July 8 2016
The Society for Remediation of Radioactive Contamination in Environment (SRRCE)

Current Trends and Issues on Contaminated Soil and Waste Treatment Technologies

Ryutaro Yatsu, Ph.D.
President & CEO
Japan Environmental Storage and Safety Corporation (JESCO)

Overview of JESCO

JESCO was established by the Law to assist MOEJ for implementation of the PCB waste treatment and Interim Storage project.

1. Title of the Law: Japan Environmental Storage and Safety Corporation (entry into forth on Dec. 24, 2014)

- PCB Wastes Treatment
- Interim Storage Project in Fukushima

2. Minister in charge : Minister of the Environment

3. Establishment: Apr. 1, 2004

4. Capital : ¥ 9.6 Billion (All from the Government) (as of Mar. 31, 2016)

5. Employee : Board Member: 9、Employee : 370 (as of Mar. 31, 2016)

The revision of the laws to expand the mandate to include interim storage project in Fukushima

Responsibility of the Government

1. The Government shall construct the facilities and secure the safety.
2. The Government shall take an appropriate actions to obtain recognition and cooperation from the residents near the facilities
3. The Government shall take an appropriate actions to accomplish final disposal outside Fukushima Prefecture within 30years from the start of the project

Mandate of JESCO

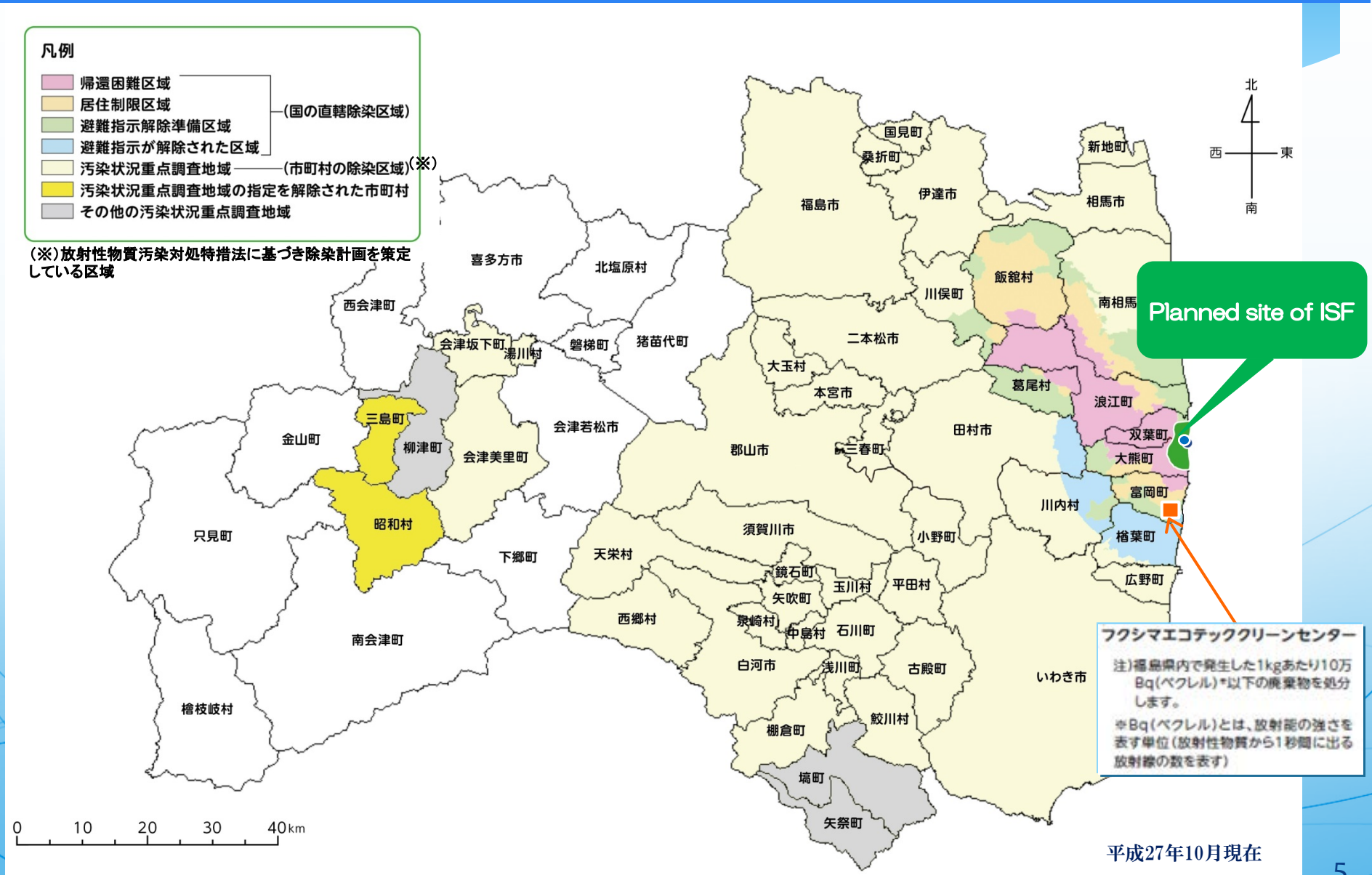
JESCO implements collection and transportation of removed soil, information gathering, providing technological knowledge, research & development for the project

※ The Law was entry into forth on Dec. 24, 2014.

Outline of the JESCO's Role in 2016

1. Consultation for Ordering Process of Construction Works
2. Deputy Supervisor Service of Construction Works
3. O&M of the Facilities
4. Supervisor Service for Transportation by Integrated Information Management System
5. Environmental Monitoring and Communication
6. Training and Education
7. Technological Survey
8. Demonstration Project of Treatment Technologies of Removed Soil

Location of interim storage project in Fukushima



Transportation to the ISF (Pilot Transportation)

- Pilot transportation is implemented for about a year in order to confirm safe and secure transport towards transportation of a large quantity of decontamination soil
- From the start of pilot transportation, MOE conducts management of whole targeted materials, traffic management (transportation vehicles) and monitoring survey to implement safely and steadily
- By pilot transportation, approx. 1,000 ㎥ of decontamination soil will be transported from each relevant municipality, depending on each specific situation

◆ Formulation of traffic operation plan

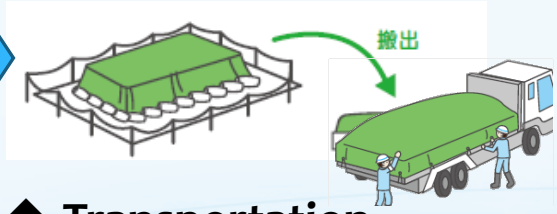
Before implementing transportation, MOE makes sufficient adjustment with the relevant municipalities and provide education and trainings to drivers and so on.

