

Japan-Korea-Taiwan Tripartite Network Meeting 2016
Advanced Treatment of Disaster Waste

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Introduction

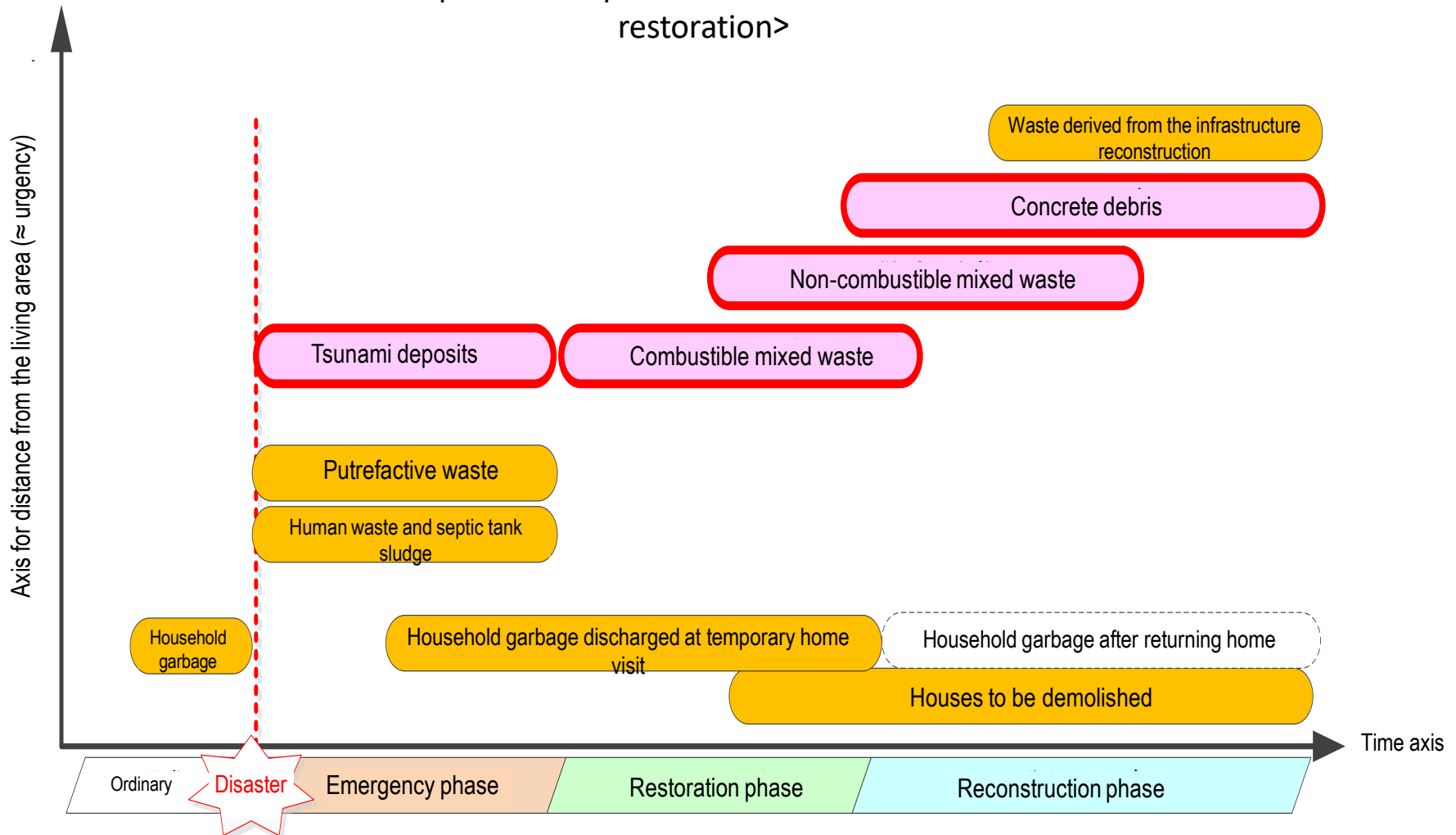
Overview of the Great East Japan Earthquake

- Epicenter extends from off the coast of Iwate to off the coast of Ibaraki, covering about 500 kilometers in the north-south and about 200 kilometers in the east-west.
- Magnitude: M 9.1, the largest seismic intensity 7
- Damages: Death and missing: 19,000 persons
 - Totaly/partially destroyed buildings: more than 400,000
- Amounts of disaster waste
 - Disaster waste: 20 million tons
 - Tsunami deposits: 11 million tons

1. Overview

Chronological changes in production of disaster waste

<Timeline of waste production phases from the outbreak of a disaster to the restoration>



Breakdown of recycling and treatment of disaster wastes

	Iwate Pref.		Miyagi Pref. (commissioned by prefecture)	
Material recycle	4.031 million tons	69.1%	8.36 million tons	86.7%
Recycling into chips (wooden materials, fuel, etc.)	62,000 tons	1.1%	120,000 tons	1.2%
Cement calcination	1.01 million tons	17.3%	—	—
Utilization as thermal source	8,000 tons	0.1%	—	—
Incineration	440,000 tons	7.5%	890,000 tons	9.2%
Reclamation	290,000 tons	5%	270,000 tons	2.8%

2. Remaining Issues

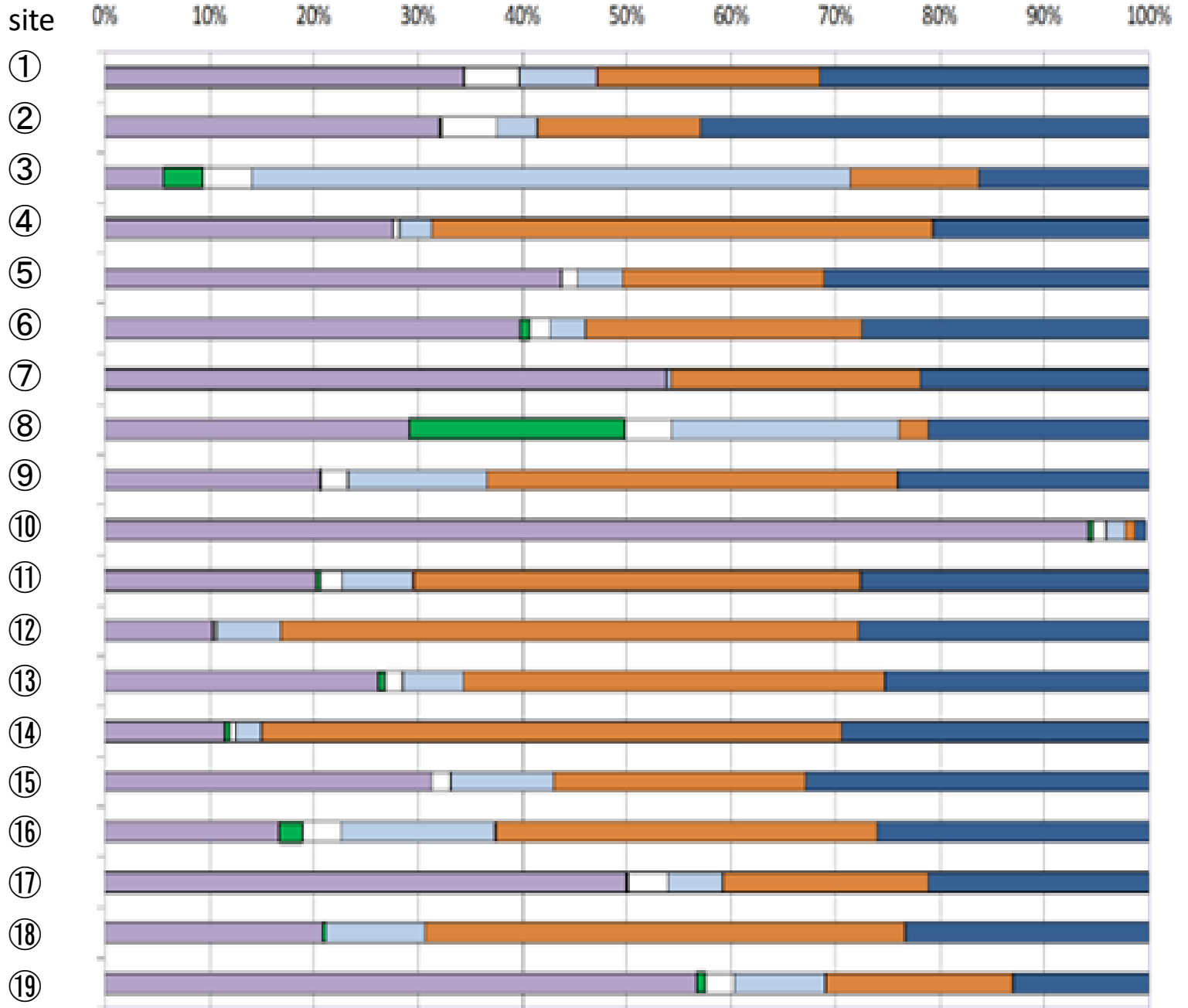
- 1. Recycling rate should be increased**
- 2. How to reduce further the final disposal amount**
- 3. How should we reduce the cost and auxiliary fuel at the incineration facility?**
- 4. Recycling of tsunami deposits should be enhanced further**
- 5. How should we address adverse impacts by tsunami deposits on sorting?**
- 6. For wooden wastes, etc., their conversion to fuels should be promoted further**
- 7. In order to reduce the treatment cost, the recycling rate should be increased further by converting wastes into cement raw materials**

