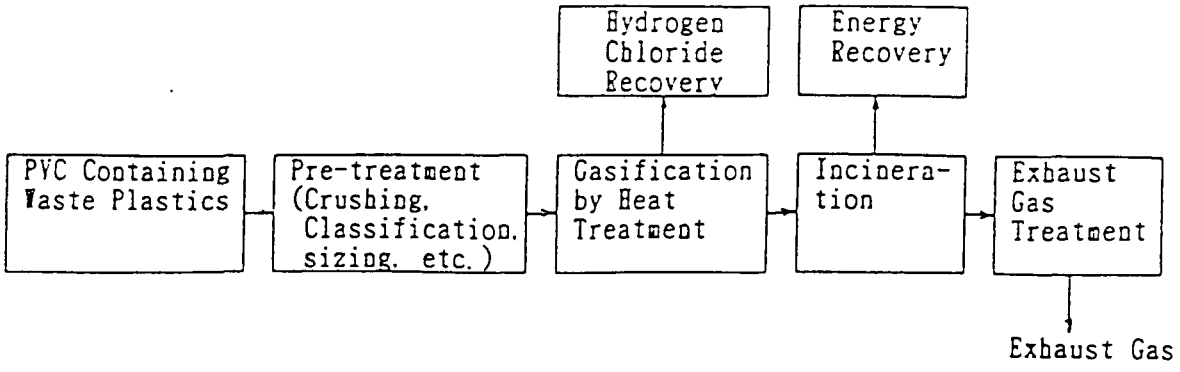
2) System Flow 2: Gasification Type



Model calculations have been conducted for respective cases by selecting PVC contents in the waste plastics to be 10 %, 30 %, 50 % and 100 %, processing capacities to be 200 Kg/hr., 1,000 Kg/hr. and 5,000 Kg/hr., and by setting forth variety of other conditions as well.

The work is scheduled to be completed by March, 1993, followed by demonstration experiments on a test plant.

Thank you.

4. THE CURRENT SITUATION OF PLASTICS WASTE INCINERATION IN JAPAN

By Masayasu Suzuki

THE BREAK-OUT ISSUES

(I)

(Incineration)

JAPAN

TRIPARTITE CONFERENCE

WASHINGTON D.C.

September 1992

The Current Situation of Plastic Waste Incineration in Japan

Masayasu Suzuki
Plastics Department, Kureha Chemical Indudtrial Co., Ltd.

1. Incineration of municipal waste

The quantity of waste in Japan is increasing in proportion to its economic growth. According to the Ministry of Health and Welfare, the amount of waste produced from people's daily life was 130 thousand tons per day in 1989 in comparison with 113 thousand tons in 1980. The recent statistics report that about 1 kg per head of waste is produced everyday. It is pointed out that the increase is mainly attributable to the business such as offices rather than the household. There are two methods of waste disposal: incineration and landfill. The difficulty to find places for landfill due to a smaller area for the population of our country and the advanced development of land causes to increase the incineration of waste.

To cope with the situation, the construcition of incinerators increased reaching a peak in 1972. Regarding the type of incinerator, a fluidized bed incinerator with a high capacity and a good heat resistance became popular since 1977. The percentage of the incineration increased to 73.9% in 1989 as compared with 60.4% in 1980.

During these years, the composition of waste also has been changing. An example of Osaka city indicates a remarkable increase of papers and plastics in combustible waste compared with those in early 1970s when the construction of incinerators began to increase. The calorific value of the waste in incineration was exalted accordingly, and the problem of heat resistance has been aroused for the type of incinerators.

The following research to develop the incineration technology to burn up the waste with high calorific values has been carried out in Tokyo.

The construction of a new type incineration plant which is able not only to incinerate the waste with high calorific values but also positively to utilize the combustion heat started. Many incineration plants are now using steam and hot water obtained by the combustion heat to provide heating within the plant and a heated swimming pool or local air conditioning. Among the waste incineration plants in Japan, 100 plants have power generation

facilities in operation in 1990, and 30 such plants will be added by the end of 1994.

Table 1. Research and development on the incineration of high calorific waste in Tokyo

Plant	Ohta incineration plant 2nd factory	Experimental facilities for source segregated waste in Tokyo	Facilities for treatment of crushed waste in Tokyo
Capacity	600 t/day	50 t/8 hr, 1 unit	180 t/day (under construction)
Main component	Source segregated waste (plastic content: max 40%)	Plastic content: max 33%	Large-size waste, crushed waste
Max calorific value	About 4200 kcal/kg	About 4900 kcal/kg	About 3800 kcal/kg
Furanace type	Rotary kiln + stoker furnace	Rotary kiln	Fluidized bed furnace
Combustion method	Heat-decomposed gas combustion	Intensive combustion	fluidized combustion
Ash disposal	Fe elimination, slug by electric furnace	Landfill	Landfill
Problem etc.	Clinker by-product	Clinker by-product Restricted optimum operation conditions	

(Source: The Tokyo Metropolitan Government)

The actual results of the electric power generation from waste incineration in 1990 are summarized as follows: the approved power capacity is about 300,000 kW in Japan. There are 46 power generation facilities installed in the waste treatment plants. They sell the power to electric power companies as much amount corresponding to 43% of the total power they generated.

Table 2. Power purchased by electric power companies from waste treatment plants (1990)

Number of waste facilities sold power	46
Approved capacity	ca. 220 × 10^3 kW
Power generated (a)	ca. 1350 × 10^4 kW
Power sold (b)	ca. 580 × 10^4 kW
Ratio (b/a)	ca. 43%

(Source: Federation of Electric Power Companies)

The capacity of power generation facilities installed in waste treatment plants are

distributed from 500 kW to 22,000 kW (start in 1994) and are centralized at around 1000-5000 kW.

On the other hand, the incinerator capacities per turbine generator are concentrated at around 300-400 t/day.

The energy recovery efficiencies are different in a range of 5-50% according to the type of plant. The recovery ratios for the power generation are not exceeding 10% in most plants.

The power generation in the waste treatment plant has the difficulties as shown below.

Economical problem: chiep selling price of power due to a poor confidence of power generation (occurrence of troubles such as power failure) and insufficient quality (fluctuation of power).

Technical problem: corrosion in equipment such as furnaces and boilers.

At the end of this section, the smoke emission standards for the exhaust gas from incinerators are shown in Table 3.

Table 3. Smoke emission standards

Item	Particulate matter		
Emission standards	Continuous incinerator		Others
	Less than 0.2 g/Nm^3	Less than 0.7 g/Nm^3	Less than 0.7 g/Nm^3
Remarks	Exhaust gas More than 40,000 N^3/h Special emission standards Less than 0.1 g/Nm^3	Exhaust gas More than 40,000 N^3/h Special emission standards Less than 0.2 g/Nm^3	Special emission standards Less than 0.4 g/Nm^3
Item	Sulfur oxides	Hydrogen chloride	Nitrogen oxides
Emission standards	Less than Q (Nm^3/h) when calculated based on: $Q = K \times 10^{-3} \times He^2$	Less than 700 mg/Nm^3 Calculated in terms of $O_2 = 12\%$	250 ppm Calculated in terms of $O_2 = 12\%$
Remarks	He: Effectibe height of a stack K: A value set by area	Less than 430 ppm in terms of concentration	Exhaust gas More than 40,000 Nm^3

2. Incineration of plastic waste

The production and estimated amount of waste of plastics in Japan, as shown in Table 4, were 12.63×10^6 tons and 5.57×10^6 tons in 1990 in comparison with 7.25×10^6 tons in 1980, respectively. Both production and waste during the decade have increased to about 1.7 times in parallel.

Table 4. Estimated plastic waste generation

Year	Plastics output (1,000 t/ year)	Woult-be plastic waste	Generated plastic wastes				
			Total	Municipal (1,000 t/ year)	(%)	Industrial (1,000 t/ year)	(%)
1976	5,802	3,702	2,567	1,444	56	1,123	44
1977	5,849	3,603	2,616	1,452	55	1,164	45
1978	6,748	4,431	2,650	1,446	55	1,204	45
1979	8,210	6,065	2,853	1,545	54	1,308	46
1980	7,518	5,523	3,258	1,784	55	1,474	45
1981	7,038	5,179	3,490	1,974	57	1,516	43
1982	7,135	5,343	3,538	2,025	57	1,513	43
1983	7,812	5,790	3,685	2,148	58	1,537	42
1984	8,914	6,627	3,988	2,171	54	1,817	46
1985	9,232	6,994	4,188	2,317	55	1,871	45
1986	8,374	7,296	4,258	2,502	55	2,026	45
987	10,032	7,916	4,656	2,604	56	2,052	44
1988	11,016	8,613	4,878	2,761	57	2,117	43
1989	11,912	9,574	5,060	2,911	58	2,149	42
1990	12,630	9,994	5,569	3,127	56	2,442	44

Note: (Would-be plastic wastes) = (Plastics output) − (exports) + (imports) − (liquid resins) − (synthetic fiber PVC, PE, PP)

Source: PWMI

The plastic waste is divided into municipal waste and industrial waste, and the ratio between them has been kept almost constant at about 55:45 during the decade.

It should be helpful for the estimation of the content of waste to investigate the actual applications of plastics. The plastics production in 1991 was about 12.8×10^6 in which PVC occupied about 16%. Concerning the applications, films/sheets are dominant being used for vessels, especially as container and other wrappings for food, etc. These goods are characterized by their short life to be discarded as municipal waste which is inevitably disposed by incineration.

Their exhist also plastic products used for a long time. In consideration of these long life products, the amount of waste plastics incorporated into the municipal waste is estimated to be 2.9×10^6 tons/year. Since the amount of the mumicipal waste is estimated as 45×10^6tons/year, the content of waste plastics is calculated as 6.5%.

The results of incinerator manufacturers' investigation on the incineration of plastic industrial waste are summarized as follows.

(1) Capacity: incinerators treating wastes with high calorific values exceeding 4000 kcal/kg are generally of small capacities below 50 tons/day.

(2) Type: general trend is stoker type for small size, rotary kiln type for middle size, and fluidized bed type for large size incinerators.

(3) Operation time: most incinerators (82%) operate for 24 hours.

(4) Pretreatment equipment for wastes: 70% incinerators are equipped with: 50% with crushers, 25% with a dehydration machines.

(5) Waste composition: 61% incinerators treat wastes of plastic content not exceeding 30%. Waste containing PVC is about 46%.

(6) Exhaust gas treatment device: 92% incinerators equipped with.

(7) Heat recovery: 91% incinerators recover steam.