◆ Route setting

Transport route is set beforehand, making use of express highways.

◆ Loading

Extra care is taken for the surrounding environment by loading and securing the packaging so it does not scatter or leak.



◆ Transportation

During the delivery, transport objects and location are monitored.

◆ Response to accidents

A system is established to immediately respond in case of an accident.

◆ Monitoring survey

Impacts on the living environment and of radiation doses due to transportation are monitored and will be publicly announced.

⇒ MOE is preparing for future transportation through implementation and review of the pilot transportation

Aspect for 5year Ad-hoc Policy on Interim Storage Facility ①

FY		Land Acquisition	Volume of Transportation	Volume of soil generated from decontamination <> is the volume before incineration
2015	March 2015 Transportation started	Approx. 22 ha ※Actual amount as of march 25, 2016	Approx. 50,000 ㎥	＜Approx. 10.6 mil. ㎥＞ ※Actual amount as of the end of Dec. 2015 ※Total amount of storage and amount already delivered
2016		Approx. 140 – 370 ha	Approx. 0.2 mil. ㎥	Approx. 16 – 22 mil. ㎥ <approx. 18.7 – 28 mil. ㎥> ※Estimated value based on decontamination implementation plan as of July 2013 Among following items which are difficult to treat other than in ISF will be installed, but it is not included in above volume of soil generated from decontamination ① Approx. 0.7mil. ㎥ of decontamination soil with radioactive concentration of less than 8,000Bq/kg ② Approx. 0.4 mil. ㎥ of waste generated from ISF construction (①&② will possibly be significantly decreased or increased after the incineration) ③ Volume of waste in the “Area where people have difficulties in returning for a long time” and in future follow-up decontamination which are both difficult to estimate for the moment
2017		Approx. 270 -830 ha	Approx. 0.5 – 0.7 mil. ㎥	
2018	Opening between Ryozan & Soma IC (goal) Facilitation of Okuma IC completed (goal)	Approx. 400 – 940 ha	Approx. 1.4 – 2.5 mil. ㎥	
2019	Facilitation of Futaba IC completed (goal)	Approx. 520 – 1,040 ha	Approx. 3 – 6.5 mil. ㎥	
2020	July: Tokyo Olympic and Paralympic will be held	Approx. 640 – 1,150 ha	Approx. 5 – 12.5 mil. ㎥ (3.5 – 8 mil. ㎥ until June)	

※ This prospect will be reviewed according to the progress of ISF construction, as needed

< Concept of estimation >

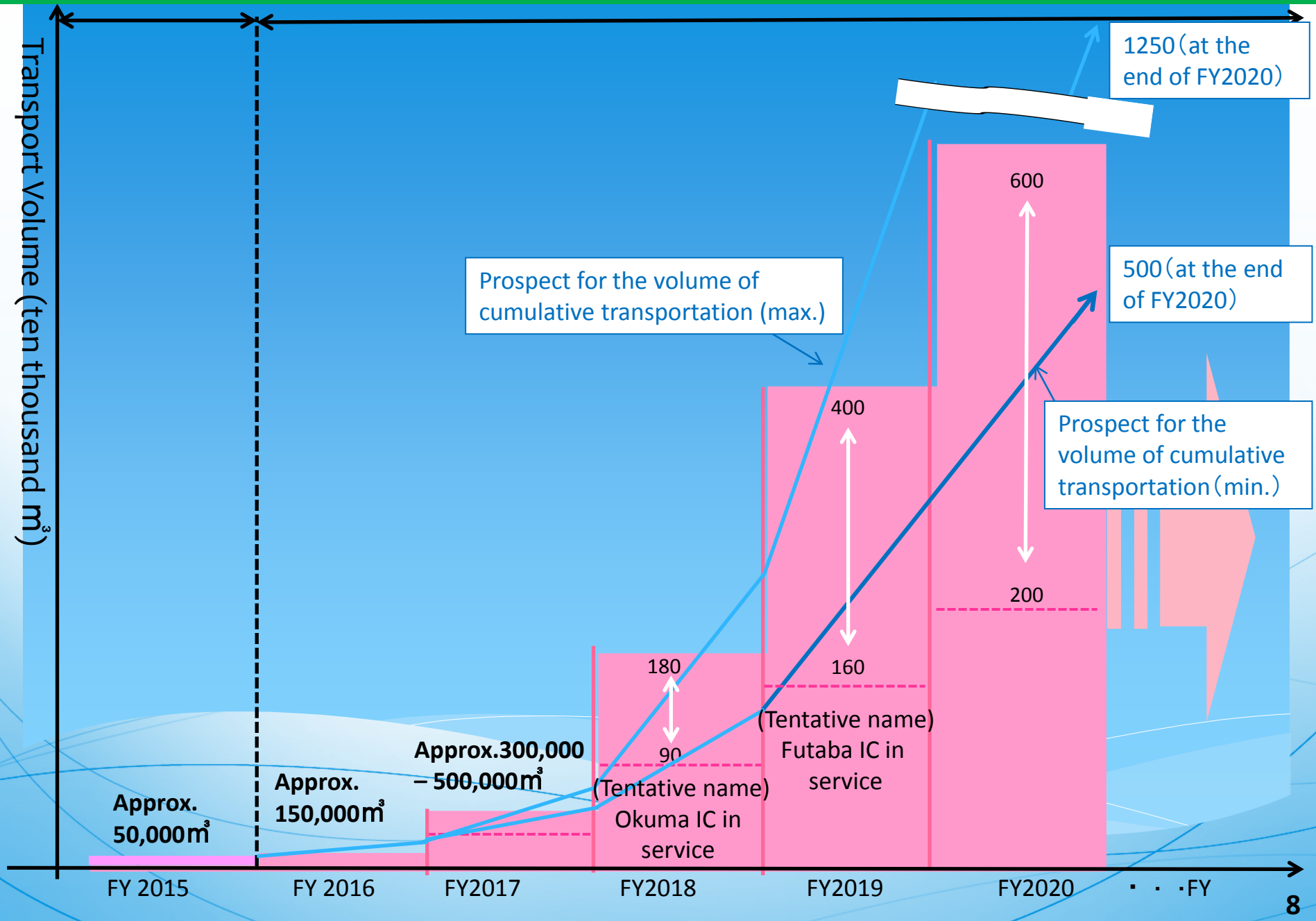
◆Area for land acquisition will be estimated flexibly according to explanation phase to the landowners