3. Issues on the temporary storage yard

Main categories for sorting of disaster wastes at the primary temporary storage yards

Category	Main objects
Mixed waste	Combustible and non-combustible waste (including sediments and tsunami deposits)
Combustible waste	Wood waste
	Used tires
	Combustible bulky waste (furniture, tatami mats, futon [bedding], mattresses, etc.)
	Clothes
	Plastic waste
Non-combustible waste	Concrete debris, asphalt debris, glass and ceramic waste, roof tile waste, etc.
Metallic waste	Waste of metallic shelf and bicycles, etc.
Hazardous and harmful waste	High-pressure gas cylinders, gasoline and kerosene tanks, pesticide and chemicals, fire extinguisher, asbestos waste, gypsum board, PCB waste, devices using CFC, infectious waste * These items should be stored separately with signs.
Used home appliances	TV sets, refrigerators, washing machine, air conditioner, PCs, microwave ovens, etc.
Used vehicle	Cars
Tsunami deposits	Soil and muddy waste

Wood
 Paper
 Fiber
 Plastic
 Fine particles in diam. 5 mm or less
 Other non-combustible waste



Points for sorting the waste and garbage at a temporary storage yard

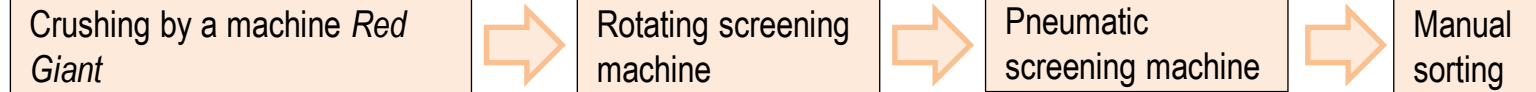
- Heaps of mixed waste and garbage may cause a spontaneous combustion due to fermentation of organic matters and oxidation of metals.
- The decomposed wastes and garbage from marine products, disaster-afflicted rice grains and dead livestock may be a source of bad smells,
- It is important that wood wastes such as pillars, wasted wood materials are separated from combustible mixed wastes and should be collected and deposited temporarily.
- With regard to fishing nets, they become sometimes a waste difficult to treat, since they are prone to get entangled with the blades of cutters.
- Large concrete pieces and blocks, large sized home appliances, bicycles, motorcycles and automotive vehicles should not be included in noncombustible mixed waste

4. Issues on the pre-treatment

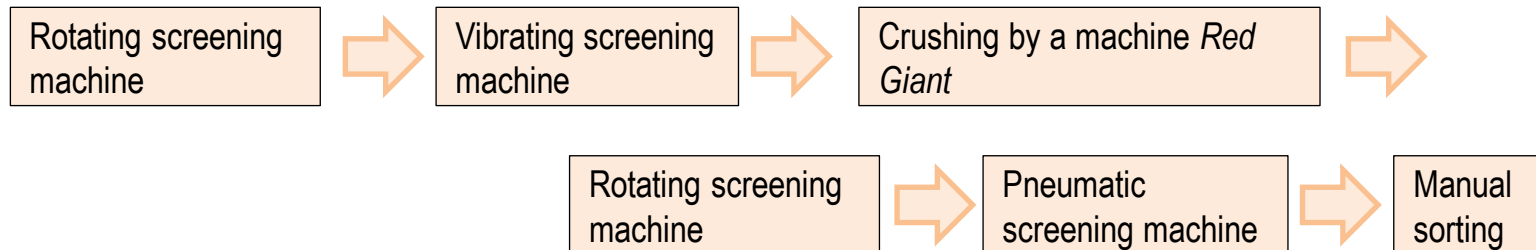
Block	Jurisdiction	Mixed waste (t)	Functions of the treatment facility	Treatment capacity (t/day)
Kesenuma block	Kesenuma	321,000	Crusher, screening machine, pneumatic separator, manual sorting line	764.8
			Crusher, screening machine, pneumatic separator, manual sorting line	240.0
			Crusher, screening machine, pneumatic separator, manual sorting line	5,500.0
			Crusher, screening machine, pneumatic separator, manual sorting line	200.0
	Minami-Sanriku	185,000	Crusher, screening machine, manual sorting line	665.0
Ishinomaki block		1,121,000	Crusher, classified sorting, precise sorting (pneumatic)	17,142.7
			Classified washing	4,800.0
			Classified sorting	960.0
Miyagi east block		154,000	Crusher of bulky waste, crusher of bulky mixed waste, sorting	1,201.8
			Trommel	240.0
			Crushing sorting	322.0
Watari-Natori block	Natori	420,000	Rough crusher, pneumatic/manual sorting	280.0
	Iwanuma	293,000	Sorting by heavy machinery, classifier, manual sorting on the floor, manual sorting	400.0
	Watari	274,000	Trommel, rough crusher, manual sorting, etc.	1,000.0
	Yamamoto	433,000	Rough crusher, trommel, manual sorting	620.0