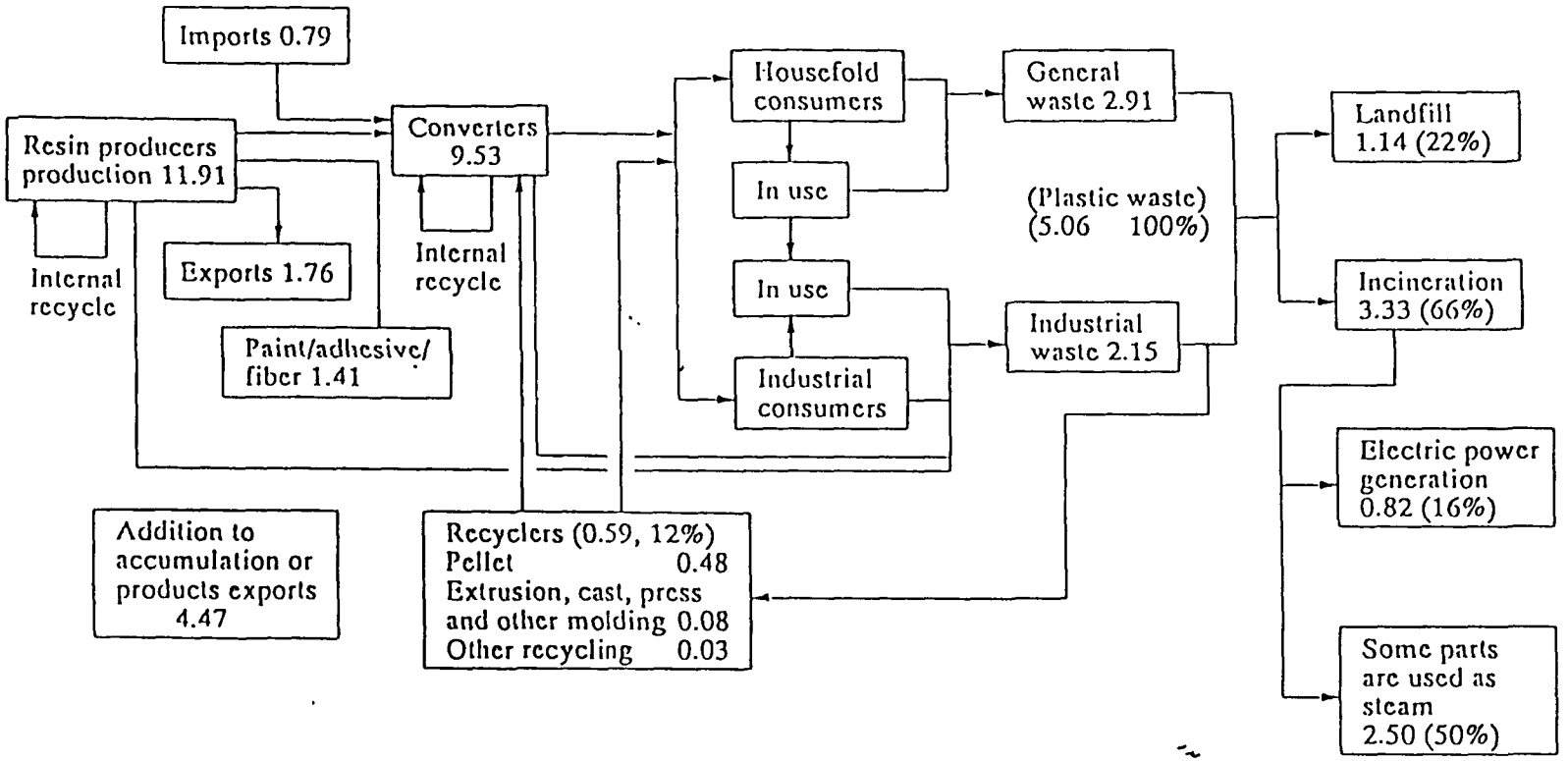


Fig. 1. Material balance for plastic waste management and recycling stream in Japan (1989) Unit: 1,000,000 t

Source: Plastic Waste Management Institute

3. Incineration of PVC rich waste

The shortage of land suitable for the reclamation with industrial waste is making the disposal difficult year by year in Japan. The incineration treatment of plastic waste is increasing recently. However, the plastic waste containing PVC, which generates hydrogen chloride during incineration, has problems such as corrosion in incinerators and neutralization treatment for exhaust gases. Although the incineration of PVC is apt to be evaded, it should be necessary to make the incineration of PVC of PVC rich industrial waste possible.

Under these situations, Japanese PVC Association (JPA) in cooperation with a group of PVC processer establish Japan PVC Recycle Promoting Council (JPPRPC) for the purpose of promoting the recycle of PVC. However, it is inevitable that the recycled PVC products must be finally treated as waste PVC or PVC rich waste to be incinerated.

A plan to design a model system which is able to treat waste PVC or PVC rich waste by incineration was undertaken. The research was entrusted to The Society of Chemical Engineers, Japan for the implementation of this plan. The summary of the plan is shown as follows.

Two processes fo the incineration treatment are considered. The one is a direct incineration method and the other is a gasification method in which the waste is gasified in the preliminary step of incineration and consequently, after hydrogen chloride being recovered, the resit is burned up.

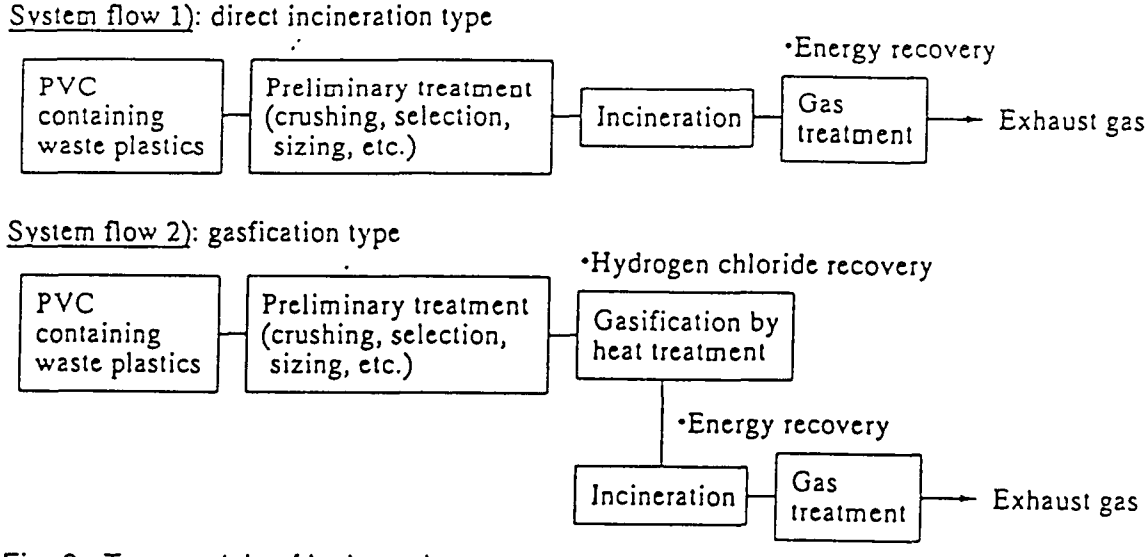


Fig. 2. Two models of incineration

The simulation for the above two incineration methods is conducted. The data of the incineration conditions (input data for simulation) are estimated from the properties and the form of current PVC waste as shown in Table 4. Moreover, the items for investigation such as operation conditions are added.

Table 5. Conditions for PVC waste treatment system (direct incineration type)

<Conditions for the waste received>

Item		Conditions			
Heavy metal (as Pb)		2% to PVC			
PVC content (as rigid PVC)		10%	30%	50%	× 100% (only 200 kg/h)
Water content (% w/w)		5%	20%	50%	
Noncombus-tibles	Concrete, glass, iron, etc. (as earth & sand)	0% and 50% to the rest (other than PVC)			
Combustibles	Wood, papers	50% and 100% to the rest (other than PVC)			
	Other plastics (as PE)	Same as above			
Pretreatment (crushing, selection)		Yes and no			

<Conditions for treatment>

Item	Conditions		
Operation type	8 h/day (intermittent)	24 h (continuous), 8,000 h/year	
Treatment capacity	200 kg/h	1,000 kg/h	5,000 kg/h
HCl content in exhaust gas	10 ppm	50 ppm	100 ppm
Others (fly ashes, ashes, dioxine, NOX, N;O)	Within the standards		
Fuel (auxiliary)	Kerosene		

1) Investigation on technical information and summary

① Determination of investigation items

② Investigation by JICST, PATRIS

- Pretreatment technology for waste plastics
- Heat treatment technology
  - a) Incineration technology
  - b) Heat decomposition technology
- Gas treatment technology
- Resouces recycling technology

③ Summary of investigation results

2) Investigation on manufacturers

① Determination of investigation items

② Selection of manufacturers to be investigated

③ Preparation of action program for investigation

④ Investigation implementation

⑤ Preparation of investigation summary

3) Examination of system flows

① Preparation of typical system flows

② Determination of target system flow

③ Examinaiton of system flows

④ Collection of basic data

4) Examination of elemental technologies (unit operations)

① Preparation of elemental technologies list

② Arrangement of each unit operation and determination of conditions for respective operations

5) Calculation of material and heat balances

① Investigation on calculation methods, arrangement of each method

② Development of application methods by improvement and modificaiton of calculation methods

③ Implementation of calculation

6) Establishment of calculation method for treatment cost

① Clarification of basic conditions and assumptions

② Selection of equipment types

③ Depreciation expenses (system equipment, peripheral equipment, buildings, etc.)

④ Utility cost

⑤ Labor cost

⑥ General administrative expenses

⑦ Other expenses

7) Arrangement and selection of input data

① Quantity of treatment, PVC content, etc.

② Data for variable expenses such as utility cost

③ Prices of recovered and recycled products

8) Implementation of model calculation (calculation of treatment cost)

① Calculation of total expenses

② Appraisal of treatment plant based on each model calculation

③ Implementation of case study, preparation of summary

9) Preparation of resport

An interim report on the simulation of the direct incineration process is expected at the end of November, and the final report including the gasification process will be finished in March 1993.

The typical incineration treatment process will be selected based on this simulation. The plan for the actual plant construction will be presented. This plan is to be distributed to those having interest in the incineration process for PVC rich waste.