◆To construct facilities, it will need comprehensive area and 2/3 will be assumed to be used for facilitation. The possible volume for installation is to be 10,000㎥/ha and 140,000㎥/5ha for a storage facility, and will be installed from TSS to ISF sequentially

◆Approximate period from contract with operators to ISF operation: 3months for TSS, 6months for delivery & classification, 12months for storage, 18months for incineration

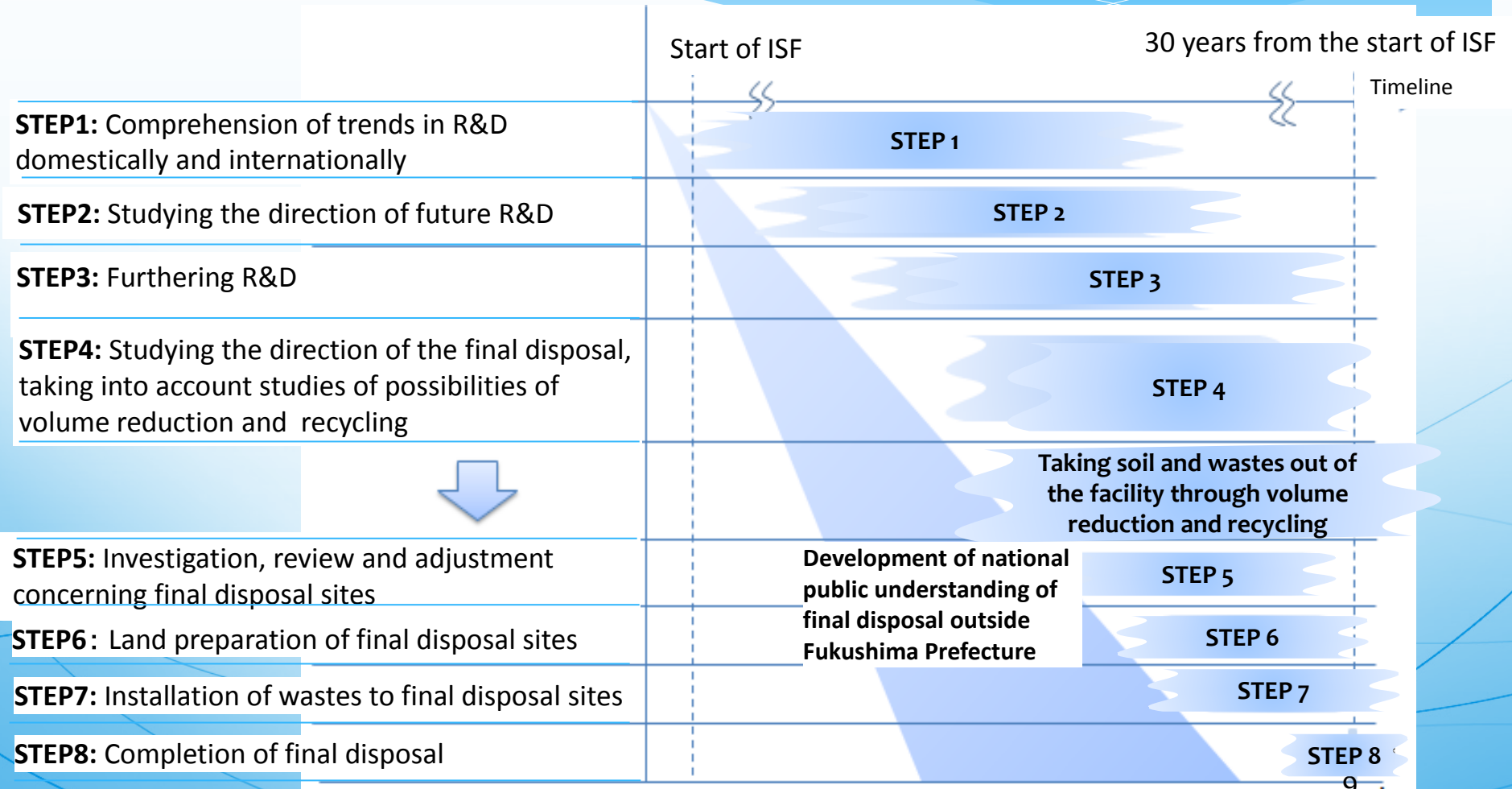
◆On the premise that infrastructure construction on roads for Okuma and Futaba IC would proceed as planned, the maximum volume of possible transportation is estimated: 2mil. ㎥ /y before the operation of both IC, 4mil. ㎥/y after Okuma IC & before Futaba IC, 6 mil. ㎥/y after the both ICs operation

Aspect for 5year Ad-hoc Policy on Interim Storage Facility ②



8 Steps towards the Final Disposal outside Fukushima Prefecture within 30 years from the Start of the ISF

- MOE conducts R&D and examines a direction of the final disposal, taking into account radioactive decay and possibilities of volume reduction and recycling
- MOE will also develop national public understanding through dissemination of information concerning the reuse of low radioactive materials and the final disposal outside Fukushima Prefecture



Facilities and Disposal Process at the Interim Storage Facility

- The Interim Storage Facility will consist of several facilities with various functions.

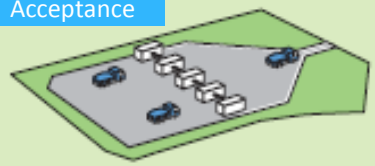
Temporary Storage Sites, etc.

Acceptance & Separation Facility

To separate the soil and waste transported by measuring the weight and radiation dose.