An example of recycling and treatment flow 1

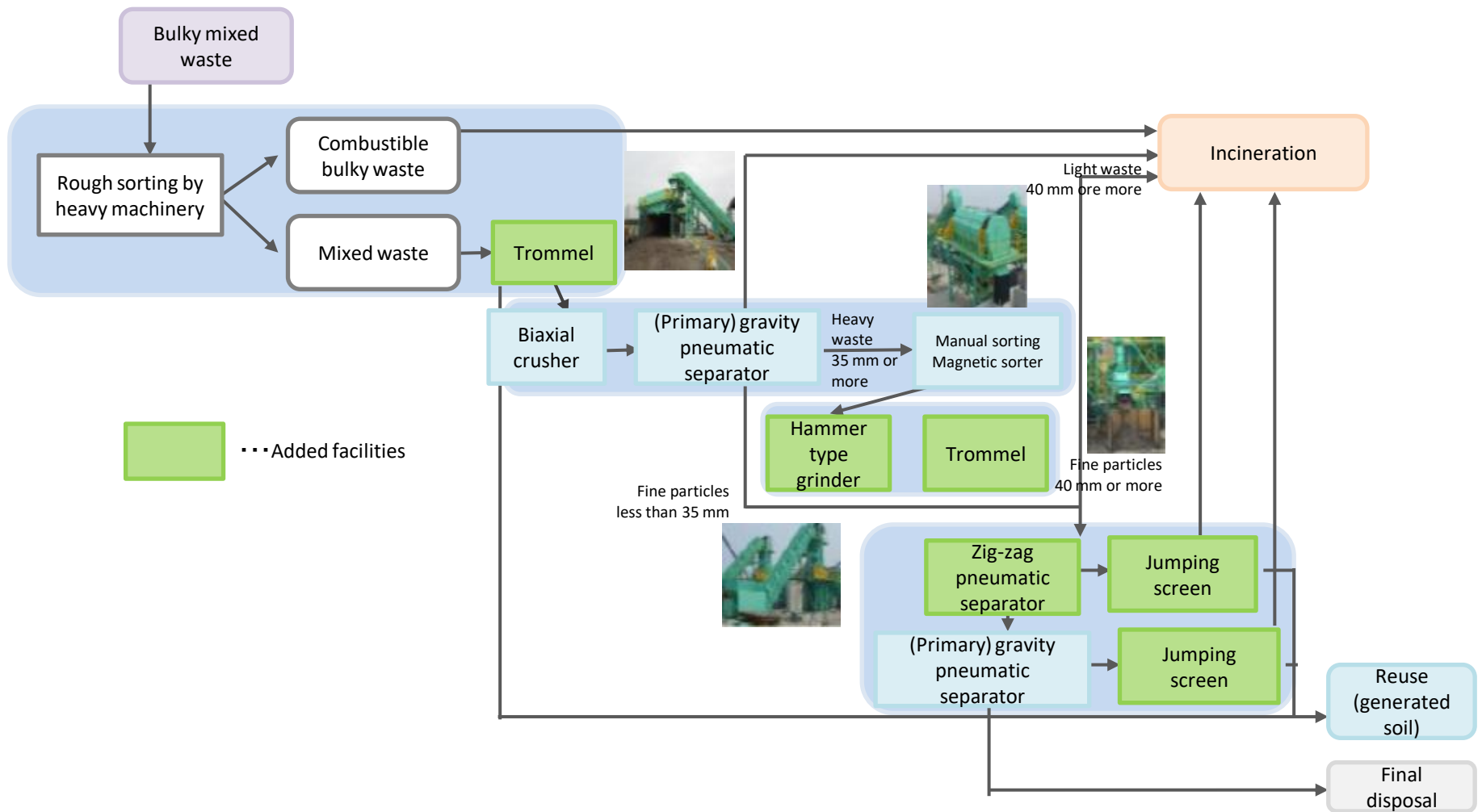
1. Mixed waste



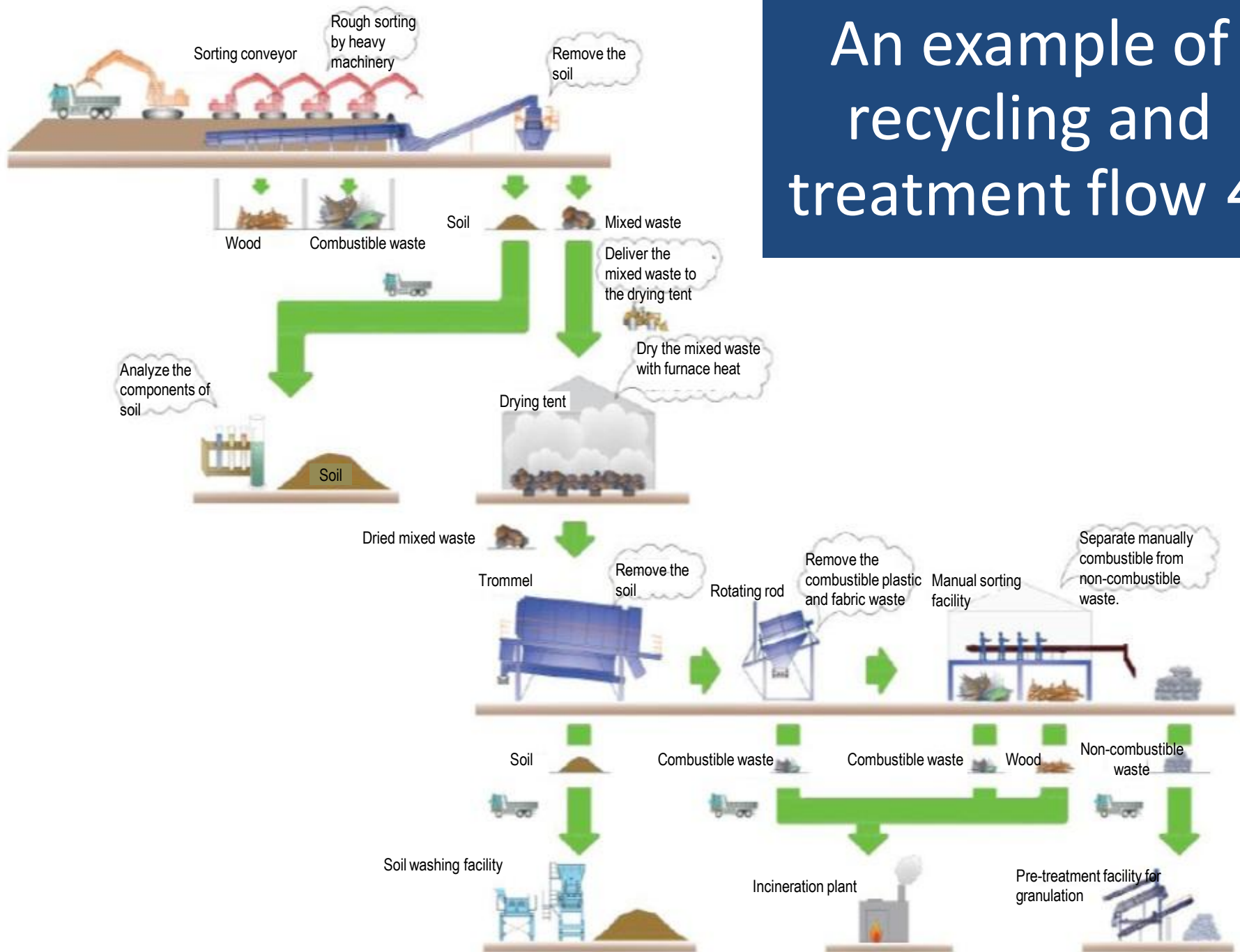
2. Sand mixed waste



An example of recycling and treatment flow 3



An example of recycling and treatment flow 4



Points for sorting of combustible mixed wastes and garbage

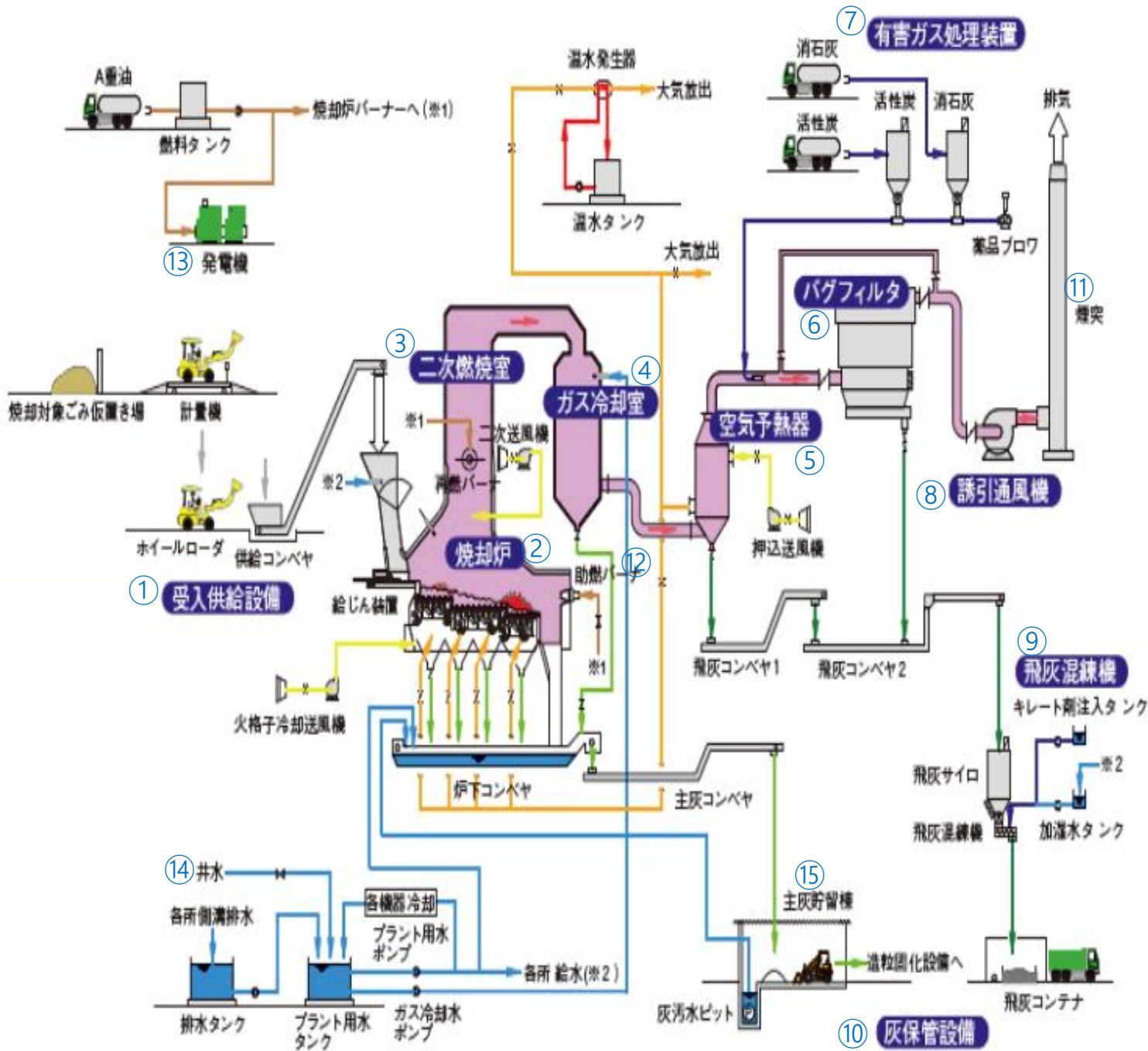
- The important thing to consider is how to separate the soil adhering to the waste. Because of this, it is necessary to strengthen the sorting line before and after the crushing process.
- Removal of the soil from the waste is effective, if it is dried and lowered in water content.
- The sorting machine should be of travelling type, so that the separation steps are designed to be flexibly changeable to have a high efficiency.
- In the pile of mixed waste and garbage, waste substances already started to separate from each other, and to decompose. The higher the light substance concentrates, the lower heavy small gravels become numerous. Therefore, in the latter half of the treatment process, the sorting line is required to be enhanced

Points for sorting of noncombustible mixed wastes and garbage

- It is important to select an adequate crusher considering its technological features. For hard materials such as concrete, bricks and slates, a hammer crusher is recommendable, and for soft materials such as composite products, you are recommended to use a low speed uniaxial or biaxial crusher.
- After removing materials of large diameters on the rotation or vibration sieve, it is effective that materials under the sieve are subject to wind force separation and to specific gravity difference separation.
- For removal of the soil from tsunami deposits, the sorting line should be enhanced in capacity. To eliminate the soil strongly adhering to the material, it is necessary to pass materials through the sieve two or three times.

