Session V Waste Management

Management of Solid Waste Arising from Fukushima Daiichi (1F) Decontamination and Decommissioning

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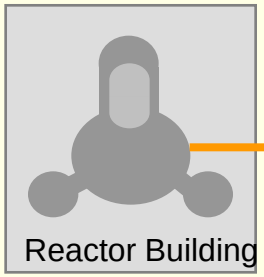
1. **Waste Arising from 1F D&D**

Gaseous, liquid and solid waste are generated by decommissioning works.
Most radioactivity concentrated in the solid waste to be safely stored.

Gaseous waste

Exhaust gas



PCV gas treatment system

Filter

Most radioactivity concentrated in filters treating gas through PCV.

Managed as solid waste

Liquid waste

Contaminated water (eg, accumulated water in RB)

Contaminated water treatment systems

Absorbent column sludge etc.

Radioactive materials concentrated through purification systems

Managed as solid waste

Solid waste

Rubble etc.

Solid waste arising from decommissioning work such as metal, concrete, combustible material, filter, felled tree, and used protective clothing

Secondary waste from water treatment systems

Absorbent, columns, Sludge etc.

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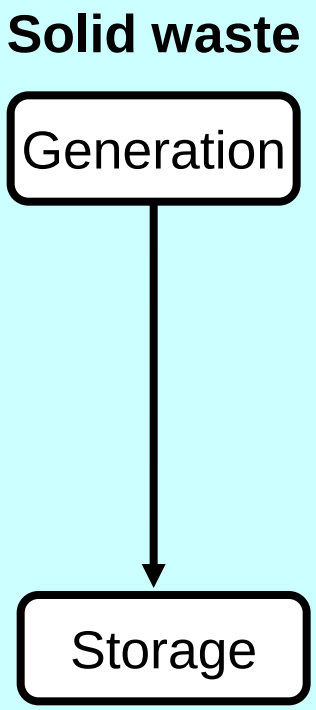
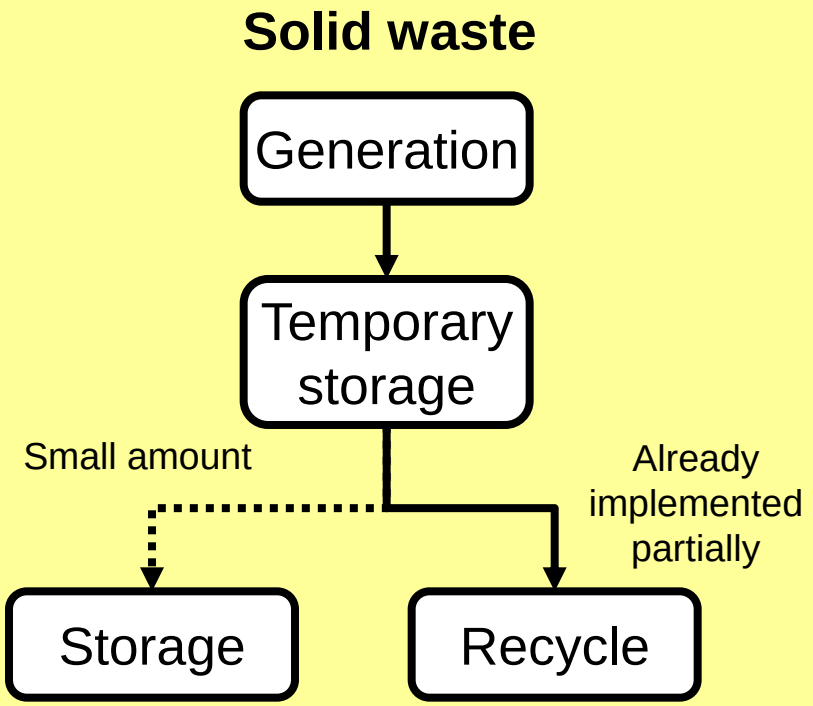
2. Waste Flow from Generation to Storage

Before accident: Solid waste stored in storage building with containment and a shielding
After accident: Vast amount waste generated by recovering work from emergency situation in short time. Due to the limited capacity in waste storage buildings, large part of waste stored outside temporarily as an emergency response.