Image

Acceptance



Separation

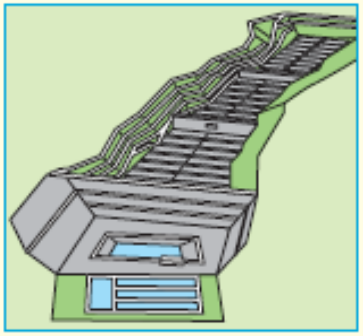
Other Facilities

・Screening ・Water treatment ・Stock yard
・Admin. Office ・R&D

Soil Storage Facility

To store soils after separation by radioactive cesium concentrations and other features

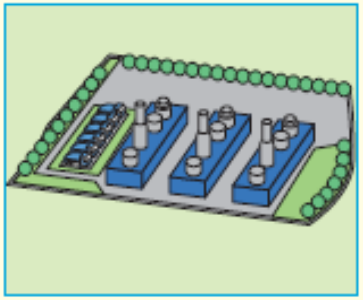
Image



Volume Reduction Facility

To reduce the volume of stockpile by incinerating the combustibles (branches and plants, etc.)

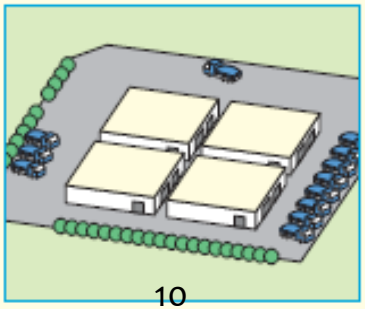
Image



Waste Storage Facility

To store waste (incineration ash, etc.) measuring more than 100,000 Bq/kg

Image

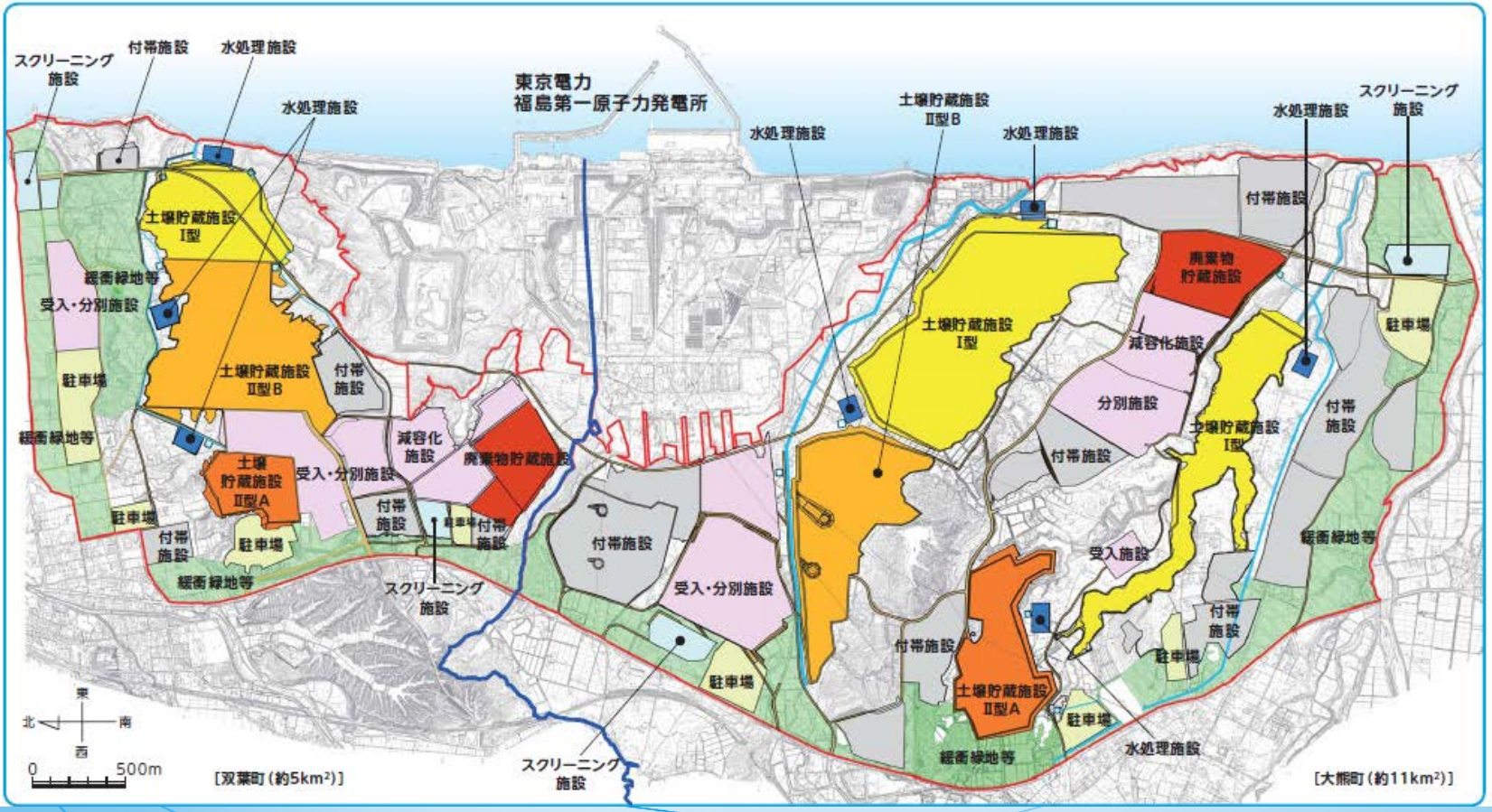


Location of interim storage facilities

用地の取得状況や除染土壌等の発生状況に応じて、段階的に整備を進めます。

<配置の基本的考え方(主な事項)>

- 施設は、貯蔵する土壌や廃棄物の放射性セシウム濃度、施設を配置する地盤の強度・高さなどを考慮して適切に配置します。
- 谷地形や台地などの自然地形を最大限に活用して、土地改変をなるべく避けて施設を設けることにより、環境負荷の低減と工期の短縮を図ります。
- 施設全体の機能性・効率性を勘案しつつ、各施設が一体的に機能するよう 配置します。