5. Issues on incineration

	Block	Jurisdiction	Treatment method	Facility capacity (t/day)	Number of furnaces	Total capacity of facilities (t/day)	Incineration capacity (t)	Operation period (from when the furnace operation started)	
Iwate	Miyako		Floor-fixed type stoker	47.5	2	95	55,314	Mar. 2012 - Mar. 2014	
	Kamaishi		Shaft furnace	50	2	100	44,723	Feb. 2012 - Mar. 2014	
Miyagi Pref.	Kesennuma	Kesenuma (Hashikami)	Stoker	219	1	219	40,932	Jan. 2013 - Nov. 2013	
			Rotary kiln	219	1	219	32,119	Dec. 2012 - Nov. 2013	
		Kesenuma (Koizumi)	Stoker	219	1	219	27,544	Feb. 2013 - Aug. 2013	
			Rotary kiln	109	1	109	13,160	Jan. 2013 - Aug. 2013	
	Minami-Sanriku		Vertical stoker	95	3	285	90,490	Sep. 2012 - Oct. 2013	
	Ishinomaki		Stoker	329.4	3	988.2	364,137	Jul. 2012 - Jan. 2014	
			Rotary kiln	300	2	600	211,083	May 2012 - Dec. 2013	
	Miyagi East block		Stoker	110	1	110	31,680	Jul. 2012 - Oct. 2013	
			Rotary kiln	210	1	210	60,655	Aug. 2012 - Oct. 2013	
	Watari-Natori	Natori	Water-cooled stoker	95	2	190	71,505	Apr. 2014 - Oct. 2013	
			Iwanuma	Floor-fixed type stoker	50	2	100	35,110	May 2012 - Oct. 2013
		Rotary kiln		95	1	95	30,431	May 2012 - Oct. 2013	
		Watari		Chain stoker	105	5	525	167,772	Apr. 2012 - Nov. 2013
		Yamamoto	Stoker	109.5	1	109.5	52,231	Jun. 2012 - Dec. 2013	
Rotary kiln			200	1	200	82,313	Apr. 2012 - Dec. 2013		
Sendai City	Gamo receiving site		Rotary kiln	90	1	90	55,281	Oct. 2011 - Sep. 2013	
	Arahama receiving site		Rotary kiln	300	1	300	152,392	Dec. 2011 - Sep. 2013	
	Ido receiving site		Chain stoker	90	1	90	53,351	Oct. 2011 - Sep. 2013	



- ① Waste Supply
- ② Incinerator
- ③ Chamber
- ④ Gas Cooler
- ⑤ Air Heater
- ⑥ Bag Filter
- ⑦ Acid Gas Cleaning Device
- ⑧ IDF; induced draft fan
- ⑨ Fly Ash Fixation
- ⑩ Ash storing equipment
- ⑪ Chimney
- ⑫ Burner
- ⑬ Generator
- ⑭ Water
- ⑮ Bottom ash reservoir