Before accident



After accident



3. Difference between Normal Decommissioning and 1F Decommissioning

R&D for volume reduction and processing and disposal challenged due to the vast amount and a wide variety of waste generated from 1F Decommissioning

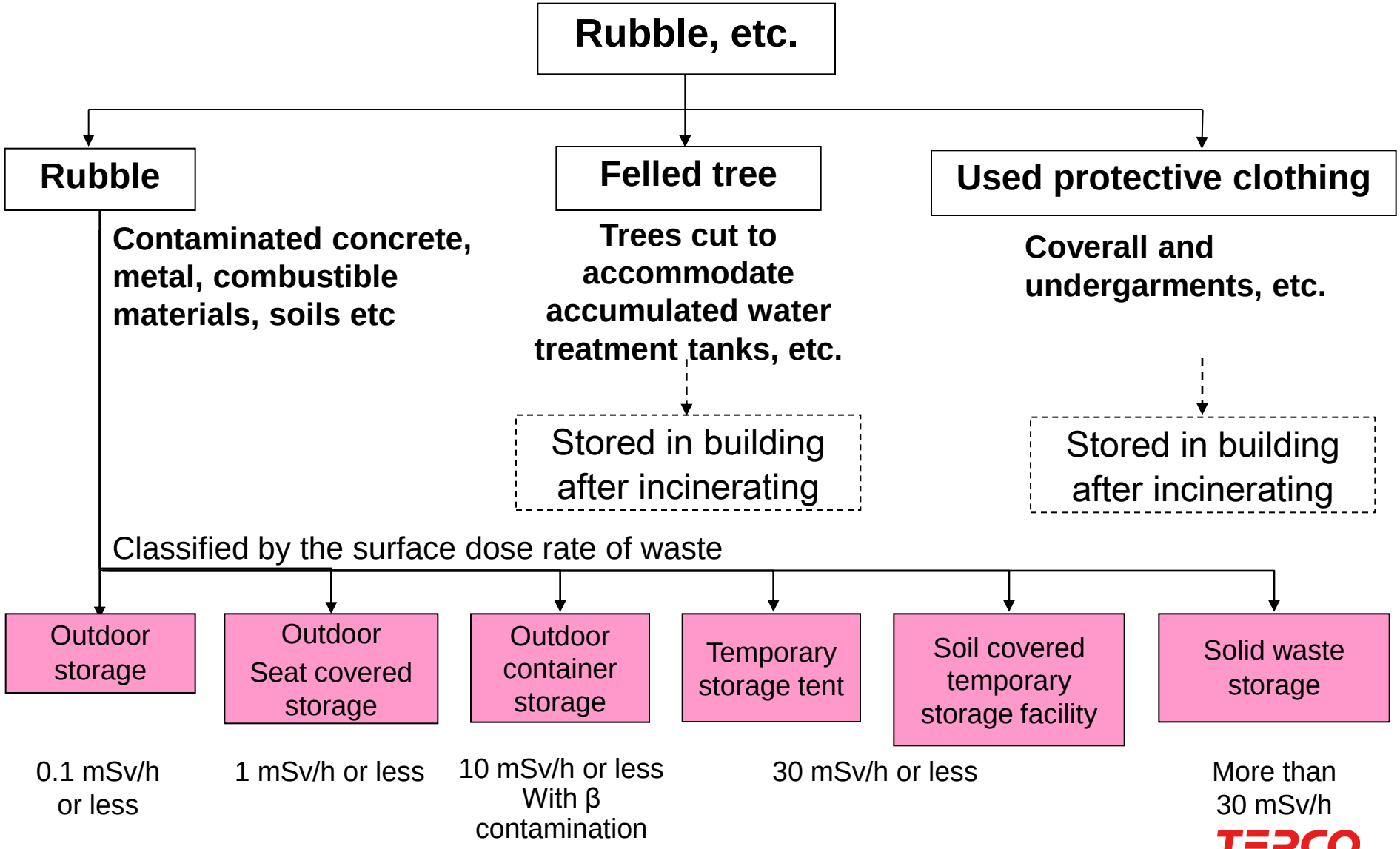
Table 1. Management flow for solid waste arising from normal decommissioning