本図面に示す各施設の配置は、ボーリング調査等の結果に基づき、現段階での案として示したものであり、今後変更の可能性があります。

Monitoring Plan of Interim Storage Facility

Classification	Purposes	Objectives	Measurement period	Measurement frequency
Environmental radioactivity level	Evaluation of additional radiation impact	Air dose rate	from the time of construction to in operation	24 hours real time monitoring
		Radioactive material in the a		24 hours continuous sampling Cs nuclide (once a week)
		Radioactive material in the final effluent		Not currently discharge
		Radioactive material in the groundwater		once a week
Radioactivity level in exhaust gas and effluent	Measurement of radioactivity of exhaust gas end effluent from the facilities	Radioactive material in the exhaust gas	from the time in operation	Not currently discharge
		Radioactive material in the effluent		Not currently discharge
Working environment	Safeguarding the employees	Air dose rate	from the time of construction to in operation	Once a day
				Continuous measurement in working time
		Radioactive material in the a		Once at a time of decontamination activity
Environmental conservation of the site	Evaluating effectiveness of environmental measures based on the guidelines and agreements	Dioxin	from the time of construction to in operation	Incinerator in operation
		Harmful heavy metal		
		Sulfur oxides		
		Dust concentration		
		Other hazardous substances		
Monitoring validity of the facility design and safety assessment	Monitoring of trends or site condition	Groundwater level	from the time of construction to in operation	In environment impact assessment
		Earthquake vibration		
		Ground subsidence		
		Water Pollution		
Monitoring for environmental communication	Meeting the needs of local residents	Noise	from the time of construction to in operation	4 times a year / During transport of soil and waste
		Vibration		
		Odor		not currently monitored
		Radioactive level of vehicles		24 hours real time monitoring of the road side
				Once a year: Air, Dust, Transportation volume, and congestion survey

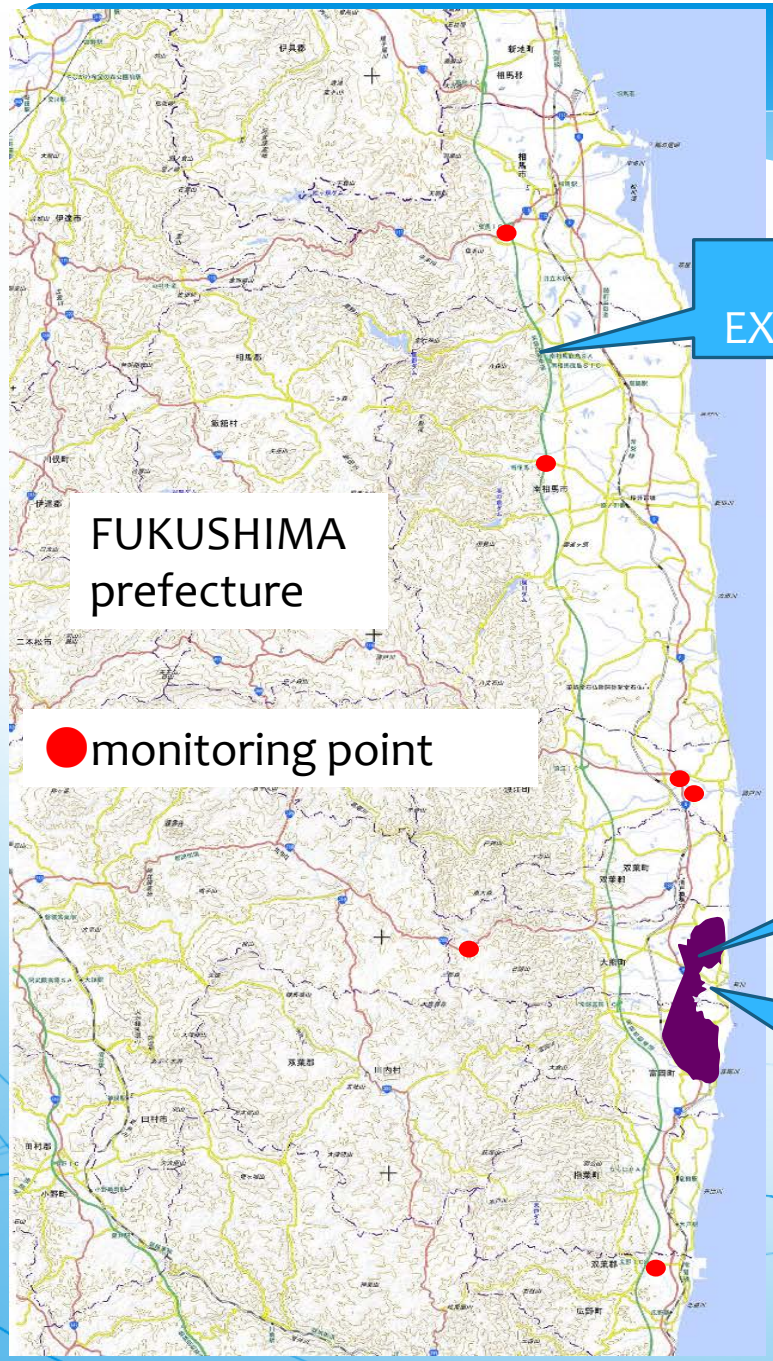
Monitoring in the stockyards

the stock yards in Futaba

Fukushima Daiichi Nuclear Power Station

the stock yards in Okuma

Monitoring in transportation route



JESCO signed to MOU for R&D with NIES and SRRCE

○MOUs

National Institute for Environmental Studies (NIES), May 11, 2015

The Society for Remediation of Radioactive Contamination in Environment (SRRCE), Sep. 29, 2015

Archive of the processing by Incinerator for disaster debris from Great Hanshin-Awaji Earthquake in 1995 and Great East Japan Earthquake and Tsunami in 2011

1. Introduction

Japan experienced serious disaster and associated generation of huge volume of disaster debris. Among them, burnable wastes could cause secondary environmental and health damages by odor or fire hazard through corruption process.

Incineration was primary technology to prevent these secondary damage particularly in Great Hanshin-Awaji Earthquake in 1995 and Great East Japan Earthquake and Tsunami in 2011.

These are some facts and lessons learned from the disasters.

2－1 Incineration volume in the processing disaster debris from Great Hanshin-Awaji Earthquake in 1995 and Great East Japan Earthquake and Tsunami in 2011

Units: Ten thousand ton		Great Hanshin-Awaji Earthquake	Great East Japan Earthquake and Tsunami		
		Hyogo Pref.	Iwate Pref.	Miyagi Pref.	Fukushima Pref.(Coastal 5 municipalities.) *
Total amount		2,002	618	1,930	304
Earthquake disaster debris					
	Incineration	**209**	**43**	**187**	**11**
	Recycling	554	386	945	128
	Landfill	689	29	40	19
	Public facilities	550	-		
Tsunami disaster debris					
	Recycling	-	184	752	126
	Landfill		0	6	8

*Estimate amount in Sea-side 5 local gov. (Shinchi Town, Soma city, (except the evacuation area) Minami Soma City, Hirono Town, Iwaki City.) in end of March 2015.