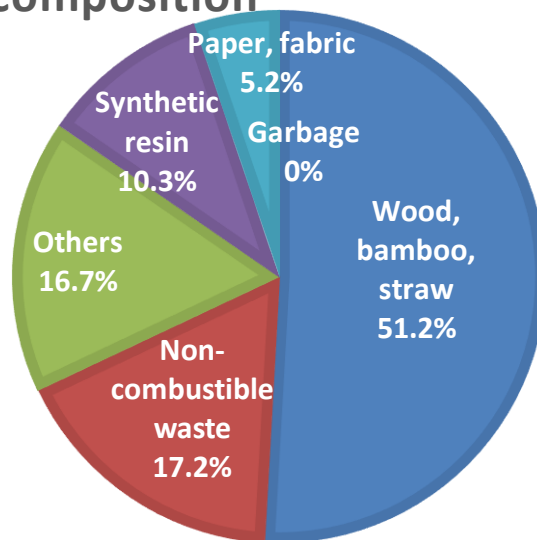
Legend for flow types:

- Trash (Grey arrow)
- Gas (Red arrow)
- Air (Yellow arrow)
- Heated Air (Orange arrow)
- Water (Blue arrow)
- Hot Water (Red arrow)
- Heavy Oil (Brown arrow)
- Chemical (Dark Blue arrow)
- Bottom Ash (Green arrow)
- Fly Ash (Light Green arrow)

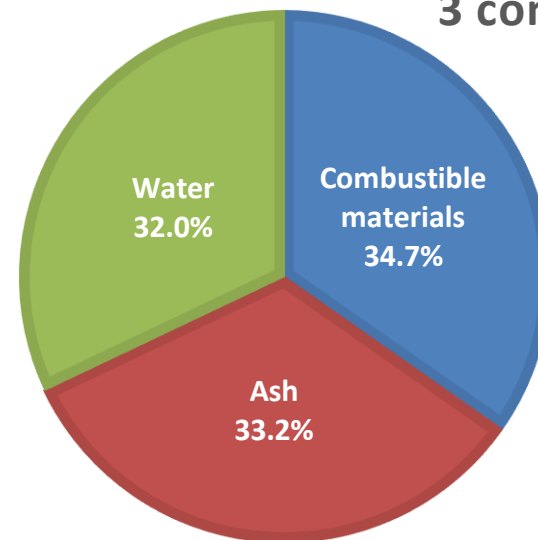
Characteristics of disaster waste to be incinerated

Item				Average	Range
Stoker type	Waste type, composition	Paper, fabric	(%)	5.2	0.0 – 26.2
		Synthetic resin	(%)	10.3	0.1 – 35.4
		Wood, bamboo, straw	(%)	51.2	13.3 – 97.5
		Garbage	(%)	0.0	0.0 – 0.0
		Non-combustible waste	(%)	17.2	0.2 – 44.0
		Others	(%)	16.7	0.0 – 51.9
	3 components	Water	(%)	32.0	14.0 – 49.3
		Combustible materials	(%)	34.7	12.6 – 66.7
		Ash	(%)	33.2	2.5 – 64.2

Type & composition

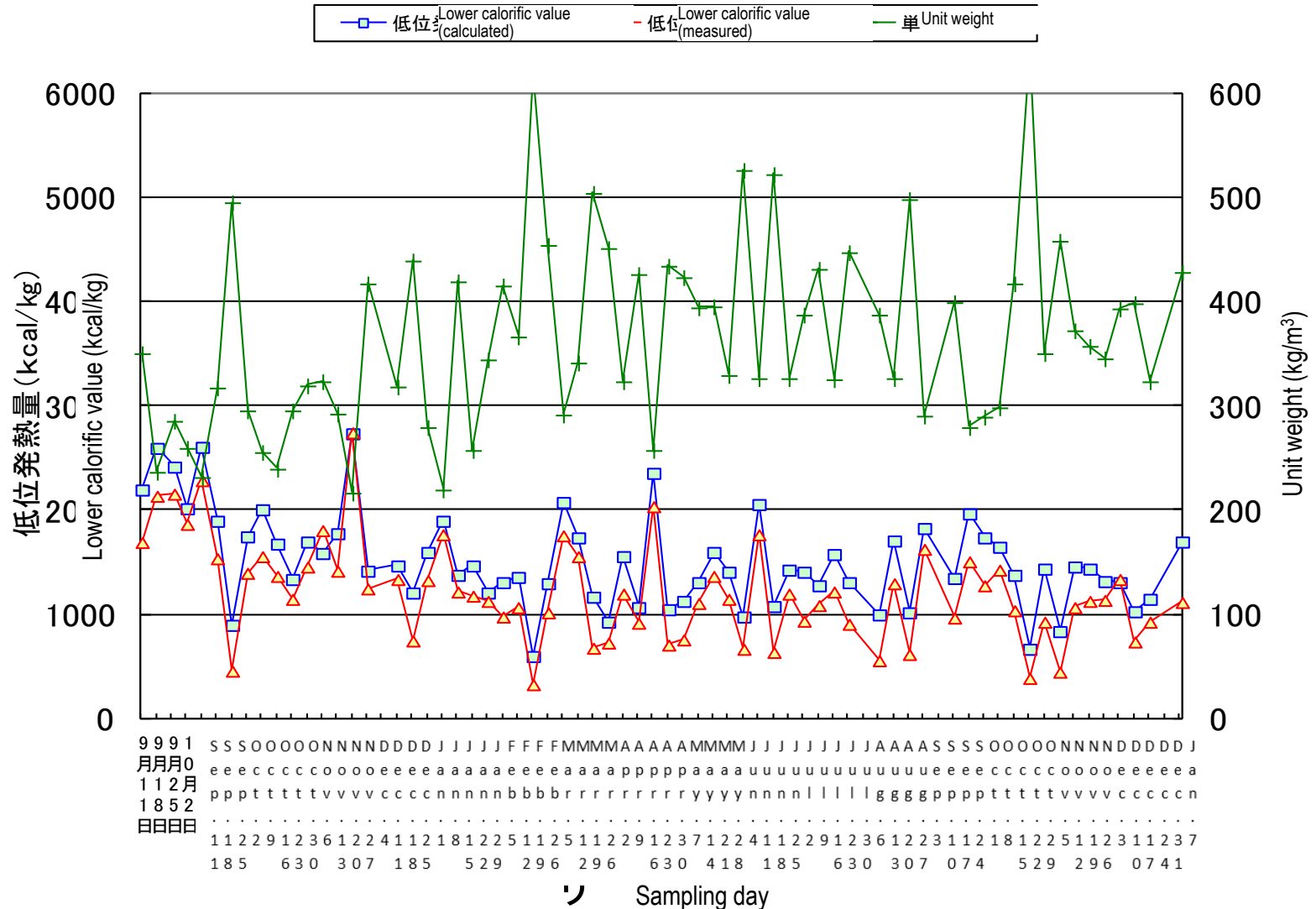


3 components



Changes in characteristics of waste to be incinerated

Results of analysis of combustible waste (calorific value, gravity)



Points should be improved for incineration

1. The calorific value of the waste is low due to insufficient separation performance on the pre-treatment.
2. The waste quality is likely to change significantly during the process of treatment.
3. The moisture content of the waste is prone to be adversely affected by the rain.
4. Combustibles for incineration tends to have a high proportion of ash due to tsunami deposits.
5. Bulky wastes and things likely to coil (nets, cords) hinder the waste feeding process.
6. With the use of an auxiliary desiccant in the pretreatment process, the generation of fly ash increases.
7. In some cases, it is necessary to charge a large amount of insolubilizing agent for the treatment of fly ash.

