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Continuing to Provide Paper



## Reduction and Effective Utilization of Waste

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We are working hard to reduce the amount of waste produced by our manufacturing process while also promoting effective waste utilization measures in order to minimize the ultimate disposal of waste.

## Ideally, a manufacturer turns all the raw materials it procures into products, but in reality some waste always occurs, and papermaking is no exception.

In addition to pulp produced from wood and recovered paper, filler composed mainly of calcium carbonate and several chemicals that give paper its necessary characteristics are also used to make paper. Further, securing the energy required to manufacture our products takes a combination of fossil, renewable and waste-derived energy.

In not only papermaking, but all manufacturing industries alike, the ideal is that 100% of raw materials becomes part of the product. This ideal is based less on waste reduction than on the

principle that manufacturing costs would be cut by using all raw materials without waste. At each of its manufacturing sites, the Oji Paper Group has added numerous innovations to its processes to try and reduce waste, even if only a little. However, because of certain characteristics of the raw materials and equipment used, a certain amount of paper sludge (PS) ultimately occurs that cannot be used as product. In addition, when fuel is burned in boilers to power papermaking, it leaves behind combustion ash.

### ■ The main wastes that occur in the papermaking process

#### 1. Paper sludge (PS)

This is the general term for the sludge emitted by paper production processes.

#### PS from the recovered paper pulp production process

Recovered paper pulp manufacturing is the process of breaking down recovered paper in water and extracting pulp fibers. When this is done, microscopic pulp fibers and the other non-pulp fiber materials that form paper come together as PS, which is then emitted.

#### PS from the papermaking process

The final raw material produced by mixing pulp fibers with fillers and chemicals is laid onto what is called "wire" and then pressed to remove water. At that time, microscopic

pulp fibers fall out of the wire, along with filler and other material. Material that has fallen is collected and used again as raw material, but material that is ultimately unable to become paper gets emitted as PS.

#### PS from wastewater processing

Water that has been used in the mill is collected into water processing equipment, where impurities are removed, after which water that meets emissions standards is released into public waterways following processing. Solid matter left behind by this process is also PS.

#### 2. Combustion ash Ash left behind in boilers

All paper mills have at least one boiler, and some have as many as five; each of these produces combustion ash.

Depending on the type of fuel initially burned, the amount of combustion ash left behind can vary. Fuels that produce larger amounts of combustion ash include RPF and scrap tires, coal, and to a lesser degree, wood material. Conversely, not much combustion ash is produced by black liquor or heavy oil. Since the new energy boilers adopted from 2004 onward mainly burn RPF and scrap tires, they produce a larger amount of combustion ash than previous boilers.

### ■ Efforts to reduce waste

Reducing waste, even a little, is our most important task. We long ago began to take measures at all our mills to reduce PS in particular. For example, the PS emitted by the recovered paper pulp production process is microscopic, but the attendant pulp material and filler are relatively large, meaning that by utilizing them in other mill processes such as papermaking, we can reduce the total amount of waste produced. Also, because PS includes water, some mills press the liquid out and then further incinerate the PS to create PS ash (see photograph at right) in their efforts to reduce waste.



Post-incineration PS ash, which is effectively utilized as a cement and soil enhancer.

## While our mills tirelessly work to reduce waste, we simultaneously promote its effective utilization.

Our first priority is given to reducing the amount of waste produced by our facilities, but the waste that does occur is processed by one of two methods: Effective utilization or disposal in landfills.

### Waste disposal methods

#### Effective utilization

Effective use of waste materials in cement raw materials, road sub-base raw materials, soil enhancers or snow melting agents, etc. as opposed to disposal in landfills. Only a small portion of waste can be sold, and the rest is processed at high cost.

#### Disposal in landfills

Disposal in a properly managed industrial waste landfill: Disposal costs money.

### Final disposal rate

The final disposal rate is defined as the amount of waste generated at mills that was disposed of by burying in landfills, expressed as a percentage of production volume. The Oji Paper Group's Environmental Action Plan 21 sets forth a target of 0.5% or less by fiscal 2010. Reducing the amount of waste produced is a top priority, and the Group intends to promote the effective use of waste that does occur while reducing the amount that gets buried as much as possible. However, the average final disposal rate for paper mills of the Oji Paper Group is 0.97% (see Figure 1), meaning that unfortunately, the Group has not yet achieved its target.