5. INTRODUCTION OF INCINERATION FACILITIES FOR MUNICIPAL AND INDUSTRIAL WASTE AND PROCESS FOR PRODUCTION OF SOLID FUEL

By Tsutomu Ueda

THE BREAK-OUT ISSUES

(II)

(Incineration)

JAPAN

TRIPARTITE CONFERENCE

WASHINGTON D.C.

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(Cases of incineration in Japan)

Introduction of Incineration Facilities for Municipal and Industrial Waste and Process for Production of Solid Fuel

Tsutomu Ueda
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The incineration facilities for municipal waste containing an amount of plastics and industrial waste and the process for production of solid fuel in Japan are introduced.

1. Incineration of municipal waste contining an amount of plastics (the Ohta incineration plant in Tokyo)

In Tokyo, municipal waste is divided into combustible and source segregated (unsuitable waste for incineration) waste and each of them is collected on different days. The most part of the combustible waste is treated by incineration and the most part of segregated waste is treated by landfill. However, because of the difficulty to find the place for landfill in the Tokyo bay area, the incineration of the segregated waste has become necessary recently.

The Ohta incineration plant is the only facilities that can incinerate the source segregated waste.

The composition of combustible and source segregated waste in Tokyo in 1990 are shown in Figure 1.

In the Ohta incineration plant, the combustible waste containing about 8% plastics (PVC about 0.8%) is incinerated in the 1st factory, and the waste containing about 20% plastics (PVC about 2%) is incinerated in the 2nd factory. The ashes from the two factories are melted to reduce their volume. Each factory has three incinerators, and each of these 6 incinerators has a capacity of 200 tons per day to make up the total capacity to be 1200 tons per day.

The incinerators in the 1st factory are of conventional type. The combustible waste is burned up being transferred on fire grates according to the steps of combustion. The incinerators in the 2nd factory are a rotary kiln type specially developed for the treatment of

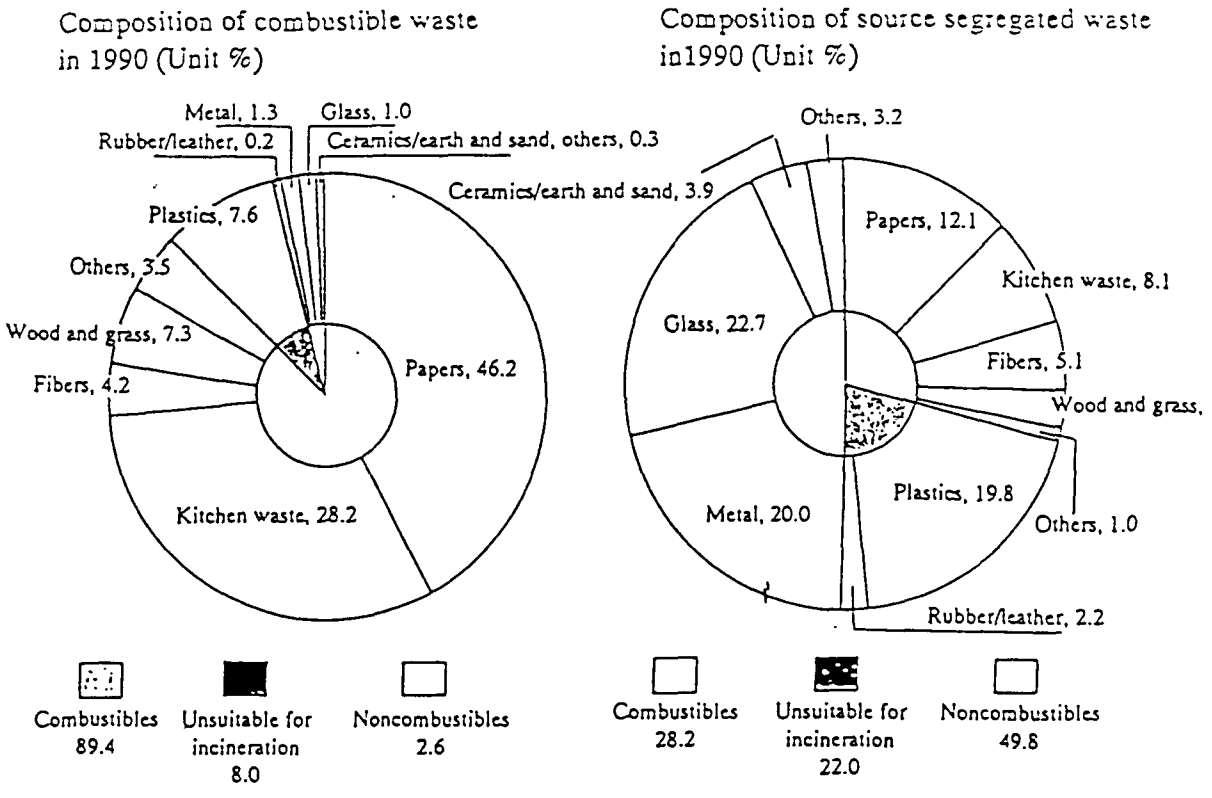

Fig. 1. Composition of waste in Tokyo

the source segregated waste. The combustion of the waste in the kiln is controlled by keeping the oxygen content at a relatively low level so that the waste decomposed thermally generates a flammable gas which is to be burned in the after buring room.

There are two ash treatment facilities, each having a capacity of 250 tons per day. The ashes are melted at 1400 ℃ by electrodes in a melting furnace. The molten ashes are pulverized by rapid cooling with water to be taken out as particle slugs. The volume of ashes is reduced by the conversion into slugs in which harmful components are confined.

The operations of main equipment in the Ohta incineration plant are throughly automated and labor-saved. The combustion heat is recovered by a waste heat boiler and converted into electric power by a steam turbine generator. The power is not only used in the plant but also sold to an electric power company. This lates pollution control facilities can give favorable results exceeding the target values which are already far below compared with those of legal regulation as shown in Table 1.

As the measures against odious odor, the air in a waste pit is sent into the incinerator in which the odor components are completely decomposed at high temperatures due to the combustion heat so that an odorless atmosphere in the factory is attained. Garbage trucks go

out from the factory after being washed by a car-washing machine. A green belt around the plant site as well as green tracts of land near the buildings are making the plant amiable with lots of trees.

On the construction of this plant, the environmental assessment was carried out for five years. The agreement with residents in the area within a radius of 5 km was obtained. The plant was completed after the construction period of 7 years spending 80 billion yen.

Table 1. Antipollution measures in the Ohta incineration plant

Item	Facility	Unit	Regulation	Target	Actual
Dust	Electric precipitator	g/Nm^3	0.2 or 0.7	0.02 or less	ca. 0.006
SOx	Exhaust gas scrubber	ppm	80	20 or less	ca. 0-1
NOx	Combustion control, denitration	ppm	250	70 or less	ca. 40
HCL	Exhaust gas scrubber	ppm	430	15 or less	ca. 0-1

Flowcharts of incineration and ash melting facilities in the 2nd factory of the Ohta incineration plant are shown in Figures 2 and 3.

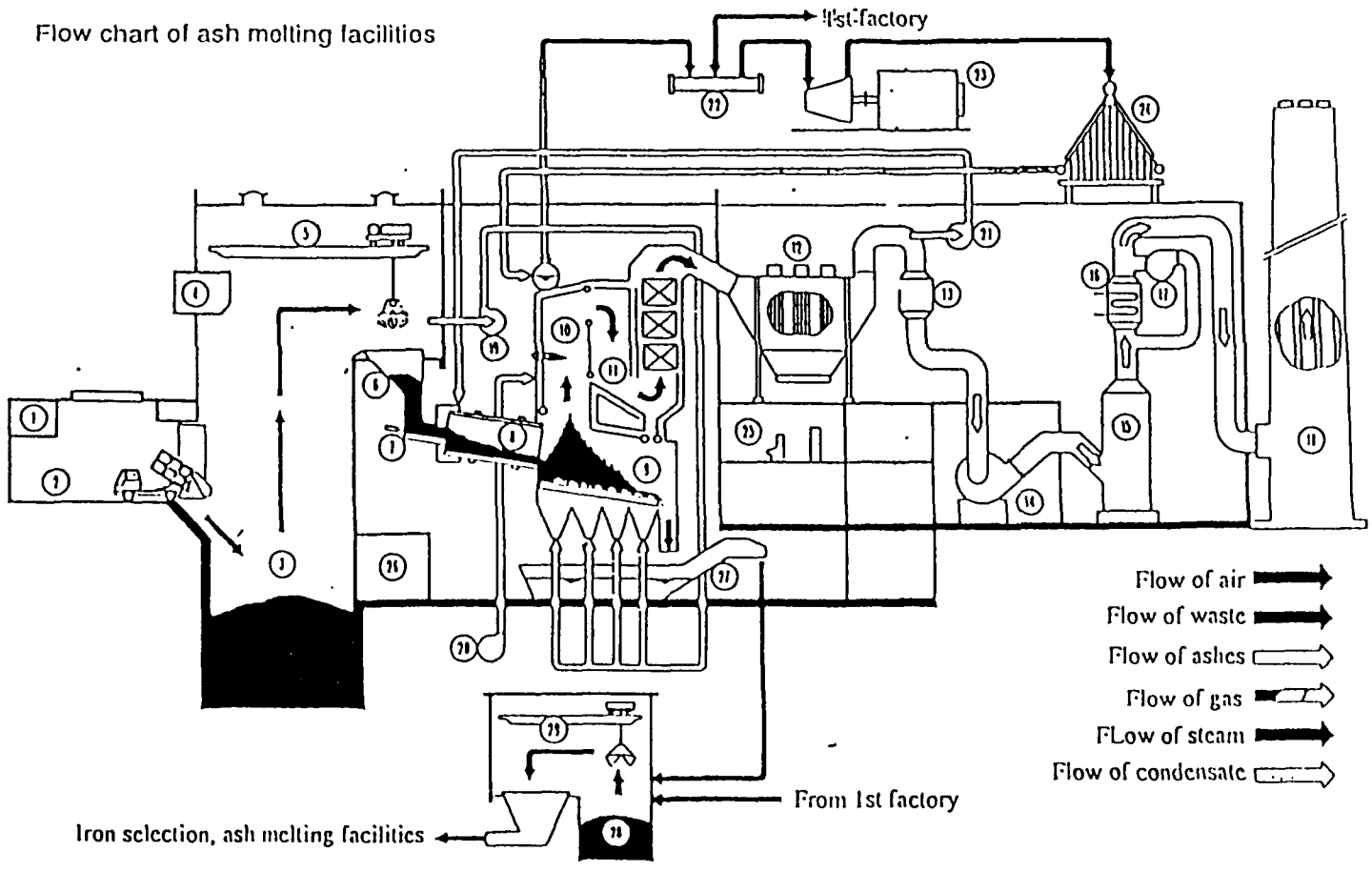

Fig 2. Flowchart of waste treatment facilities in the 2nd factory

Summary of facilities

1) Car control room 2) Platform 3) Waste bunker (20,000 m³) 4) Waste crane control room 5) Waste crane (overhead traveling)
6) Waste feeding hopper (with bridge release device) 7) Waste feeding device 8) Rotary kiln 9) After burning room (oscillating step fire grates)
10) After burning room 11) Boiler (natural circulation boiler) 12) Electrostatic precipitator (capacity 101, 700 Nm³/h)
13) Denitration facilities (catalytic denitration) 14) Suction fan (81,800 Nm³) 15) Exhaust gas scrubber 16) Steam reheater (pair tube type)
17) Circular fan (55,000 Nm³) 18) Stack (centralized stack with 3 internal steel cylinders) 19) Forced draft fan (22,000 Nm³)
20) Incinerator cooling fan (22,000 Nm³) 21) Exhaust gas recycling fan 22) High pressure steam receiver
23) Steam turbin generator (power 15,000 kW) 24) Turbin exhaust condenser 25) Central control room 26) Waste water treatment room
27) Ash conveyor 28) Ash bunker (1,500 m³) 29) Ash crane