6. Issues on recycling

1. Issues on the use of ash from recycled waste as material of cement
2. Issues on the use of recycled tsunami deposit for construction materials

Benefits using cement plants

For the incineration treatment of waste, existing cement plants can be used effectively if they are repaired or remodeled for this use.

- ✓ Making it possible to treat the waste early and promptly
- ✓ Able to reduce new capital investment

Waste and incineration ash are usable as a raw material of cement

- ✓ In comparison with the incineration treatment, the cement plant can handle the soil and sludge more flexibly and promptly.
- ✓ No landfilling of incineration ash is needed.

Requirements for utilization of cement plants

Requirements for quality control of cement products

- ✓ To reduce the chlorine concentration
- ✓ Eliminate foreign matters including metals
- ✓ Control the grain size to a certain level or less

Requirements for repairing of cement products plants

- ✓ In the event the plant was damaged by a disaster, the facilities of the plant need to be repaired.

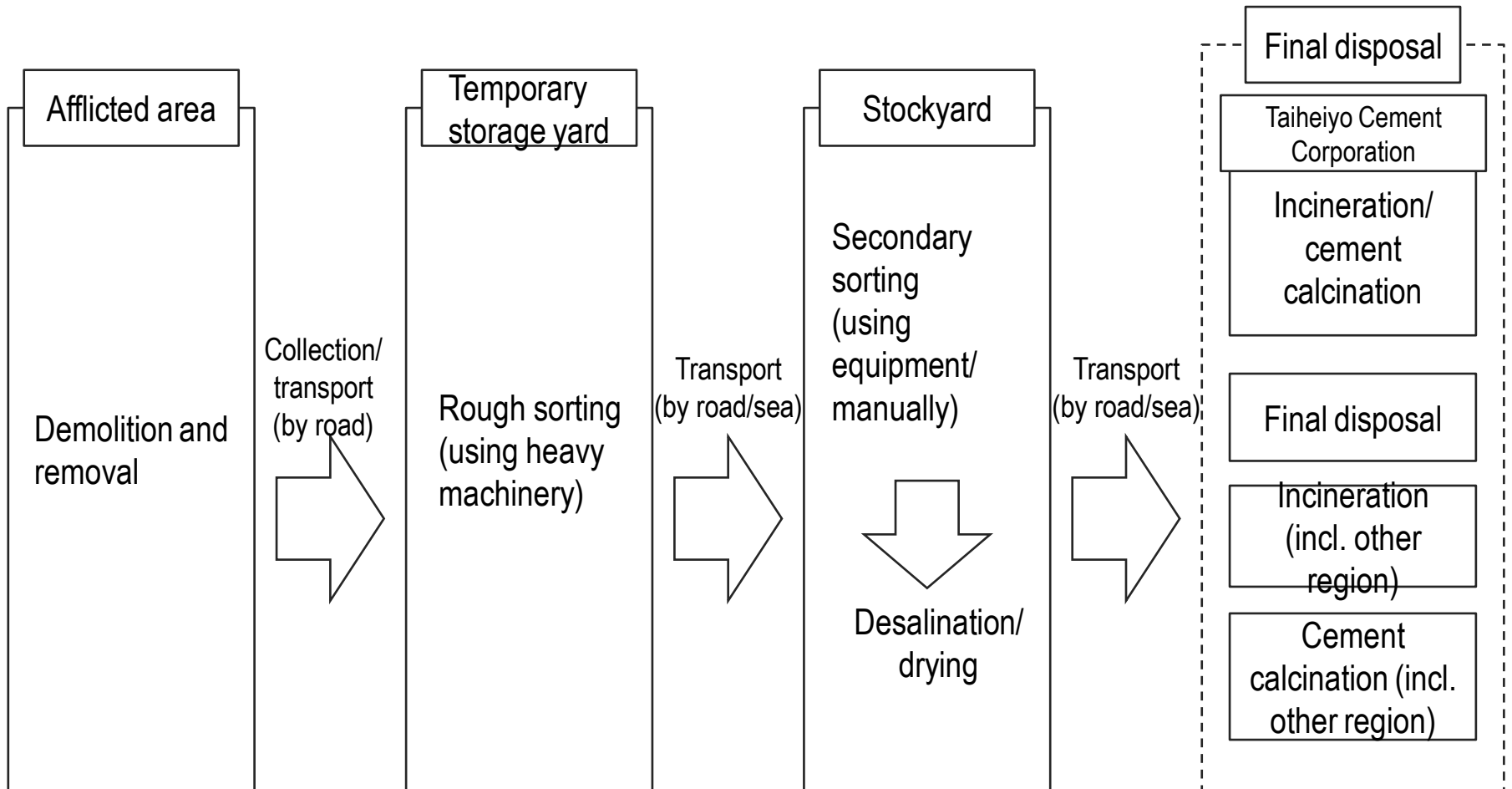
Treatment results in Iwate Prefecture

Item	Within the prefecture			
	Cement plant	Temporary furnace	Existing incineration facility	
			Coastal area	Other area in the prefecture
Number of facilities (sites)	2	2	3	11
Debris treatment capacity (t)	1,038,880	100,037	49,081	54,711
Percentage to the total amount of generated waste in the prefecture (6,180,000 t)	17%	2%	1%	1%

Table 2.5.1: Treatment results of disaster waste by type of facility in Iwate Prefecture (amount treated within the prefecture only)
 (Source: Prepared using the various reports and references)