2－2 volume of disaster debris from Great East Japan Earthquake and Tsunami in 2011

Earthquake disaster debris			Units: Ten thousand ton
	Fukushima Pref.(Other Area)*1：treated		106
	Fukushima Pref.(in Provision Area)		
		Combustible	**31**
		In-combustible	50
Waste amount of polluted radiation			
	combustible		**289**
	Soil and in-combustible *2		4,162

*1：except main area(Coastal 5 municipalities etc.)

*2：Estimated soil Amount in interim storage project:2,601万m^3に土壌密度の推計値：1.6t/m^3を乗じて算出。

2－3 Incineration volume in the processing disaster debris from Great Hanshin-Awaji Earthquake in 1995 and Great East Japan Earthquake and Tsunami in 2011

units ;ten thousand ton	Great Hanshin-Awaji Earthquake	Great East Japan Earthquake and Tsunami		
	Hyogo Pref.	Iwate pref.	Miyagi pref.	Fukushima pref. (estimated value)
Total Amount	2,002	618	1,930	4,939
Incineration amount	209	43	187	11
By Existed facilities	110	33	19	2*1
By New facilities	99	10	167	9 (330) *2

*1: Treated amount in Coastal 5 municipalities, not included other area.

*2：within value of bracket is estimated value of combustible waste.

2－4 Incineration volume, units, processing powers in the processing disaster debris from Great Hanshin-Awaji Earthquake in 1995 and Great East Japan Earthquake and Tsunami in 2011

	Great Hanshin-Awaji Earthquake	Great East Japan Earthquake and Tsunami		
	Hyogo Pref.	Iwate pref.	Miyagi pref.	Fukushima Pref. (as of June 2016)
Incinerated amount (ten thousand ton)	99	10	167	9 (330)
Units (-)	36	4*1	29	19
Capability(t/day)	2,580	204	4,659	2,924

*1：include the two existed incinerators.

3. 4. Main Facilities incinerators in Iwate, Miyagi, Fukushima Prefecture (1/2)

	Iwate pref.	Miyagi Pref.	Fukushima Pref.
Feeder System			
Storage system	yard	yard	Yard Pit (a portion of facilities)
Supply system	–	conveyer	conveyer (7) **Pit & crane** (7)
Incineration system	stoker	Stoker kiln	Stoker **Kiln-stoker,** **Fluidized bed** **Shaft Melting**

3. 4. Main Facilities incinerators in Iwate, Miyagi, Fukushima Prefecture (2/2)

Gas cooling system		Water jet	Water jet	Water jet
Gas treatment system				
	Dust collection system	Bag filter	Bag filter	**Bag filter(2stage)**
	Removal harmful gas system	dry (calcium hydroxide＋active carbon)	dry (calcium hydroxide＋active carbon)	dry (calcium hydroxide＋active carbon)
Ash treatment system		non	non	**Cement solidification**
Fly ash treatment system		Addition of Heavy metal stabilizer	Addition of Heavy metal stabilizer	Addition of Heavy metal stabilizer, **Cement solidification**

4. the outcome of the study of the planning and design of incinerators in Iwate, Miyagi, Fukushima Prefecture (1／2)

1) Iwate Prefecture

- Maximum use of existing facilities (Incinerators for municipal wastes, Cement kilns)
- Making use of incinerators out of operation after necessary repair

2) Miyagi Prefecture

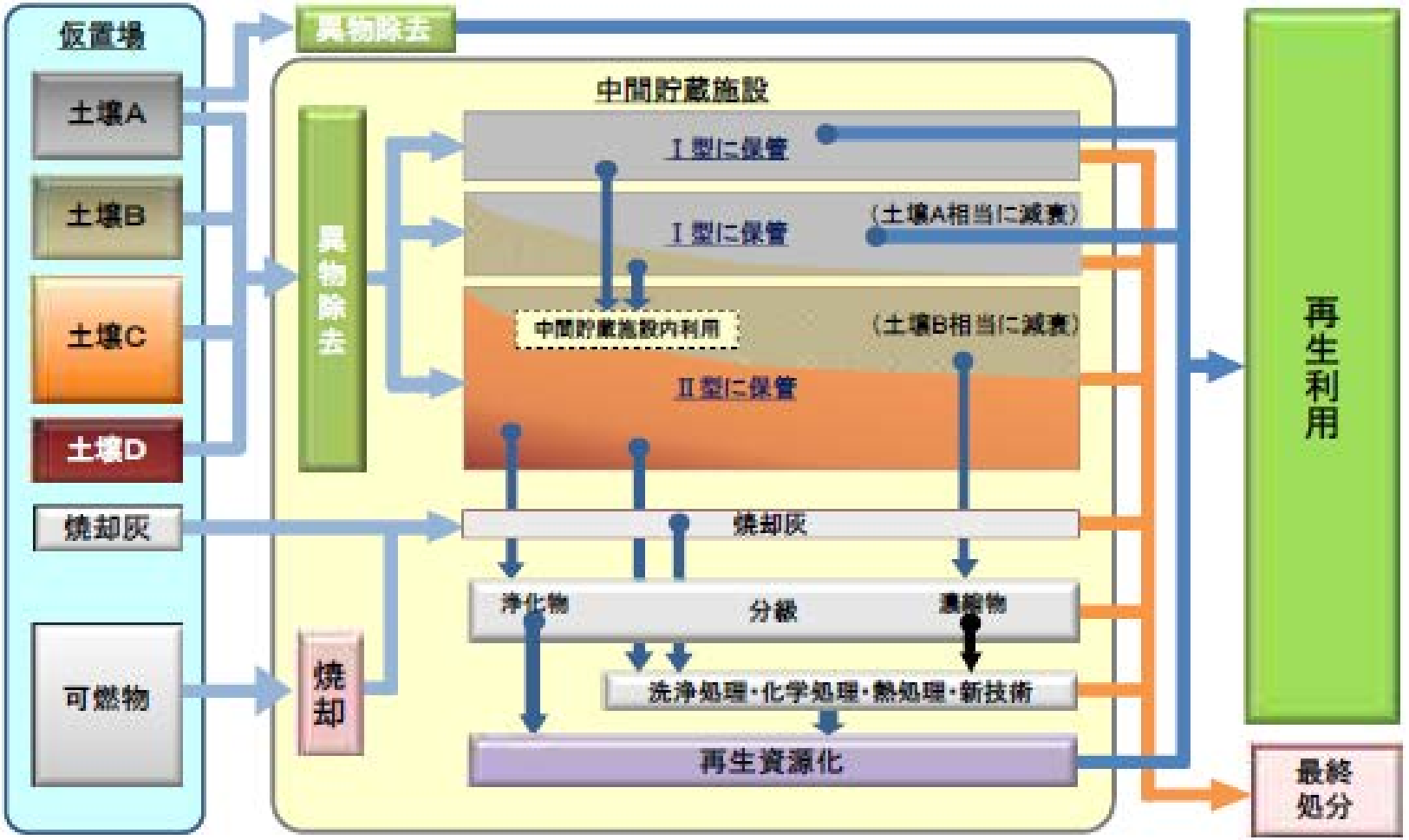
- Many temporary incinerators were installed (100～300t/d・each)
- Ash was reused as construction material after pelletization by cement
- Making use of Rotary Kilns out of operation were replaced and incinerators under manufacturing in some cases