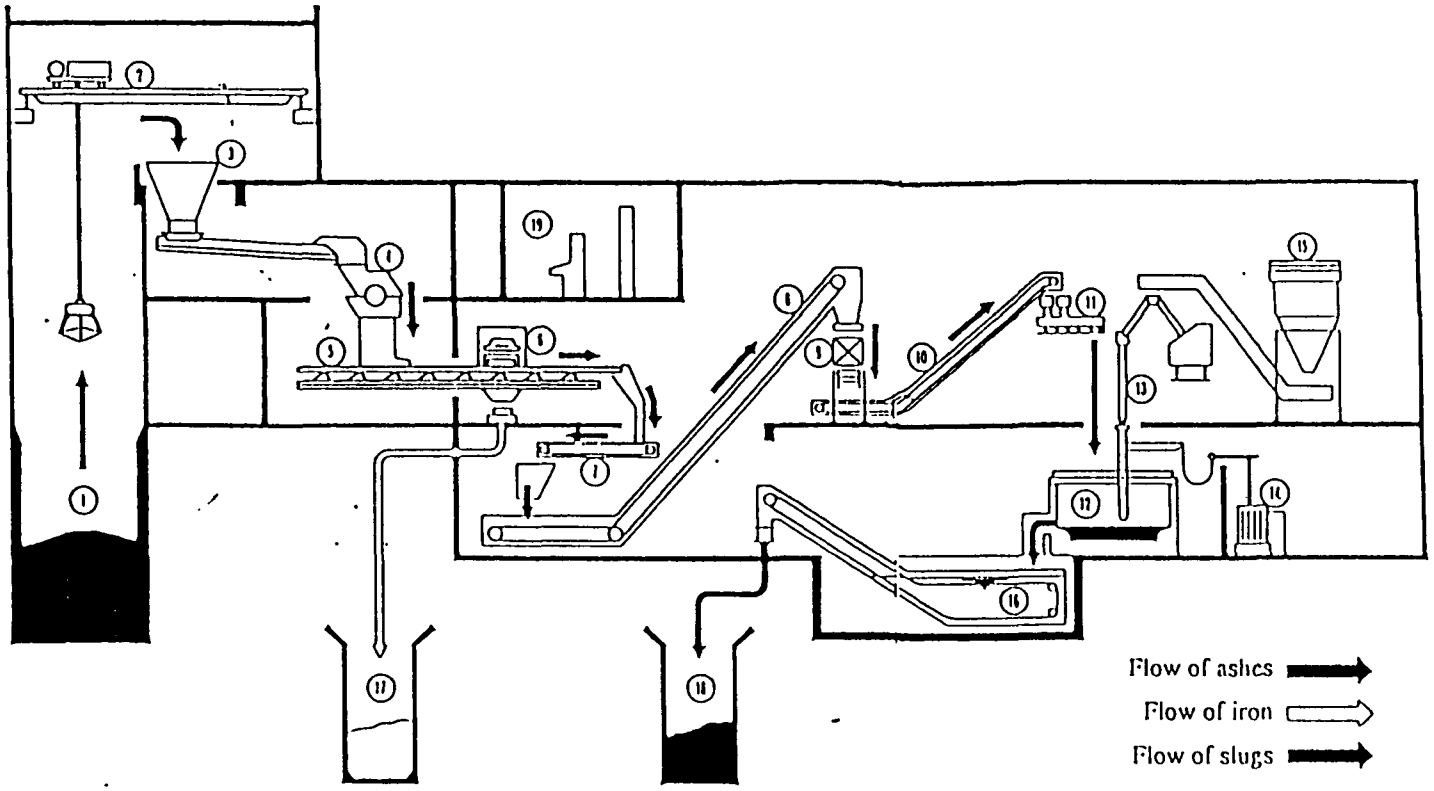

Fig 3. Flow chart of ash melting facilities

Summary of facilities

1) Ash bunker (1,500 m³) 2) Ash crane 3) Ash feeding hopper 4) Crusher (swing hammer type) 5) Carrier conveyor
6) Magnetic separator (belt separator type) 7) Measuring conveyor 8) Drying conveyor 9) Dryer (oscillating hot air dryer)
10) Ash feeding conveyor 11) Melting furnace quantitative feeder 12) Ash melting furnace (submerged arc) 13) Electrode connector
14) Transformer 15) Melting initiator hopper 16) Water crushing vessel 17) Iron bunker 18) Slug bunker 19) Ash melting control room

2. Plastic waste dedicated incineration plant (2nd Clean Center in Kahoku-gun, Ishikawa Prefecture)

This plastic waste dedicated incineration plant is located in the suburbs of Kanazawa city, an old city in Hokuriku district, and is adjacent to the sewage treatment plant and municipal waste incineration plant. The plastic incineration plant has a semi-continuous feed type fludized bed incinerator with a capacity of 10 tons per day (16 hours) including 5 tons of plastics and disposes by incinerating industrial waste containing agricultural vinyl films, plastics, rubber, fibers, etc. together with sewage and excrement sludge. The incinerator's maximum calorific value is 6700 kcal/kg. The temperature of fludized bed is 750 ℃, and the temperature at the top of incinerator reaches at 900 ℃. The exhaust gas treatment is a dry method using slaked lime or calcium carbonate. A flowchart of the facilities is shown in Figure 4.

The plant was built in late 1990 spending about 400 million yen by a contractor Nippon Kokan K.K. and is working presently.

Plastic Waste Management Institute conducted incineration experiments in March and November in 1991 in order to develop the combustion and incineration technologies of waste plastics in the presence of the Japan PVC Association representatives. In the experiments, polyethylene, polystyrene, and PVC — typical general purpose plastics — were tested. In the case of PVC, a mixture of polyethylene 90% and PVC 10% was burned. The conclusions from the experiments are summarized as follows:

1) The waste plastics were incinerated under stable conditions and the optimum incineration conditions were obtained.
2) In comparison with the incineration of municipal waste, the incineration load was found possible to increase by 50%.
3) In terms of the operation cost, the necessary amounts of chemicals, utilities, etc. were obtained.
4) In respect to the exhaust gas, the obtained results for all harmful gases regulated under the Air Pollution Control Law show favorable values eminently lower than those of regulations. The elimination ratio of hydrogen chloride was high enough to solve the problem.
5) From the above conclusions, the fundamental data for design, construction, and operation for the commercial plant of waste plastics incineration with fludized bed were collected.

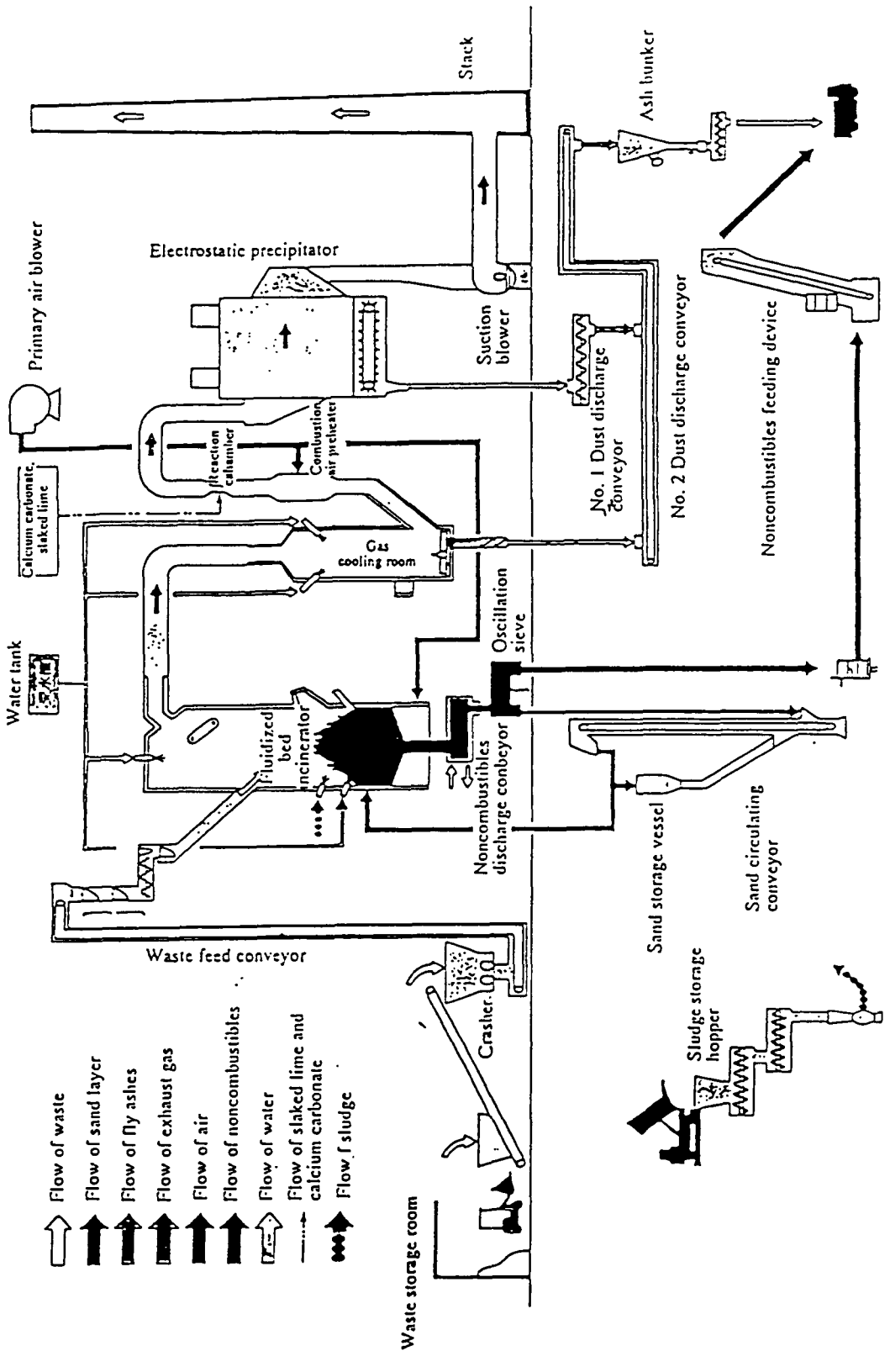

Fig. 4. Flowchart of waste treatment facilities

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3. Solid fuel production system from municipal waste (Narashino plant in Chiba Prefecture)