	Properties	Waste generation	Volume reduction	Storage	Waste route	Packaging	Transport	Disposal
Features	・Origin of contamination clear. ・Waste volume limited	Characterization possible before demolishing	Incineration or cutting selected according to the materials	Use at existing facilities	Established	Select appropriate technologies based on waste route		
Technologies	・Nuclide composition known ・Analytical method developed	–	✓	✓	–	✓	✓	✓ (No disposal site yet)
Regulation /Rule	–	–	✓	✓	–	✓	✓	Under discussion

Table 2. Management flow for solid waste arising from 1F decommissioning

	Properties	Waste generation	Temporary storage	Volume reduction	Storage	Waste route	Packaging	Trans -port	Disposal
Features and challenges	・Origin is complicated ・Vast amount	Characterization needed	Temporary storage according to the surface dose	Promote volume reduction for efficient storage	New storage building needed due to the lack of storage capacity	New category needed	Select appropriate technologies based on waste route		
Technologies	・Nuclide composition unknown	Enlarged analytical system needed	✓	✓	✓	–	R&D needed	✓	R&D needed
Regulation /Rule	–	–	Exemption	Discussion needed	Discussion needed	–	Development is needed		

4. Classification of “rubble, etc.” and Temporary Storage Method



4. Current Status of temporary storage of “rubble, etc.”

Outdoor storage (0.1mSv/h or less)

Outdoor container storage
(10mSv/h or less)

Soil covered temporary storage facility
(30mSv/h or less, plus rubbles from 1 to 4 reactor building)

Solid waste storage
building
(More than 30mSv/h)

4. Temporary Storage Volume of “rubble, etc.”

Rubble

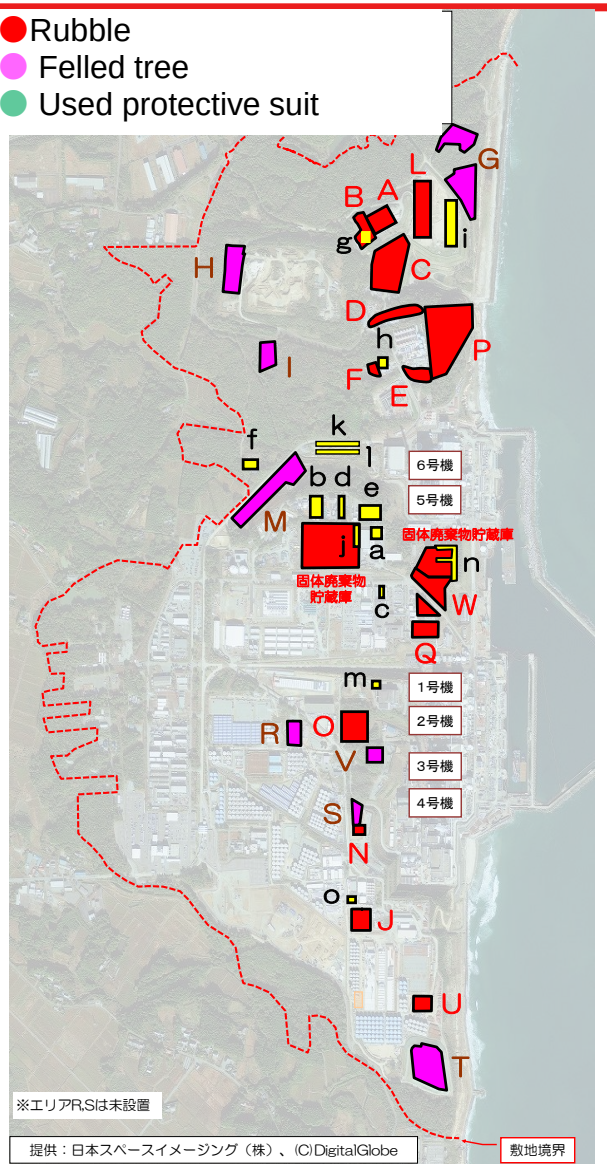
Surface dose (mSv/h)	Temporary Storage Area	Storage Volume (m^3)	Storage Capacity (m^3)
≦0.1	B, C, F1, J, N, O, P1, U, No1 storage building	122,800	208,450
≦1	D, E1, P2, W	33,800	57,300
1～30	A1, A2, E2, F2, L, Q, No2 storage building	20.300	34,850
＞30	No3～No8 storage building	6,600	15,000
Total	—	183,800	315,600