4. the outcome of the study of the planning and design of incinerators in Iwate, Miyagi, Fukushima Prefecture (2/2)

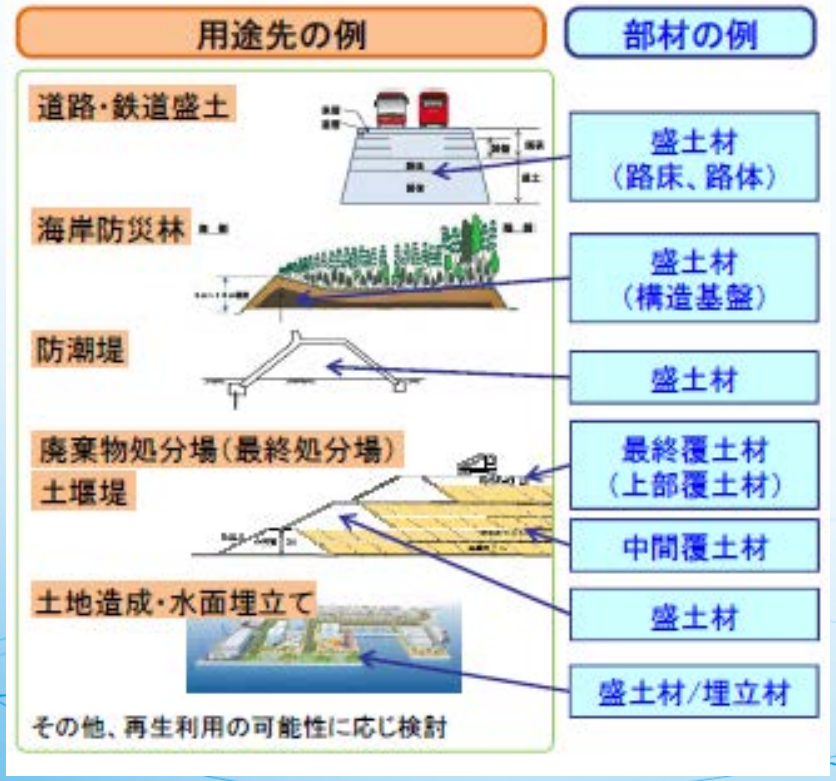
3) Fukushima Prefecture

- Pit & crane was introduced in some case
- In addition to Stoker and Kiln, fluid bed or shaft furnace was constructed
- Bag filter was installed. Double bag filters were applied to prepare for degradation or damage