In Narashino city in Chiba Prefecture, municipal waste is divided into combustible waste and source segregated (unsuitable fo incineration) waste and they are collected separately. The combustible waste is disposed by incineration, while the source segregated waste is further classified to pick up valuable organic and inorganic materials. Inorganic materials such as glass and aluminum are recovered for recycling of resources. On the other hand, a solid fuel production system from organic materials including mainly plastics and papers has been established.

The Narashino plant has an experience of three years demonstration operation and the separation and classification facilities are now still working. The solid fuel production facilities are not working presently because the boiler dedicated for that process was transferred.

The composition of the source segregated waste for this plant is shown in Table 2.

Table 2. Composition of the source segragated waste

Material	Content (%)
Cullets	57.5
Iron	22.6
Plastics	4.2
Ceramics	4.1
Wood, fibers, other combustibles	2.9
Aluminum	2.8
Non-ferrous metal	1.7
Others	4.2
	100.0

The Narashino plant has a capacity of 20 tons/8 hr and its system flow is shown in Figure 5.

The raw material composition for the solid fuel production process is: plastics 65%, papers 25%, and noncombustibles 5% or less. The obtained solid fuel is characterized by: calorific value 8300 kcal/kg, ashes 9%, good ignition and combustibility. The chloride in the combustion gas is obtained as 150-200 ppm.

A flowcahrt of the plant is shown in Figure 6.

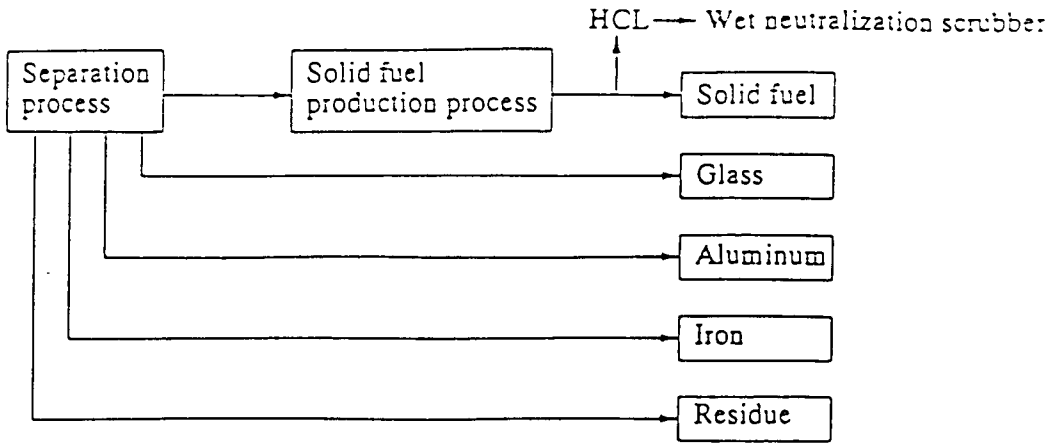


Fig. 5. System flow of the plant

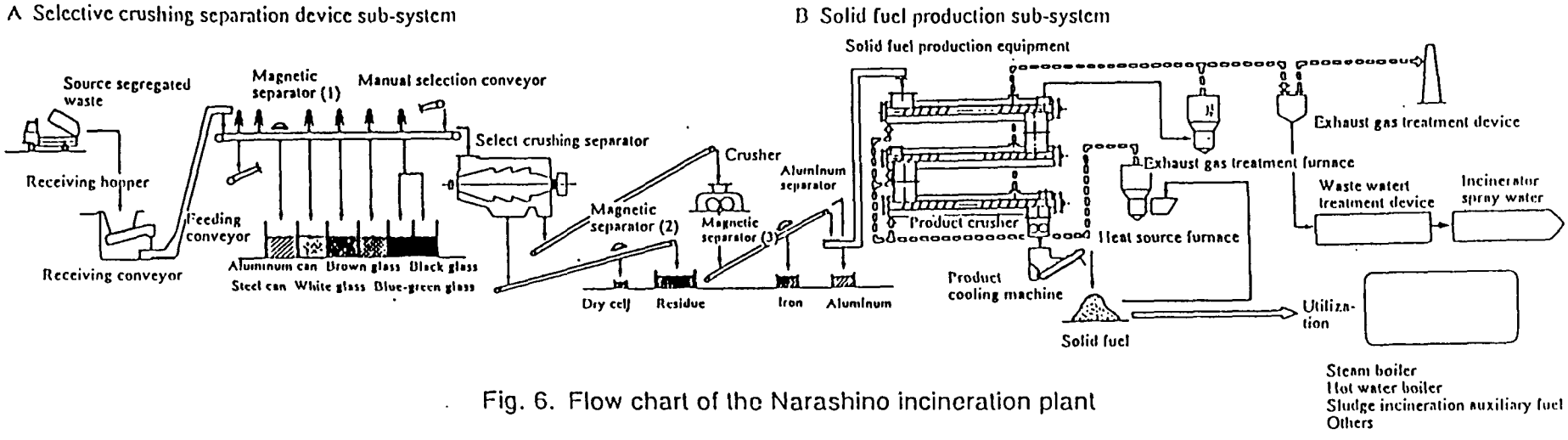


Fig. 6. Flow chart of the Narashino incineration plant

1. The collected source segregated waste, after being measured by truck scale, is placed on the receiving stage and after the separation of bulky waste is fed into the receiving hopper

2. The waste fed is charged on the manual selection conveyor via feeding conveyor to separate steel can, aluminum can, and glass (4 sorts). The cost can be reduced by selling valuables.

3. After the recovery of valuables, the waste is fed to the selective crushing separator to separate earth and sand, tiles and stones, redue such as dry cells (non-combustibles), from the solid fuel raw materials including plastics and papers (combustibles). Since dry cells in the residue are eleimanated by the magnetic separator, there are no harmful materials in the final residue. The substantial absence of flammables also contributes to the stabilization of the reclaimed land.

4. The raw materials for solid fuel, after being crushed, is fed to the solid fuel production process, and after the hydrochloric acid elimination treatment by heat-melting is cooled and crushed to prepare the solid fuel fee from pollution. The solid fuel is utilized in the city's facilities.

5. Since the exhaust gas is washed by the wet scrubbing method, there occurs no secondary pollution. The drain, after being filtered, is circulated as the spray water for the incinerator to make up a closed system.

6. LAW PROMOTING THE USE OF RECYCLABLE MATERIALS (RECYCLING LAW)

Law Promoting the Use of Recyclable Materials (Recycling Law)

I. Overview

1. Legislation of the Law

Promulgation Date: April 26, 1991
Enforcement Date: October 25, 1991

2. Background, etc.

The disposition of general and industrial wastes has become a social problem as both are increasing in volume year by year.

In order to prevent the deterioration of our environment caused by the increasing volume of these wastes, the reduction and recycling of wastes is essential.

For promoting the above, the whole nation; that is the governmental administration, industries and consumers should work together to tackle this problem.

Individual measures are required to be taken as the problems to be solved are different in kind, and in the types of waste produced by various industries.

II. Outline of the Law

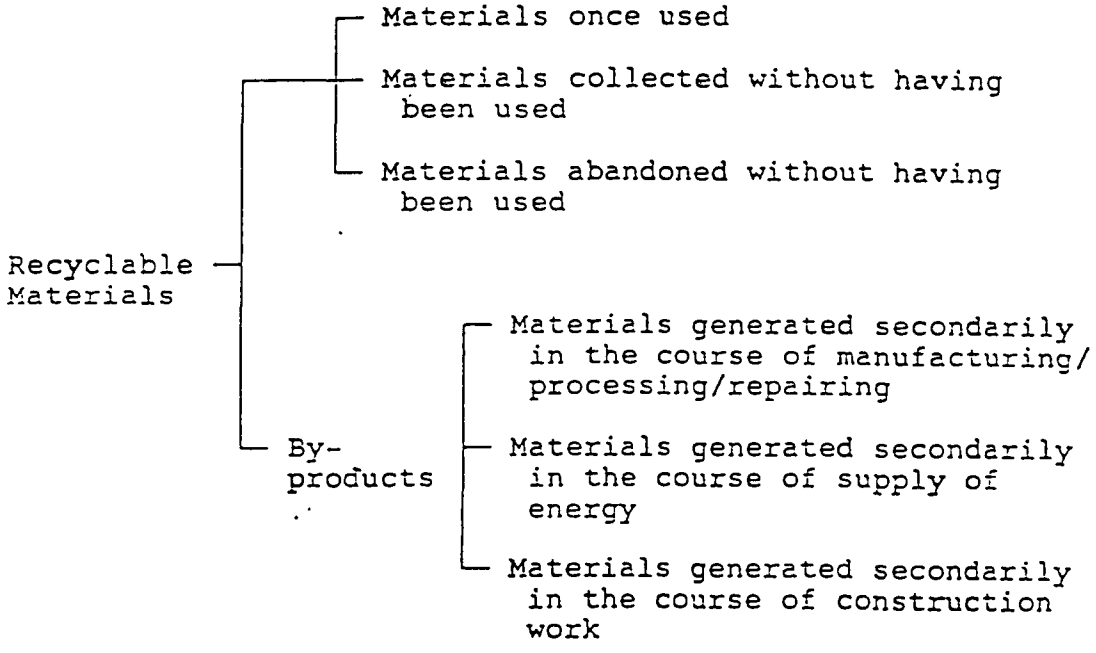
1. Objectives, etc.