Within the afflicted area

Within/out the prefecture



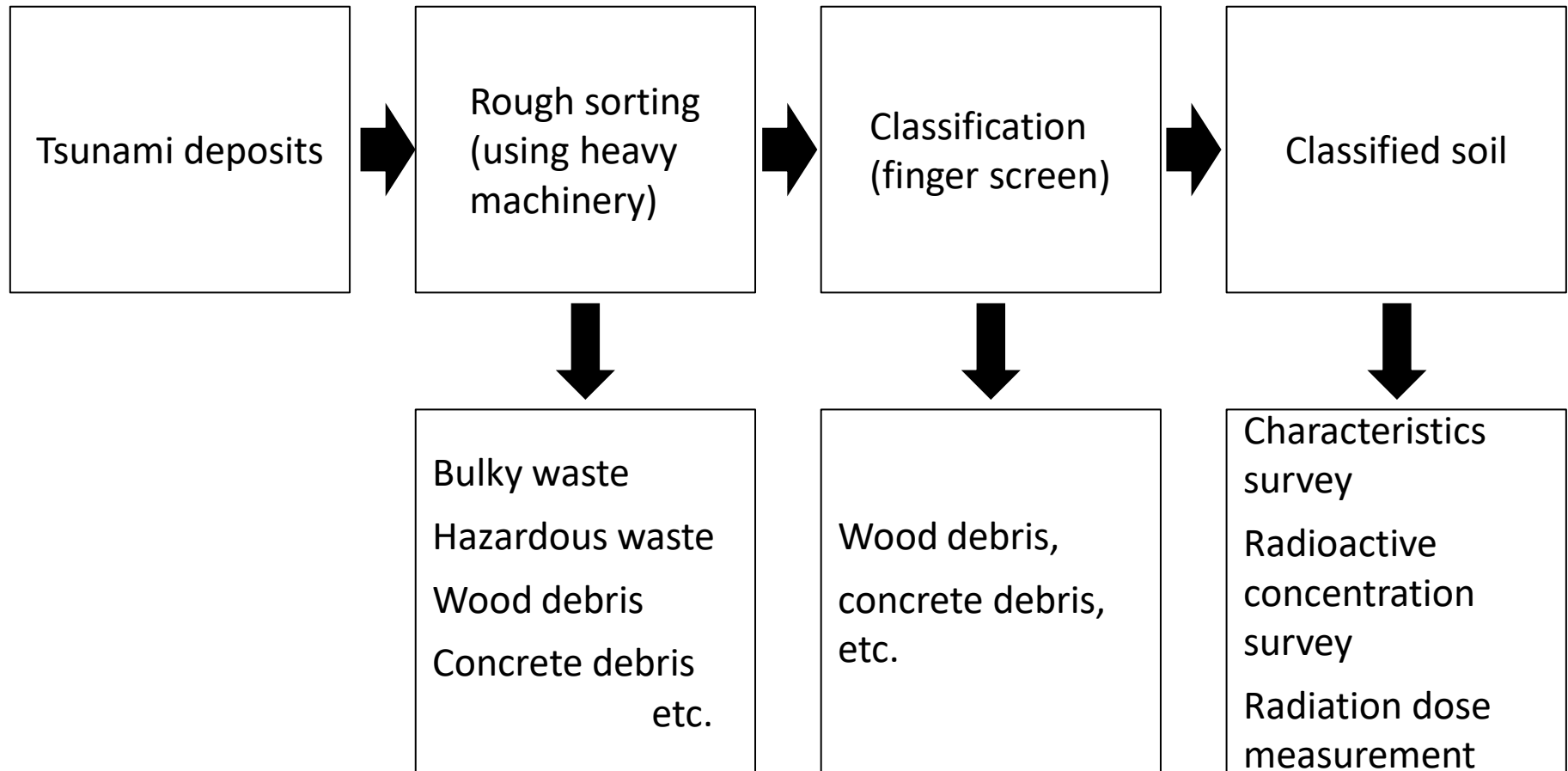
Acceptance standard of wastes for the use as cement material

Type	Incineration	Measurement items	Standard/ acceptance conditions	Grounds
Wood debris	To the biomass furnace To the incineration furnace	Chlorine concentration	<ex.0.1% (Appendix.13)	According to their self-regulation
Combustible mixed waste (wood debris, plastic waste, etc.)	To the incineration furnace	Chlorine concentration	<ex.0.1% (Appendix.13)	According to their self-regulation

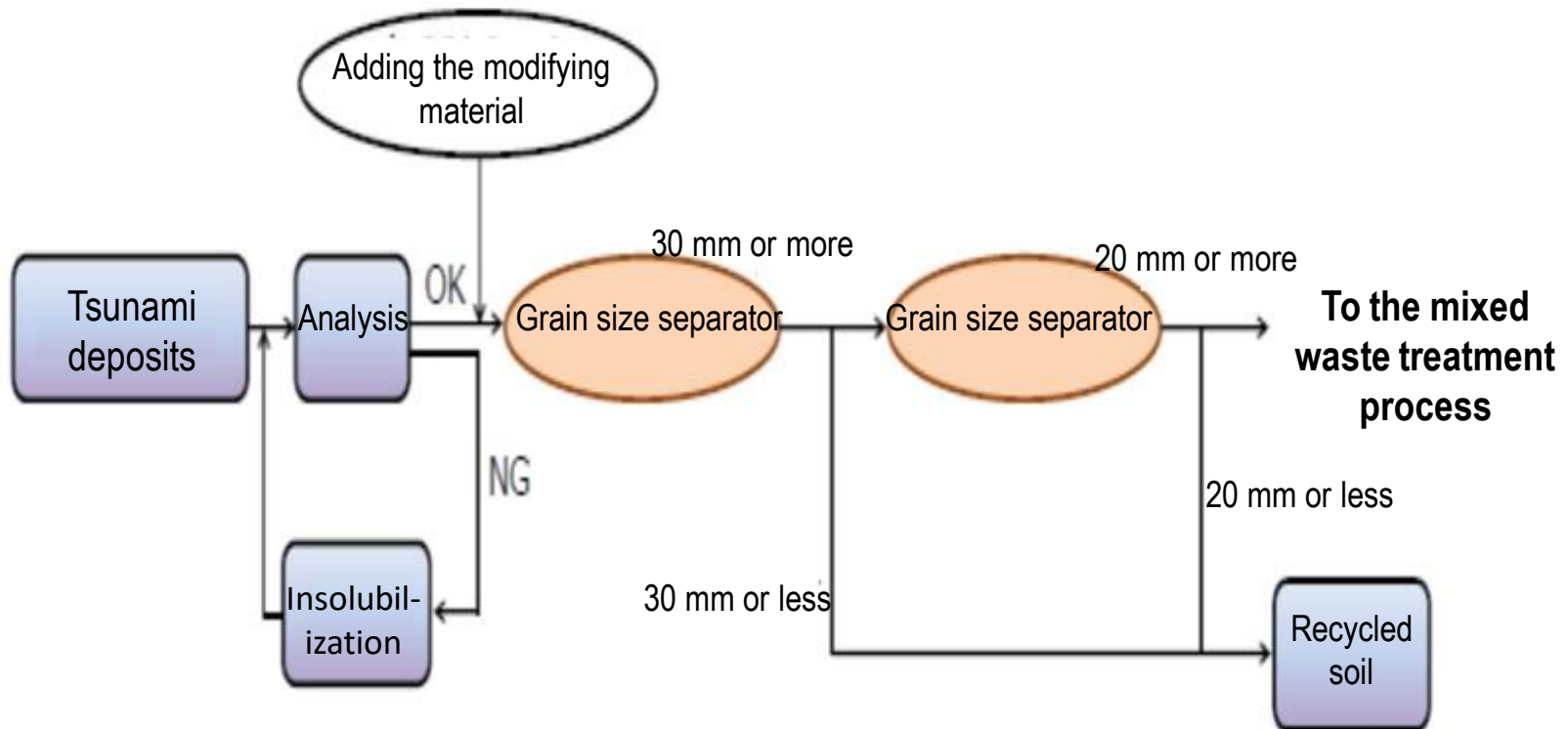
Standards for treatment residues

Type	Standards, etc.	Basis law	Measurement items/frequency
Wood incineration residue	Incineration ashes and fly ashes: landfill criteria	Prime Minister's Office Ordinance "Judgment criterion relating to metal-including industrial waste"	Heavy metals, etc.
Incineration residue of combustible mixture	Radioactive cesium: 8,000Bq/kg or less	Ministry of the Environment notice (MEN) in April, 2012	Once a month
Residue after incombustible sorting	Landfill criteria	Prime Minister's Office Ordinance "Judgment criterion relating to metal-including industrial waste"	Heavy metals, etc.
Residue after the washing of tsunami deposits	Radioactive cesium: 8,000Bq/kg or less	Ministry of the Environment notice (MEN) in April, 2012	Once a month