Felled tree

Category	Temporary Storage Area	Storage Volume (m^3)	Storage Capacity (m^3)
Root	H, I, M	64,300	73,200
Branch/leaves	G, R, S, T, V	20,800	74,400
Total	—	84,200	147,600

Used protective clothing

Temporary Storage Area	Volume	Storage Capacity (m^3)
a, b, c, d, e, f, g, h, i, j, k, l, m, n, o	69,980	70,040



4. Temporary Storage Method and Classification of Secondary Waste from Water Treatment Systems

Secondary waste from water treatment

Used vessels	Sludge	Concentrated waste liquid
Stored in outdoor temporary storage area	Stored in sludge storage facility (Indoor)	Stored in concentrated waste liquid storage tanks (Out door)

There is no plan to increase these volume because equipment which generate these waste stopped operation.

Classified by characteristics of waste

Rack	**Box culvert**	**HIC-supporting type box culvert**
Waste which does not needs an additional shield	Waste which needs an additional shield	Waste which is high water content
e.g. 2nd Cesium absorption apparatus	e.g. Cesium absorption apparatus	e.g. High Integrity Containers (HICs) from Multiple Radio-nuclides Removal System

4. Current Status of temporary storage of “Used Vessels”

Rack
（2nd Cesium absorption apparatus）

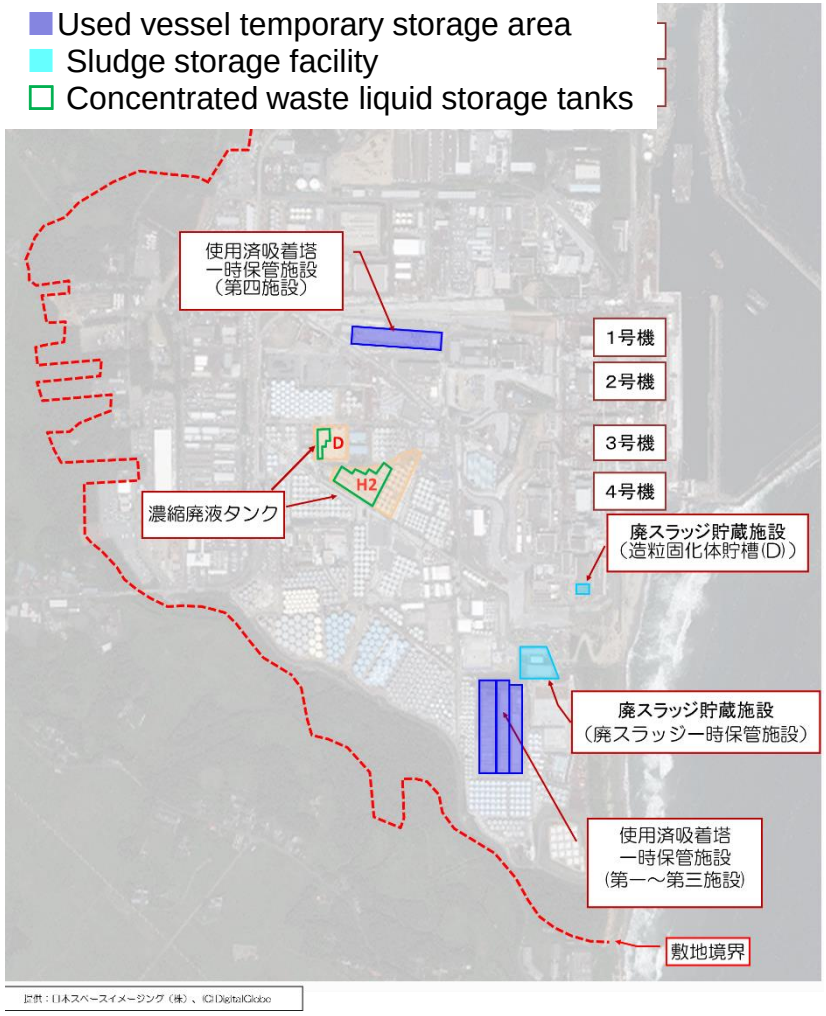
Box culvert
（Cesium absorption apparatus）