The objectives of this law are to ensure the effective use of resources, reduce the generation of waste matter, and to preserve and protect our environment, thus contributing to the healthy development of the national economy.

In order to achieve these objectives, the Law aims at drawing out self-motivated efforts by entrepreneurs to the maximum extent concerning the utilization of recyclable materials and the promotion of such utilization.

This Law is jointly administered by the Ministry of International Trade and Industry, the Ministry of Construction, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Finance, the Ministry of Health and Welfare, the Ministry of Transport and the Environment Agency.

2. Recyclable Materials Covered by the Law



3. Outline of Steps to be Taken

1) Basic policy (announced on Oct. 25, 1991)

a. Target of utilizing recyclable materials

α. Target by party concerned

(1) - (9) omitted

β. Targets for utilizing recyclable materials by kind

(1) - (5) omitted

(6) Plastics

Entrepreneurs engaged in manufacturing plastics and plastic products and those entrepreneurs using these products should endeavor to develop or use such plastic products which are usable as recyclable materials.

These entrepreneurs should endeavor, in cooperation with the distributors as necessary to do the following:

- introduce material indications in order to facilitate separated waste matter collection in accordance with the characteristics by product;
- improve plant facilities for making necessary processing for effectively using recyclable materials, including capacity reduction equipment; and
- expand applications of the products using recyclable materials.

The above efforts are required for increasing the usage of recyclable raw materials with regard to those plastic products which are technically recyclable as recyclable materials, such as bottles for beverages made from polyethylene-terephthalate (PET bottles) and packaging materials of polystyrene foam.

(7) - (12) omitted

b. Matters relating to the diffusion of knowledge concerning the meaning of promoting the use of recyclable materials which would contribute to the preservation of our environment

omitted

2) Responsibilities of parties concerned

Each of the nation's local public bodies, entrepreneurs, and consumers should bear a reasonable share of responsibility in carrying out recycling efforts.

3) Measures to be taken by entrepreneurs

Judgment criteria to be observed by entrepreneurs should be established, under which guidance and advice are to be given.

Recommendations and directions may be given and announcements may be made as necessary.

4. Basic Policy

(1) To establish targets for use of recyclable materials by kind.
(2) To diffuse knowledge relating to promoting the use of recyclable materials.
(3) To promote the use of other recyclable materials.

5. General Responsibilities of the Parties Concerned

1) Responsibilities of entrepreneurs

(1) To endeavor to use recyclable materials as raw materials.
(2) To design products in advance so that such products after their use can be used as recyclable materials.
(3) To arrange for by-products to be used as recyclable materials, or to facilitate the use of such by-products by other entrepreneurs.

2) Cooperation by consumers

(1) To positively use products made from recyclable materials.
(2) To cooperate with the national leadership, local public bodies and entrepreneurs in their efforts concerning recycling.

3) Measures to be taken by the national and local public bodies (Measures to be taken for promoting the use of recyclable materials)

(1) Measures for securing the funds required.
(2) Promotion of technology.
(3) To deepen the nation's understanding of the recycling issue and to ask for national cooperation.

6. Individual Measures to be Taken by Entrepreneurs

To designate the type of industries where the recycling ratio should be raised and the products to which specific indications for separated waste matter collection should be given.

The criteria for designation:

(1) Necessity
Those wastes whose volumes generated are large and whose usages are insufficient.
Those wastes whose values as recyclable materials are high.
(2) Efficiency
Those wastes whose efficiencies for the promotion of use are expected to be raised by designation.
(3) Feasibility

Classification of designation:

(1) Designation of specified industries
Those industries which should promote the use of waste matter as raw materials of recyclable materials and which should raise their recycling ratios.

(2) Designation of Class 1 designated products
Those products which should be elaborated upon in terms of their structure and materials so that they can be easily recycled after use.

(3) Designation of Class 2 designated products
Those products to which some indications should be given for identification so that after use they can be collected separately from similar products.

(4) Designation of designated by-products
Out of the by-products generated in plants and other places, those by-products which should be elaborated upon for improving quality so that their efficient use shall be promoted, and their type of industry shall be designated.

III. Details of Individual Measures to be Required of Entrepreneurs

1. Designation of Specified Type of Industry

The types of industry where it is particularly required that the use of recyclable materials as raw materials be accelerated and that the recycling ratio be raised, and the recycling materials, have been designated.

The competent Minister shall determine judgment criteria for facilitating the use of recyclable materials and shall provide necessary guidance and advice. Further, the Minister may give recommendations and directions, and make announcements as necessary.

Designated type of industry	Recyclable materials	Details of judgment criteria
Paper manufacturing industry	Used paper	(1) Set a target to raise the ratio of used paper use to 55% in the entire paper manufacturing industry before fiscal 1994. (2) Establish a used paper use program and record the progress in its implementation. (3) Improve plant facilities and technology.
Glass container manufacturing industry	Cullet	(1) Set a target to raise the cullet used ratio to 55% in the entire glass container manufacturing industry before fiscal 1995. (2) Establishing a cullet use program and record the progress in its implementation. (3) Improve plant facilities and technology.
Construction industry	Earth and sand Clods of concrete Clods of asphalt/concrete	(1) Establish a recyclable materials use program by construction work and recording the progress in its implementation. (2) Use earth and sand in accordance with their nature. (3) Use clods of concrete as a recycled aggregate. (4) Use clods of asphalt/concrete as recycled aggregate and as the mixing materials for recycled heating asphalt.

2. Designation of Class 1 Designated Products

Those products which should be elaborated upon in terms of structure and materials have been designated so that they can be easily recycled after use.

The competent Minister shall determine the judgment criteria which should be followed by entrepreneurs engaging in manufacturing, processing, repairing and selling, and at the same time may give necessary recommendations and directions and make announcements as necessary.

Designated products	Designated entrepreneurs	Details of judgment criteria
Automobiles	Entrepreneurs engaged in the business of manufacturing	(1) Implementation of devices concerning the materials for parts, structures and matters relating to separation. (2) The entrepreneurs will perform preliminary evaluation on the points listed in the preceding clause (1) at the time of designing automobiles, and will record the results accordingly. (3) Offering of information useful for furthering the use of recyclable materials and improving the technology, etc.
	Entrepreneurs engaged in the business of repair	Use of usable spare parts for replacement and separating the used parts.
Unit type air conditioners TV receivers Electric washers Electric refrigerators	Entrepreneurs engaged in the business of manufacturing	(1) Implementation of devices concerning the materials for parts, structures and matters relating to separation. (2) The entrepreneurs will perform preliminary evaluation on the points listed in the preceding clause (1) at the time of designing electric washers, etc., and will record the results accordingly. (3) Offering of information useful for furthering the use of recyclable materials and improving the technology, etc.

3. Designation of Class 2 Designated Products

Those products to which specific indications should be given for identification have been designated so that they can be collected separately from similar products after use.

The competent Minister shall determine the matters to be indicated for the Class 2 designated products, and matters to be observed by the entrepreneurs engaged in manufacturing and selling, and at the same time will give necessary guidance and advice. Further, the Minister may give recommendations and directions and make announcements where necessary.

Designated products	Designated entrepreneurs	Details of indication criteria
Products for cans which hold beverages	Entrepreneurs manufacturing cans	(1) Matters to be indicated (of aluminum or steel) (2) Matters to be observed (instructions regarding the format and the places easily visible)
	Entrepreneurs filling cans with beverages and importers of cans in which beverages are filled	
Products of cans which are filled with liquors	Entrepreneurs manufacturing cans	(1) Matters to be indicated (of aluminum or steel) (2) Matters to be observed (instructions regarding the format and the places easily visible)
	Entrepreneurs filling cans with liquors and importers of cans which are filled with liquors	

4. Designation of Designated By-products

Out of the by-products to be generated in the plant, those by-products which should be elaborated upon for improving quality so that their efficient usage shall be facilitated, and the types of industry, shall be designated.

The competent Minister shall determine the judgment criteria to be followed by entrepreneurs who should endeavor to efficiently use the designated by-products, and at the same time shall give necessary guidance and advice. Further, the Minister may give recommendations and directions and make announcements as necessary.

Designated by-products	Type of industry which should promote the use of the designated by-products	Details of judgment criteria
Slug	Steel manufacturers using blast furnaces and steel rollers	(1) Processing the steel materials under specific standards and specifications in accordance with the usage (2) Establishing a steel slug use promotion program and recording the progress in its implementation. (3) Improving the plant facilities and the technology
Coal ashes	Electric power industry	(1) Processing coal ash under specific standards and specifications in accordance with the usage. (2) Establishing a coal ash use promotion program and recording the progress in its implementation. (3) Improving the plant facilities and the technology.
Earth and sand Clods of concrete Clods of asphalt/ concrete Lumber	Construction industry	(1) Carrying out classification and crushing of the designated by-products at the work sites and at the same time utilizing the facilities for recycling materials. (2) Establishing a recyclable materials use promotion program by construction work and recording the progress in its implementation. (3) Classifying the nature of the earth and sand at the time these items are transported.

Revision of the Law Concerning Disposition of Waste Matter and Cleaning (Waste Matter Disposition Law)

I. Overview

The above law was drastically revised and promulgated on October 5, 1991.

The competent ministry for the law is the Ministry of Health and Welfare.

II. Outline of the Contents of Revision

1. Objectives of Revision

Restraining of emissions of waste matter and promoting its reduction through appropriate separation, collection and recycling.

Ensure the proper processing of waste matter.

Ensure the maintenance of processing facilities for waste matter.

2. Responsibilities and Cooperation by Entrepreneurs

Assume responsibility for properly disposing of industrial waste.

Reduce the volume of waste matter through the use of recycling.

Provide information concerning the development of products and containers which would avoid any difficulties in making the preliminary evaluation and disposition when such products and containers become waste matter, and the proper method of disposal.

Cooperating with the nation and local public bodies in their measures concerning the reduction of the volume of waste matter and ensuring of proper disposition of products and containers.

3. The mayors of cities, towns or villages may give directions to the parties concerned, to develop a reduction program for the facilities which generate a large volume of general waste matter in accordance with the course of their operations.

   The governors of the metropolis and prefectures may give directions to the parties concerned to develop a program concerning the disposition of industrial waste with regard to the facilities which generate a large volume of industrial waste in accordance with the course of their operation.

4. Establishing a specific classification for "waste matter under special control" for general and industrial waste matter

   General waste matter under special control (explosives, toxic and infectious waste matter and the like)
   e.g. the ashes generated from the incineration of ashes in an incinerator, medical waste matter, etc.