Recycling examples of tsunami deposits



Recycling examples of tsunami deposits 2



Acceptance condition of recyclables

Type	Uses	Criterion and acceptance conditions	Measurement items and frequency
Wood waste	Board materials	Chlorine concentration 0.4% or less Radioactive cesium concentration 100Bq/kg or less	The reception is based upon the regulations of receivers. One a month, basis law: MEN dated April 17, 2012
	Fuel	Chlorine concentration 0.1% or less Radioactive cesium concentration 240 to 480 Bq/kg	The reception is based upon the regulations of receivers. One a month, basis law: MEN dated April 17, 2012
Plastic waste	Plastic raw material	Radioactive cesium concentration 100Bq/kg or less	One a month, basis law: MEN dated April 17, 2012
	Fuel	Radioactive cesium concentration 240 to 480 Bq/kg	One a month, basis law: MEN dated April 17, 2012
Concrete debris	Reusable as crushed stone	Quality standard Grain size distribution: regulation for percentage passing Corrected CBR: 20% or more Plasticity index IP: 6 or less Optimum water content, compaction test Reduction by friction 50% * Regulation for the use as sub base course material Hazardous substances (hexavalent chromium, others) Radioactive cesium concentration 100Bq/kg or less	Surprise inspection method by lot management Iwate Prefecture's manual for the use of reconstruction materials, dated July 3, 2012 Once a month, basis law: MEN dated April 17, 2012
Asphalt debris	Raw material of asphalt	Radioactive cesium concentration 100Bq/kg or less	Once a month, basis law: MEN dated April 17, 2012
Metallic waste Tsunami deposits	Scraps Regenerated soils	Radioactive cesium concentration 100Bq/kg or less Soil pollution standard	Once a month, basis law: MEN dated April 17, 2012 "July 2011's Guidelines for the treatment of tsunami deposits", Ministry of the Environment

Conclusion

1. Points for sorting the waste and garbage at a temporary storage yard

The garbage from marine products and dead livestock may be a source of bad smells. These wastes should be prevented from being mingled with combustible mixed waste, and be buried into the ground immediately.

2. Points for sorting of combustible mixed wastes and garbage

Removal of the soil from the waste is effective, if it is dried and lowered in water content. The sorting machine should be of travelling type, so that the separation steps are designed to be flexibly changeable to have a high efficiency.

3. Points for sorting of noncombustible mixed wastes and garbage

For removal of the soil from tsunami deposits, the sorting line should be enhanced in capacity. To eliminate the soil strongly adhering to the material, it is necessary to pass materials through the sieve two or three times.

4. Points should be improved for incineration

The calorific value of the waste is low due to insufficient separation performance on the pre-treatment.

The waste quality is likely to change significantly during the process of treatment.

The moisture content of the waste is prone to be adversely affected by to the rain.

5. Benefits of cement plants using for the treatment of waste,

Existing cement plants can be used effectively if they are repaired or remodeled for this use.

Overview of the partial amendments of the Waste Management and Public Cleansing Act and the Basic Act on Disaster Control Measures (enforced on August 6, 2015) (Act No. 58, 2015)

Partial amendment of the Waste Management and Public Cleansing Act

Establish relevant rules and regulations to improve preparation for disaster in peace time.

Establish a special measure regarding construction of new waste treatment plants and its use in case of disaster.

Partial amendment of the Basic Act on Disaster Control Measures

Prepare a guideline for treatment of waste generated by huge disaster.

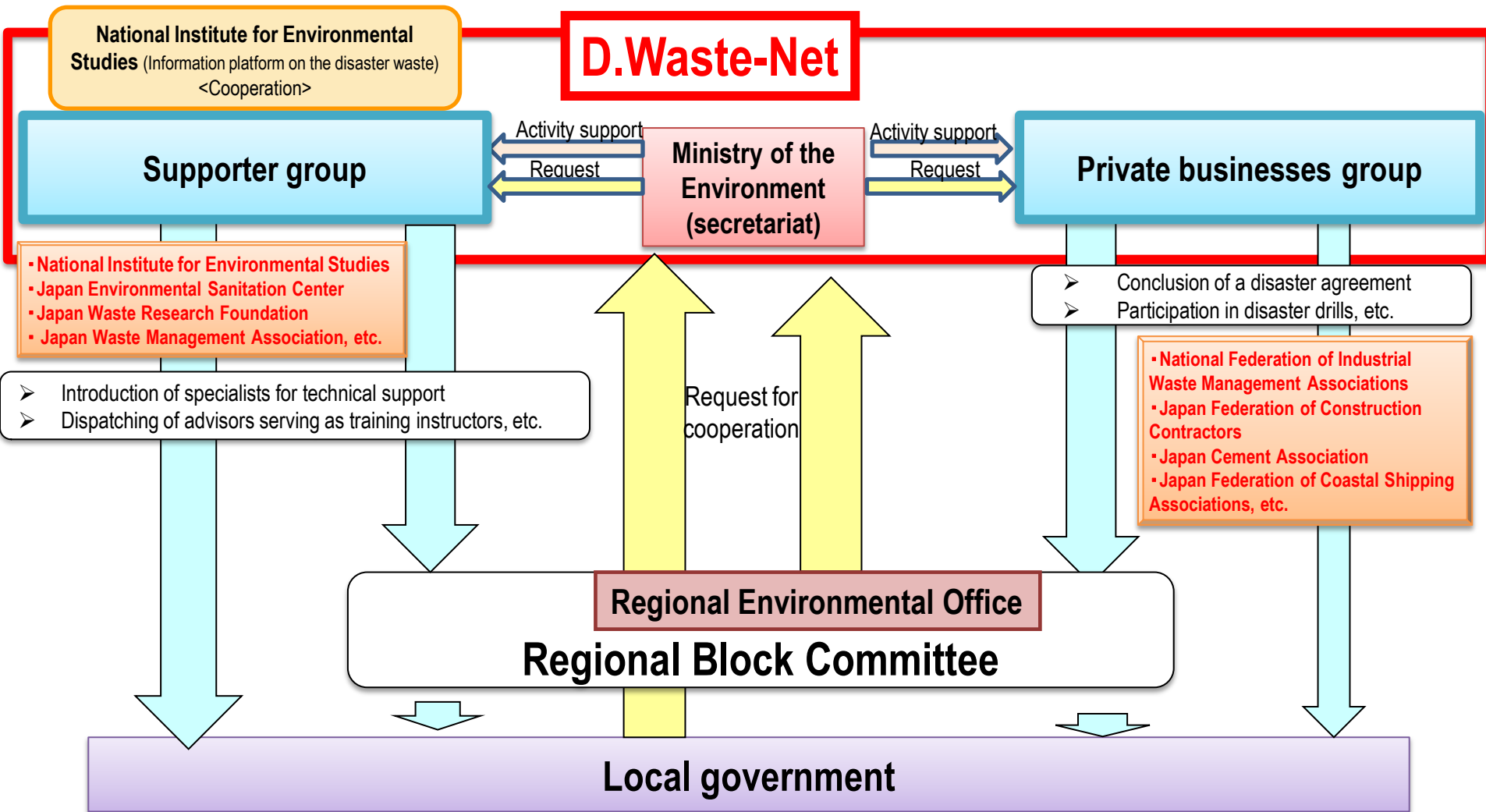
Establish measures taken on behalf of Minister of Environment for preparation for a huge disaster.

Application for the September 2015 Heavy Rainfall Disaster in Kanto and Tohoku districts

[Joso City, Ibaraki and Oyama City, Tochgi]
○ Dispatching of the specialists using the Disaster Waste Treatment Support Network (D. Waste-Net)
(Article 4-2)

[Joso City, Ibaraki]
○ Waste treatment was started at an industrial waste treatment plant on post notification
(Article 15-2-2, special measures)

Disaster Waste Treatment Support Network (D. Waste-Net) (established on September 16, 2015)



Application for the September 2015 Heavy Rainfall Disaster in Kanto and Tohoku districts

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Thank you for your attention!