HIC-supporting type box culvert
（HICs from Multiple Radio-nuclides Removal System ）

4. Temporary Storage Volume of Secondary Waste from Water Treatment

Name of “Used vessels”	Storage number	Storage number / Capacity (%)
Cesium absorption apparatus	706	3,080 / 6,067 (51%)
2nd Cesium absorption apparatus	160	
HICs from multiple radio-nuclides removal system	1,135	
HICs from improved multiple radio-nuclides removal system	824	
Used vessels from high-performance multiple radio-nuclides removal system	73	
Used column from multiple radio-nuclides removal system	9	
Used vessels and filters from mobile-type strontium removal system	173	

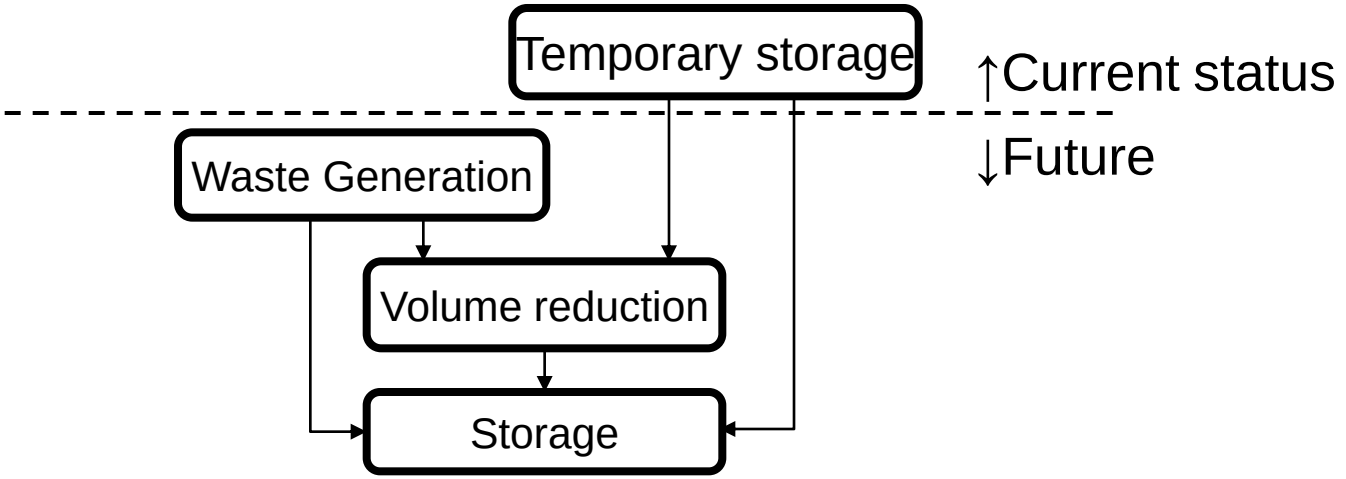
Name of waste	Storage volume		Storage volume /capacity (%)
Sludge	597	m³	597／700 （85%）
Concentrated waste liquid	9,097	m³	9,097／11,000 （46%）



5. Future Challenge ・・Improvement of Waste Management Conditions (FROM “Temporary Storage” TO “Storage”)

Temporary storage areas will be released step by step including anticipated large amount of waste to be generated in the future.