**Figure 1 Waste Disposal at Oji Paper Group Mills (FY2008)**

- Production volume = Volume of paper produced, including reprocessed products...a
- Effectively utilized volume = Dry volume of effectively utilized waste...b
- Final disposal volume = Dry volume of waste buried in landfills...c
- Final disposal rate = Amount of waste generated at mills that was disposed of by burying in landfills, expressed as a percentage of production volume...c/a

Company	Mill	Production volume (t)	Total amount of waste (t)		Final disposal rate (%)
			Effectively utilized volume	Final disposal volume	
Oji Paper	Kushiro Mill	602,501	54,971	552	0.09
	Tomakomai Mill	1,223,678	119,710	3,883	0.32
	Fuji Mill	392,121	33,380	259	0.07
	Kasugai Mill	676,183	33,198	26,724	3.95
	Kanzaki Mill	65,099	7,385	7	0.01
	Yonago Mill	490,877	38,929	400	0.08
	Kure Mill	263,672	9,795	561	0.21
	Tomioka Mill	465,675	33,761	2,970	0.64
	Nichinan Mill	261,163	20,899	24,249	9.29
<b>Total</b>	<b>4,440,969</b>	<b>352,028</b>	<b>59,605</b>	<b>1.34</b>	
Oji Paperboard	Nayoro Mill	200,391	9,001	1,785	0.89
	Kushiro Mill	*Data is included in the Oji Paper Kushiro Mill			
	Nikko Mill	217,787	3,436	2,493	1.14
	Edogawa Mill	135,904	2,579	0	0.00
	Fuji Mill	266,308	1,237	499	0.19
	Matsumoto Mill	112,928	1,380	23	0.02
	Gifu Mill	319,943	1,643	565	0.18
	Sobue Mill	299,726	23,096	285	0.10
	Osaka Mill	217,157	2,551	24	0.01
	Oita Mill	320,421	17,110	3,392	1.06
Saga Mill	319,776	10,992	26	0.01	
<b>Total</b>	<b>2,410,341</b>	<b>73,025</b>	<b>9,092</b>	<b>0.38</b>	
Oji Specialty Paper	Ebetsu Mill	196,471	25,542	170	0.09
	Tokai Mill	136,429	8,103	1,785	1.31
	Nakatsu Mill	54,476	2,825	23	0.04
	Shiga Mill	20,643	717	1	0.00
<b>Total</b>	<b>408,019</b>	<b>37,187</b>	<b>1,979</b>	<b>0.49</b>	
Oji Nepia	Tomakomai Mill	44,267	3,465	2,253	5.09
	Nagoya Mill	142,594	3,743	12	0.01
	Tokushima Mill	38,165	106	9	0.02
<b>Total</b>	<b>225,026</b>	<b>7,314</b>	<b>2,274</b>	<b>1.01</b>	
<b>Grand total</b>	<b>7,484,355</b>	<b>469,554</b>	<b>72,950</b>	<b>0.97</b>	

#### Issues in achieving the final disposal rate target

The final disposal rate of Oji Paper Group paper mills averaged 0.97% in fiscal 2008, but varied widely, from 0% to nearly 10% (see Figure 1). This was due to various circumstances, including the fact that some mills have their own disposal facilities. In many cases, paying the costs necessary to process effectively utilized waste can

make it more expensive than disposal. In addition, disposal facilities are limited, and the amount of waste that can be disposed of varies along with economic conditions. Therefore, it is not viable to simply shift from burying waste to effectively utilizing it. Furthermore, the adoption of new energy boilers has resulted in new issues,

such as the occurrence of large amounts of combustion ash that cannot be effectively utilized. It will be very difficult to achieve the fiscal 2010 target, but the Group is united as it continues to persevere in waste reduction.

## The Group is united in taking head-on the fresh problems posed by new energy boilers.

One factor preventing the Group from being able to achieve its final disposal rate target is the use of new energy boilers. As described in the topic “Promotion of Global Warming Countermeasures,” these boilers use mainly waste-derived fuel and therefore drastically reduce CO<sub>2</sub> emissions

resulting from fossil-fuel burning. On the other hand, they present many issues from a waste perspective. In any event, it has only been five years since the Oji Paper Group adopted its first new energy boiler system, and the entire Group is committed to solving its problems one by one.

### ■ Issues created by combustion ash produced by new energy boilers

#### 1. High volume of waste produced

It depends on the type of fuel being used, but because most new energy boilers use waste-derived fuels, they produce much more combustion ash than previous boilers did.