Flow of the Treated Soil and Wastes for Recycling and final disposal



The applications and requested qualities for material Recycling



要求品質の検討

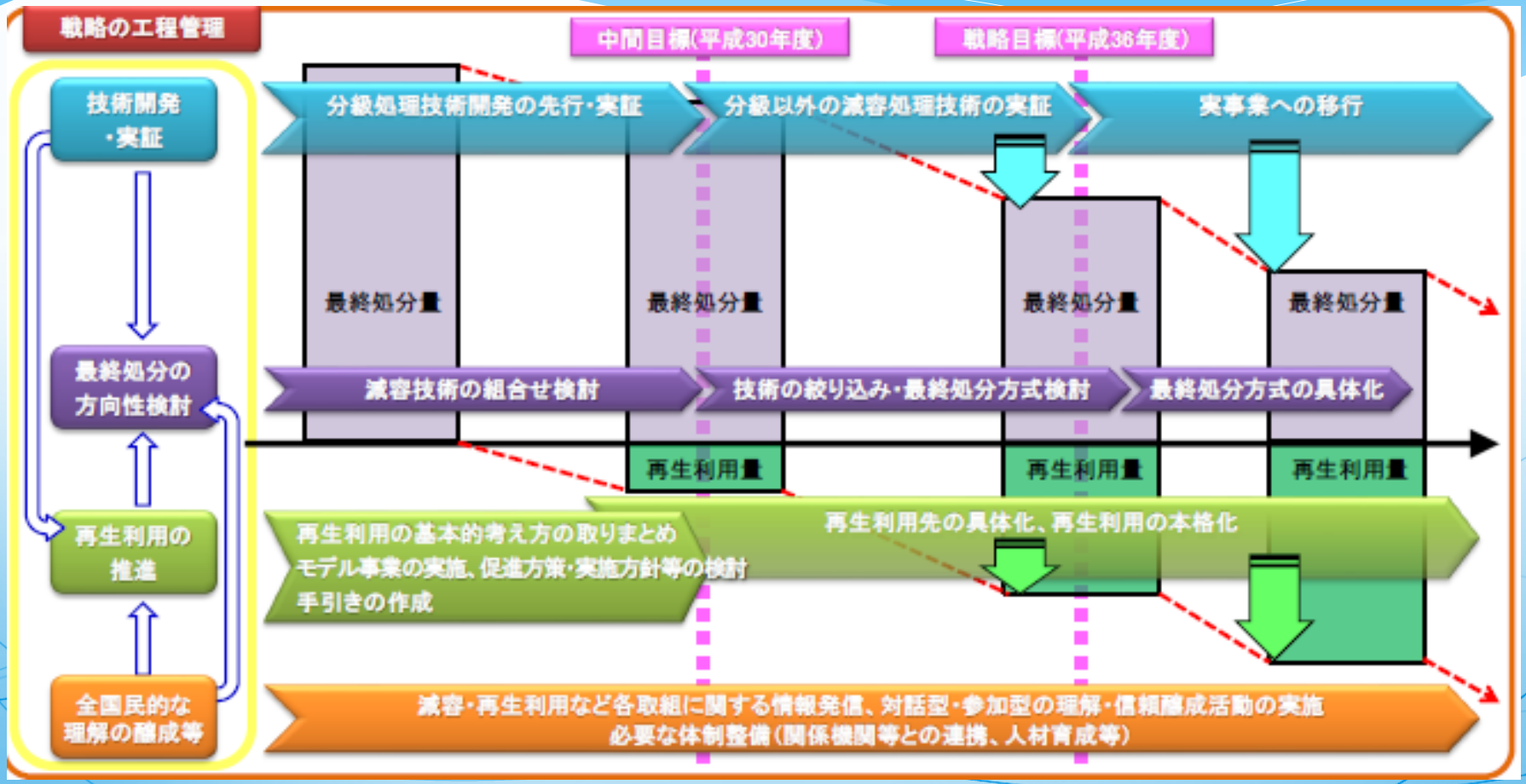
放射能以外の要求品質

- 構造・耐力上の安全性等、用途に応じて、従来どおりの土木構造物に求められる要求品質を適用。
- 土壌汚染に係る指定基準（土壌溶出量基準（環告18号）、土壌含有量基準（環告19号）に適合。
- ダイオキシン類に係る基準（1,000pg-TEQ/g以下）に適合。
- 資材を選別するための測定・分別（土質試験）の手法はJIS規格等に定められており、従来どおりの各種規格に従う。

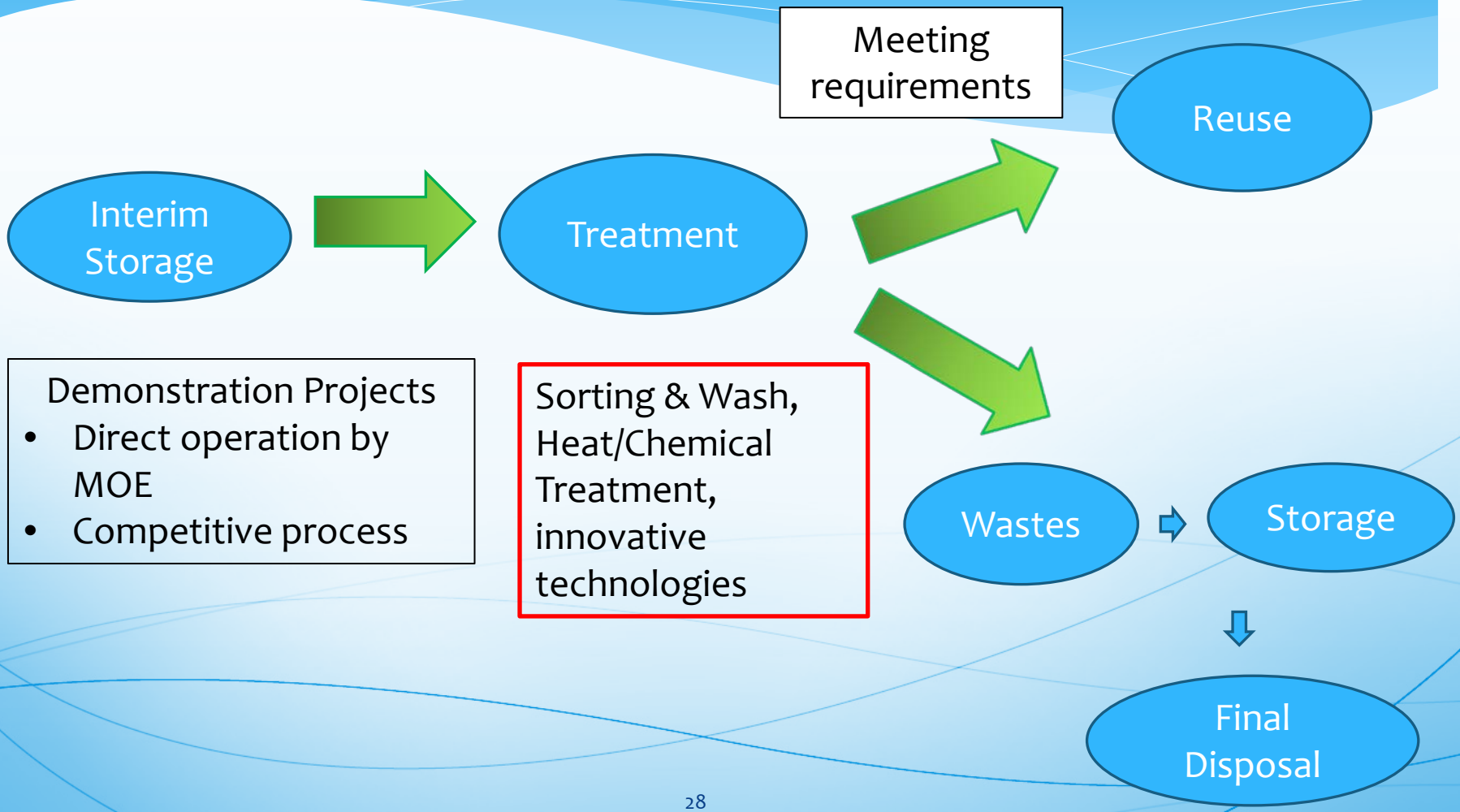
放射能に関わる要求品質

- 放射性セシウムを含む資材であることにかんがみ、用途先ごとに追加被ばく線量評価を行い、放射線影響に関する安全性を確保するための要件（使用方法、放射能濃度、管理方法等）を明確にする。

Goal of Strategy on Technological Development for Reduction and Recycling of Treated Soil and Wastes



Possible Way of R&D for Reduction and Recycling of Treated Soil and Wastes



Thank you for your Attentions