   Industrial waste matter under special control (explosives, toxic and infectious waste matter and the like)
   e.g. waste matter containing mercury, PCB's, cadmium, etc. and asbestos.

5. Those entrepreneurs whose plants are emitting industrial waste matter under special control shall be obliged to appoint individuals who shall be responsible for waste matter and for developing waste matter disposition programs.

Further, the control slips for industrial waste matter under special control shall be institutionalized (Manifest System).

6. In addition to the collectors/transporters and disposers of industrial waste, collectors/transporters and disposers of industrial waste matter under special control shall be established who are now definitely subject to the license issued by the governors of the metropolises and prefectures.

The conditions for obtaining a license have become stricter in order to ensure the quality of the people engaged.

7. Severer Standards for Facilities Disposing of Industrial Waste Matter

Such facilities are now subject to the license issued by the governors of the metropolises and prefectures.

Conformity to the technical standards precisely prescribed in government ordinances and cabinet orders is essential.

Such governors may provide the necessary conditions required for the preservation of the living environment to the licensees.

A disaster prevention program must be established.

8. Institutionalization of the Waste Matter Disposal Center

The Minister of Health and Welfare will designate the waste matter disposal center by metropolises and prefectures.

The waste matter disposal center is responsible for the disposition of industrial (general) waste matter under

special control, construction of processing facilities and their management and maintenance.

The relevant expenses in connection with the above operation shall be supported by state subsidies and fiscal preferential measurers, in addition to the funds established by the related entrepreneurs.

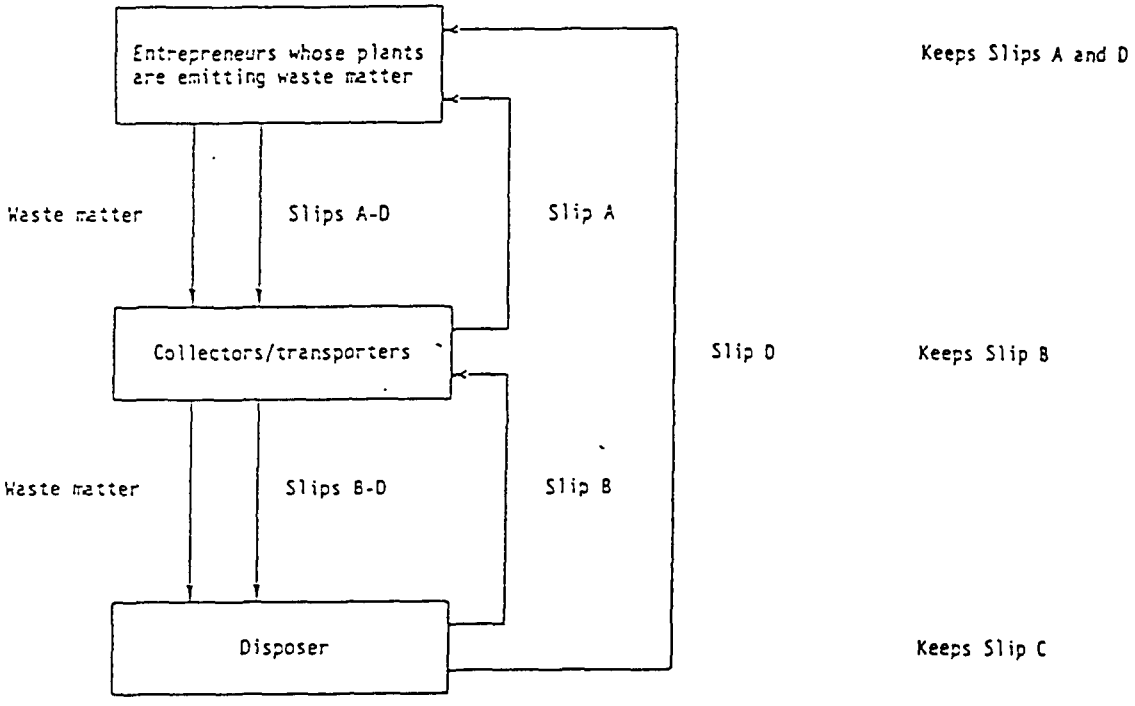
9. Steps to be Taken Concerning the Products, etc.

The Minister of Health and Welfare may request the competent Minister governing the businesses engaged in manufacturing, processing and distribution of the products, etc. to make the relevant entrepreneurs indicate the materials used for manufacturing the products and containers and/or the method of disposition, and to take other necessary steps in order to ensure the proper disposition of waste matter.

Manifest System

This is the system which is designed to confirm the situation regarding the disposal of waste matter by and between the entrepreneurs whose plants are emitting industrial waste matter under special control, its collectors/transporters and disposers who confirm each other's activities by using an established set of four pieces of control slips.

The control slips are passed through as shown in the chart below following the flow of industrial waste matter under special control. These slips shall be used as the basic data for the final confirmation and for preparing reports to be submitted to the relevant authorities later.



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Impact of Two Laws on Activities of Entrepreneurs

Impact of the Recycling Law:

1. To manufacture products using designs, standards and raw materials which can easily be reclaimed and recycled after use.

2. To endeavor to increase the use of recycled materials as raw materials of products.

3. To endeavor to carry out a reasonable review of packaging and wrapping.
   To endeavor to simplify packaging and to develop recyclable packaging materials.

4. With regard to those products which must be abandoned after use, to endeavor to make such products easily disposable and to see that they have no adverse impact on our environment.

5. To endeavor to gain the understanding of consumers by providing information regarding reclamation and recycling in the relevant instructions for the products.

6. To endeavor to make the products durable for the long-term by improving repair services and parts replacement services.
   Further, to develop products which are easily repaired and products whose parts are easily replaced.

7. To endeavor to assemble such products primarily as easily reclaimable and recyclable products.

8. To expand the assembly of those products carrying the Ecomark (the products bearing the specific authorized mark

given by the Japan Environment Protection Association, an extradepartmental body of the Environment Agency, to indicate that the products are giving due attention to the protection of our environment).

9. Even for those products which are not covered by the Law at this time, it is necessary to pay due attention to this point since there is a possibility that such products will eventually come under the Law's jurisdiction.

Further, by the revision of the Waste Matter Disposal Law:

10. Those entrepreneurs whose plants emit a large volume of waste matter are now obliged to prepare a real disposition program.

11. The entrepreneurs are now obliged to conform to screening standards which are stricter than those existing previously for the establishment of new processing facilities for waste matter.

12. The entrepreneurs whose plants emit industrial waste matter under special control will have to bear an increased share of expenses for the processing disposal of such waste matter.

13. The relevant entrepreneurs will have to establish a new structure of organization since the appointment of responsible persons in charge of waste matters is now required and the Manifest System has been implemented.

7. REVISION OF THE LAW CONCERNING DISPOSITION OF WASTE MATTER AND CLEANING (WASTE MATTER DISPOSITION LAW)

8. JAPAN PVC RECYCLE PROMOTING COUNCIL (JPRPC)

Purpose of Foundation

Amidst the increasing effort to protect the global environment, the problem of waste disposal has gathered a great deal of attention. Consequently, it is now an urgent matter to establish a recycling system for PVC products (products made of polyvinyl chloride resin).

Global resources are finite, making the recycling of wastes an important issue in the conservation of resources and reduction of wastes.

PVC products were one of the first plastic products to be recycled. Until now, the PVC industry has successfully recycled and reused agricultral films etc. To further promote and unite the recycling efforts by the industry as a whole, the Japan PVC Recycle Promoting Council (JPRPC) was established in October 1991.

The Council will provide information to help businesses with their recycling efforts and set guidelines on polyvinyl chloride recycling technologies and know-how through model operations and PR activities.

It is also the Council's intention to research and develop new recycling applications and energy recovery systems for polyvinyl chloride products to achieve more efficient recycling systems and to disseminate correct understanding of polyvinyl chloride and PVC products.

Japan PVC Recycle Promoting Council (JPRPC)

1. Establishment

October 24, 1991

2. Aims

The aim of the council is to provide information, technologies and know-how to enterprises so that they can take action in order to recycle PVC and to set guiding principles for PVC recycling, through model businesses for recycling of PVC products and public relations activities.

The council investigates new uses of recycled PVC products and energy recovery systems in order to establish effective recycling systems, and disseminates correct knowledge about PVC and PVC products.

3. Activities

1) Promotion of PVC product recycling
2) Development of applications for recycled PVC products
3) Dissemination of correct knowledge about PVC and PVC products

4. Organization

The council consists of four associations. These are the Japan PVC Pipe Association, the Japan PVC Association, the Japan Rigid PVC Sheet Association, and the Japan Vinyl Goods Manufacturers Association. The board of directors consists of the chairmen of each association.

At present, the 95 companies that belong to the abovementioned four associations support the council.

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Mr. Yamaguchi is the current chairman of the council. He is the chairman of the board of directors of TOSOH CORPORATION, and is also the chairman of the Japan PVC Association, which is an association of PVC and VCM manufacturers.

The secretary-general of the council is Mr. Matsui, who is the managing director of the Japan PVC Association.

The members of the companies belonging to each association hold concurrent posts at the council.

The Council

- Secretariat

  The staff of the Japan PVC Association concurrently performs duties at the secretariat because the council does not have a full-time staff yet.