#### 2. Ash sometimes contains chlorine or heavy metals

This is due to the chlorine present in the waste plastic contained in RPF, and the lead, etc. contained in scrap tires. When these materials are found in ash, it becomes difficult to effectively utilize.

### ■ Final disposal rate in mills using new energy boilers

In 2004 the Oji Paper Group expanded its adoption of new energy boilers, and eight are in operation today. Each serves as the main boiler of the mill where it is located. There are differences in waste volume because the scale of boilers and fuels used vary, but overall the amount of waste being produced

is greater than any the Group has previously experienced. The final disposal rate for the majority of mills is becoming higher (see Figure 2) because effective utilization of combustion ash is not progressing as hoped.

**Figure 2 Final Disposal Rate of Oji Paper Group Mills Using New Energy Boilers**

Start of operation	Mill	Location	Amount of evaporation (t/h)	Final disposal volume (t)	Final disposal rate (%) 2008
April 2004	Tomakomai Mill, Oji Paper	Hokkaido Pref.	260	3,883	0.32
May 2004	Oita Mill, Oji Paperboard	Oita Pref.	200	3,392	1.06
June 2005	Yonago Mill, Oji Paper	Tottori Pref.	250	400	0.08
May 2006	Nichinan Mill, Oji Paper	Miyazaki Pref.	130	24,249	9.29
November 2006	Tokai Mill, Oji Specialty Paper	Shizuoka Pref.	7	1,785	1.31
October 2007	Kasugai Mill, Oji Paper	Aichi Pref.	140	26,724	3.95
December 2008	Tomioka Mill, Oji Paper	Tokushima Pref.	300	2,970	0.64
December 2008	Nikko Mill, Oji Paperboard	Tochigi Pref.	70	2,493	1.14

#### Figure 2 Focus Points: Relationship between new energy boilers and final disposal rates

- Nearly all mills that have adopted new energy boilers have final disposal rates above the target of 0.5%, and the Oji Paper Group as a whole averages 0.97%.
- Because many of the mills using new energy boilers are large-scale, their effect on the Group average is significant.



## Oji Philosophy

### **Proud of the paper industry's efforts to reduce waste, the Oji Paper Group will consolidate its strength to take aim at solving the basic issues that remain.**

Forty percent of the raw material used to make paper is wood, and 60% is recovered paper. In the case of wood raw material, we have proactively utilized the unused cuttings that remain when lumber is produced. We use all of the recovered paper as well—the important resource that is painstakingly collected and separated by many people. In this way the paper industry has taken materials that, if left alone, would have become waste, and has found ways to utilize them as raw materials for production. This achievement is the result of persistent effort at the facilities, where trial and error brought about higher technologies, which in turn enabled production of raw materials that could be used in both quality and cost-efficiency. The paper industry has been very progressive in reducing waste, and the mentality of effectively utilizing all resources is deeply ingrained.

The key to reducing waste volume is to reduce the volume generated in the first place. At the same time, our industry has promoted effective utilization by other industries of waste we have produced. We have drastically reduced the volume of waste disposed in landfills while working toward our 0.5% final disposal rate target. However, because effective utilization has been performed externally, it has the drawback of being easily affected by economic fluctuations. Destinations for effectively utilizing waste are limited, and so is the amount that can be processed. The inescapable fact is that effective utilization is usually more expensive than disposal in landfills. In addition, we have been affected by the marked increase

in waste created by the new energy boilers we began adopting in 2004, along with the fact that the combustion ash they produce is difficult to effectively utilize. Lamentably, the Group as a whole is not yet in position to achieve its target in the immediate future.

Landfills are limited. Therefore, in order for us to continue providing paper, it is imperative that we accelerate the effective utilization of waste such as combustion ash, and we believe that finding the way to do that is our responsibility. The system of new energy boilers was adopted only five years ago. It poses many issues, and staff are learning more about it each day. The core idea—to take material that would otherwise all become waste and turn it into energy before disposal—is the result of a corporate mentality cultivated over many years, and we will keep moving in this direction from the perspective of maximizing effective utilization of limited resources. The Oji Paper Group is committed to overcoming this challenge by capitalizing on its collective strength. The Group also aims to voluntarily seek out communication with other industries—something that was rare in the past—as it takes on the fundamental issues and avoids superficial solutions.