General Meeting

- The board of directors
  - Steering committee

    The steering committee consists of 8 members

    - Recycling committee

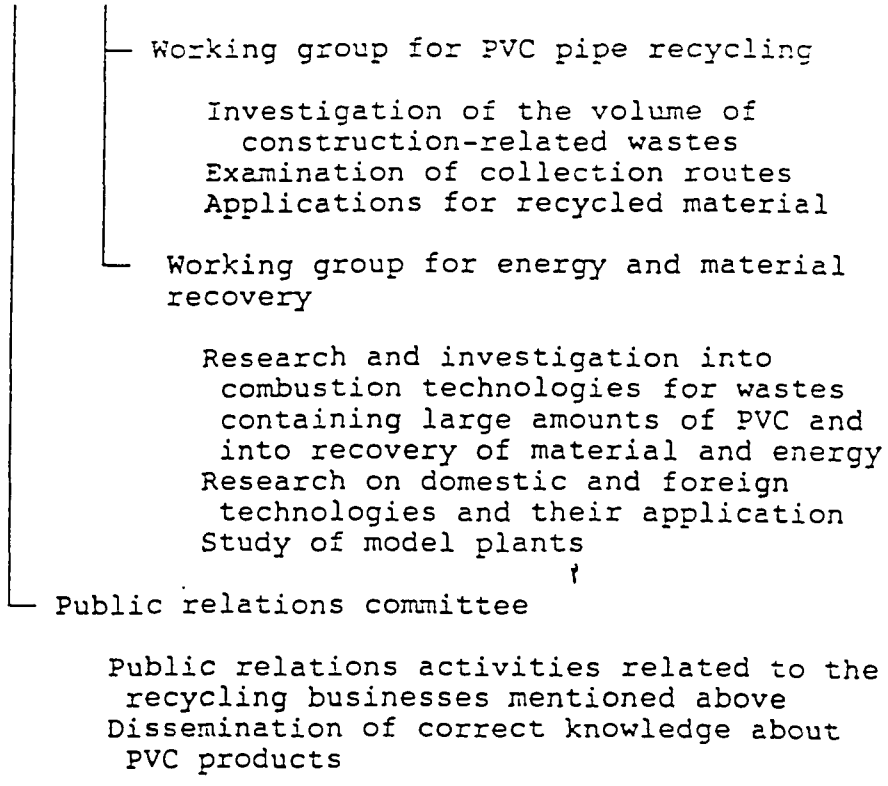
      Each working group consists of several member companies.

      - Working group for PVC bottle recycling

        Development of bottle volume-reducing equipment
        Model plant development for separation and purification (Kanegafuchi Chemical Industry Co. Ltd.)
        Collection, separation and purification experiments
        Development of technologies and applications for recycling

      - Working group for egg case recycling

        Establishment of system for collecting from general consumers
        Experiments for selection and pulverizing
        Applications for recycled material



4. Activities

The activities of the working groups are described in the 1st issue of our newsletter. We will continue to carry articles related to these activities in future newsletters.

5. Notes

The budget of the council for fiscal year 1992 is about 300 million yen.

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Activities of the Public Relations Committee

Japan PVC Recycle Promoting Council (JPRPC)
Japan PVC Association

The public relations committee works to publicize the progress of the PVC recycling activities conducted by the council and to disseminate correct knowledge about PVC products.

Most of the activities shown below are conducted by working groups made up of several members of the council.

1) Publication and distribution of newsletters

2000 copies of the first issue of a newsletter were printed in June, 1992, and distributed to local governments, the mass media, the four associations belonging to the council, and other related organizations.

The second issue will be published in late September, 1992.

This newsletter will be published quarterly.

2) Publication and distribution of pamphlets

Six thousand copies of pamphlets introducing the foundation of the council were printed and distributed to organizations related to this field and to local governments.

3) Dissemination of correct knowledge

The leaders of the PVC industrial associations directly interviewed the top management of companies which announced that they would no longer use PVC, and found out the reasons what caused them to make such a decision. If it was found that there was some kind of misunderstanding, the association leaders

talked to the company management in order to correct the misunderstanding by using pamphlets, to explain their points. (The specific names of companies and the steps taken with regard to each company are omitted.)

4) Articles and advertisements in newspapers related to the industry

As one form of public relations activities, articles such as interviews are presented to PVC users in newspapers related to this industrial area in order to achieve the aims mentioned above.

Recent presentations have been as follows:

The Japan Industrial Journal:		26, 27, 28/Feb/92, special articles
The Japan Industrial Journal:		18/Mar/92, interview article
Sekiyu Kagaku Shimbun (Petrochemical News)	:	18/Mar/92, interview article
The Nikkan Kogyo Shimbun (The Daily Industrial News)	:	30/Jul/92, an article and advertisements on special issues about the environment
Housou Times (Packaging Times)	:	Sep/92 (planned)

5) Presentations at exhibitions

The council presents and displays its activities at major domestic exhibitions related to the plastics industry in order to achieve the aims mentioned above.

'91 Japan International Packaging Machinery Show (Japan Pack) (at the Tokyo International Fairground, Tokyo), 11-15/Oct/91

JP '92 Osaka (14th Japan Plastics and Rubber Fair; at the International Exhibition Center, Osaka), 9-14/Apr/92

CTL007318

'92 Tokyo International Packaging Exhibition (Tokyo Pack) (at the Tokyo International Fairground, Tokyo), 25-29/Sep/92 (planned)

Ecological Chemistry Exhibition 92 (at the Science Museum, Tokyo), 1-3/Oct/92 (planned)

6) Preparation of video films

A first video film for public relations is now being produced, and it will be completed by next January.

We will continue the preparation of video films for public relations purposes.

7) Symposium on PVC and environmental problems (in planning)

8) Requests to experts for written contributions

We will make requests to persons who have sufficient knowledge about PVC for written contributions about its usefulness and the recycling of PVC for our public relations activities.

9) Other activities related to public relations

It is planned to conduct the observation tours of model, disposal, and recycling plants for journalists to achieve the aims mentioned above.

We are actively sending lecturers from the industry to various conferences.

CTL007319

Organization	Activities
Plastic Waste Management Institute	4-1-13, Toranomon, Minato-ku, Tokyo 03-3437-2251 Established in November, 1976. This institute is made up of 31 plastics manufacturers, and 4 industrial associations. It conducts various experiments, research, and public relations activities about plastics in general. The specific activities are summarized in its action program report.
Japan PET Bottle Association	4-1-13, Toranomon, Minato-ku, Tokyo 03-3437-2257 Established in October, 1982. This association is made up of 24 companies, including plastic materials manufacturers, plastic products manufacturers, and trading companies. The association collected data from Hadano city and the Harima Co-op for PET bottle recycling, and has a plan to construct a recycling plant with the capacity to treat 5000 tons per year with Yamaichi Cullet.
Japan Expanded Polystyrene Recycling Association	2-3, Kandasakuma-cho, Chiyoda-ku, Tokyo 03-3861-9046 Established in April, 1991. The association is made up of 8 materials manufacturers and 171 polystyrene products manufacturers, and plans to construct a recycling plant with the capacity to treat 17,000 tons per year of polystyrene fish packaging boxes and shock absorbing materials for electrical appliances.
Japan Expandable Polystyrene Foamed Sheet Industry Association Polystyrene Paper Industries Association	26, Kandahigashikonya-cho, Chiyoda-ku, Tokyo 03-3257-3334 Established in April, 1991. This association is made up of 6 PSP manufacturers. The association has been operating recycling centers that treat 20 t/m in the Kanto and Kansai areas since late 1991. The association collects PSP trays at supermarkets, etc.
Japan PVC Recycle Promoting Council	2-1-1 Uchisaiwai-cho, Chiyoda-ku, Tokyo 03-3501-2010 Established in October, 1991. The Council is made up of 4 PVC organizations with cooperation by 95 manufacturers, and conducts experiments on the recycling of PVC bottles, PVC pipes, and egg cases, and on energy recovery.
The Japan Plastics Industry Federation	3-2-6 Kasumigaseki, Chiyoda-ku, Tokyo 03-3580-0771 Established in July, 1950. The federation is made up of a total of 31 organizations, including 4 organizations in the materials industry, 16 organizations in the processing industry, and 6 organizations in the plastics industry. It has been promoting recycling by material indication (SPI method in the U.S.) since April, 1992.

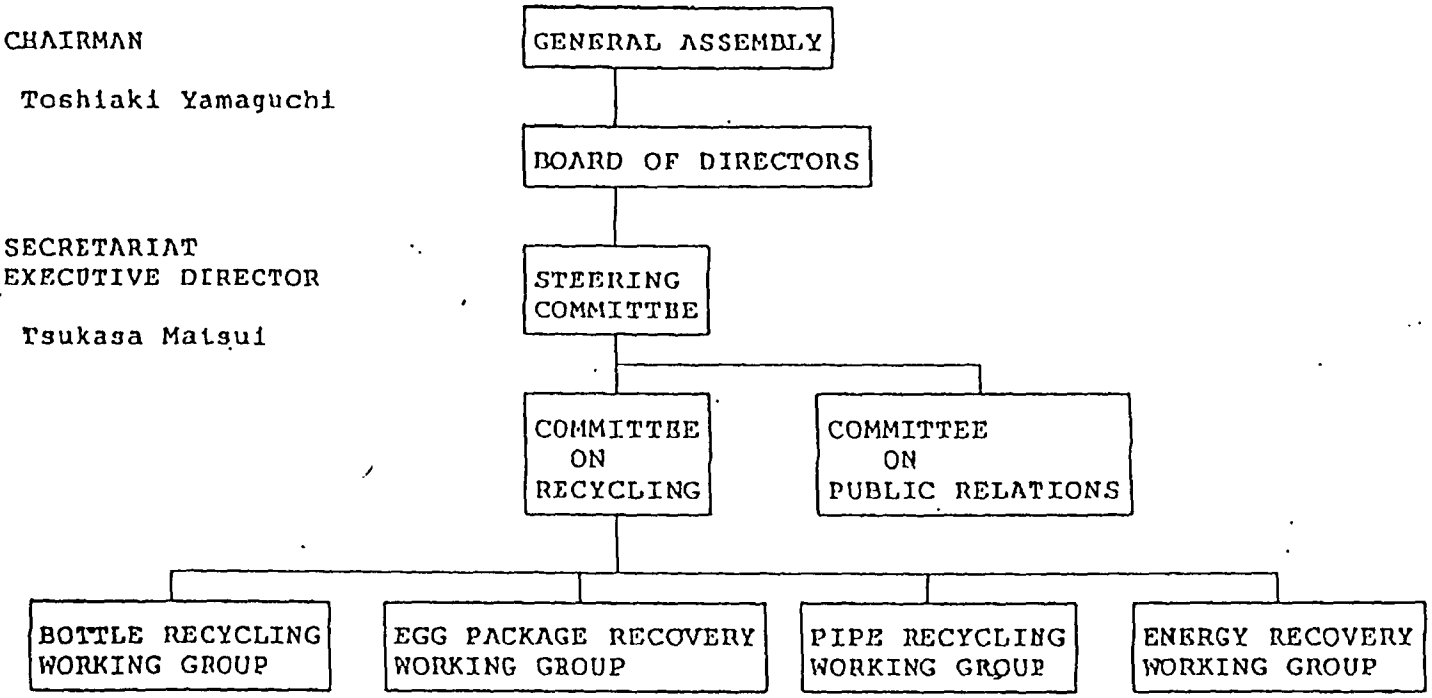
JAPAN PVC RECYCLE PROMOTING COUNCIL (JPRPC)

CHAIRMAN

Toshiaki Yamaguchi

SECRETARIAT
EXECUTIVE DIRECTOR

Tsukasa Matsui



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