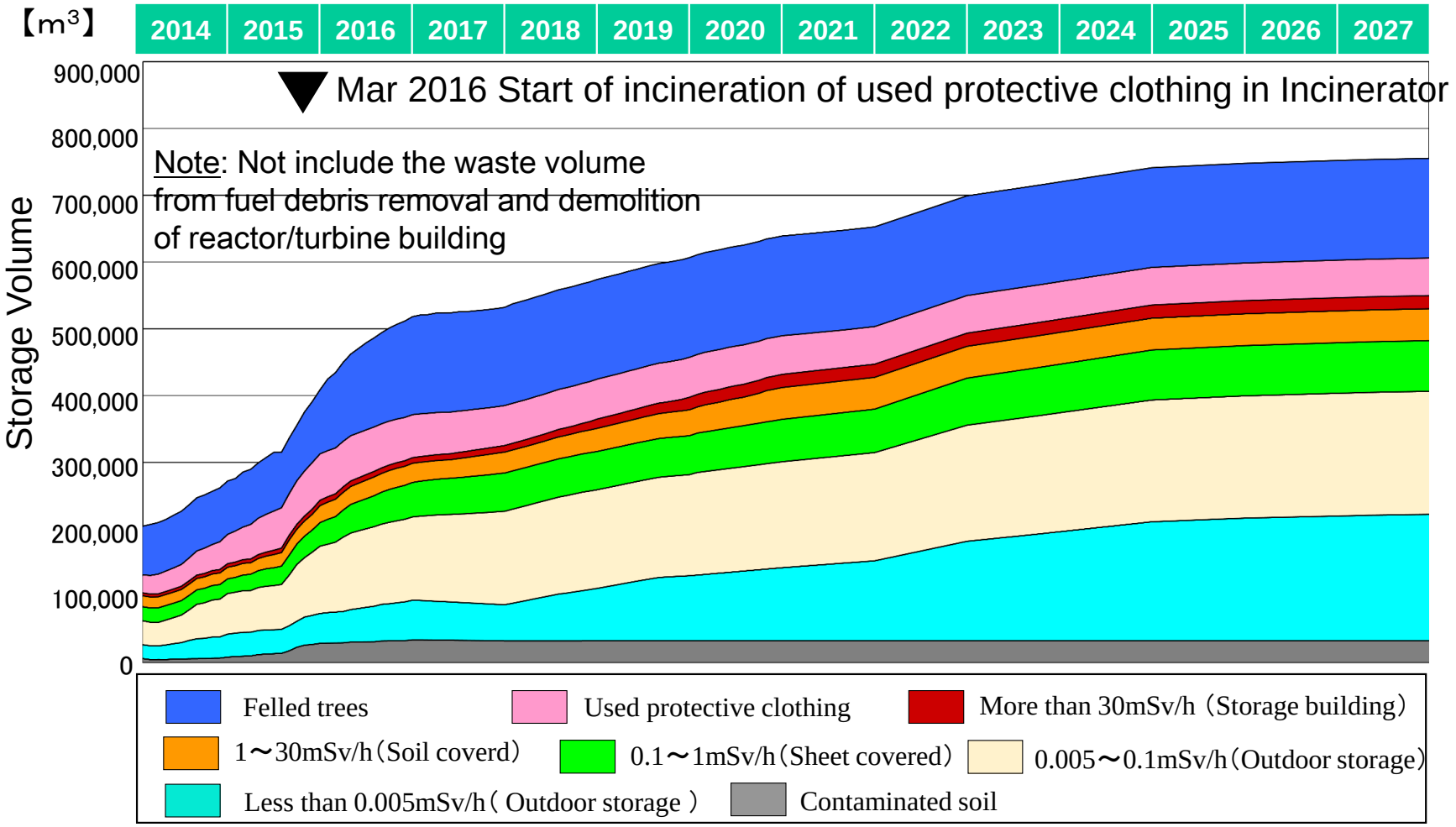
- Forecast waste volume arising from planned decommissioning works
- Develop and implement installation plan of volume reduction facility and additional waste storage building based on waste generation forecast
- The waste stored in temporary storage area and to be generated in the future will be volume-reduced as much as possible leading to storage in the solid waste building.
- Once a year, review the waste volume forecast and renew the installation plan of waste management facilities



Waste flow until storage

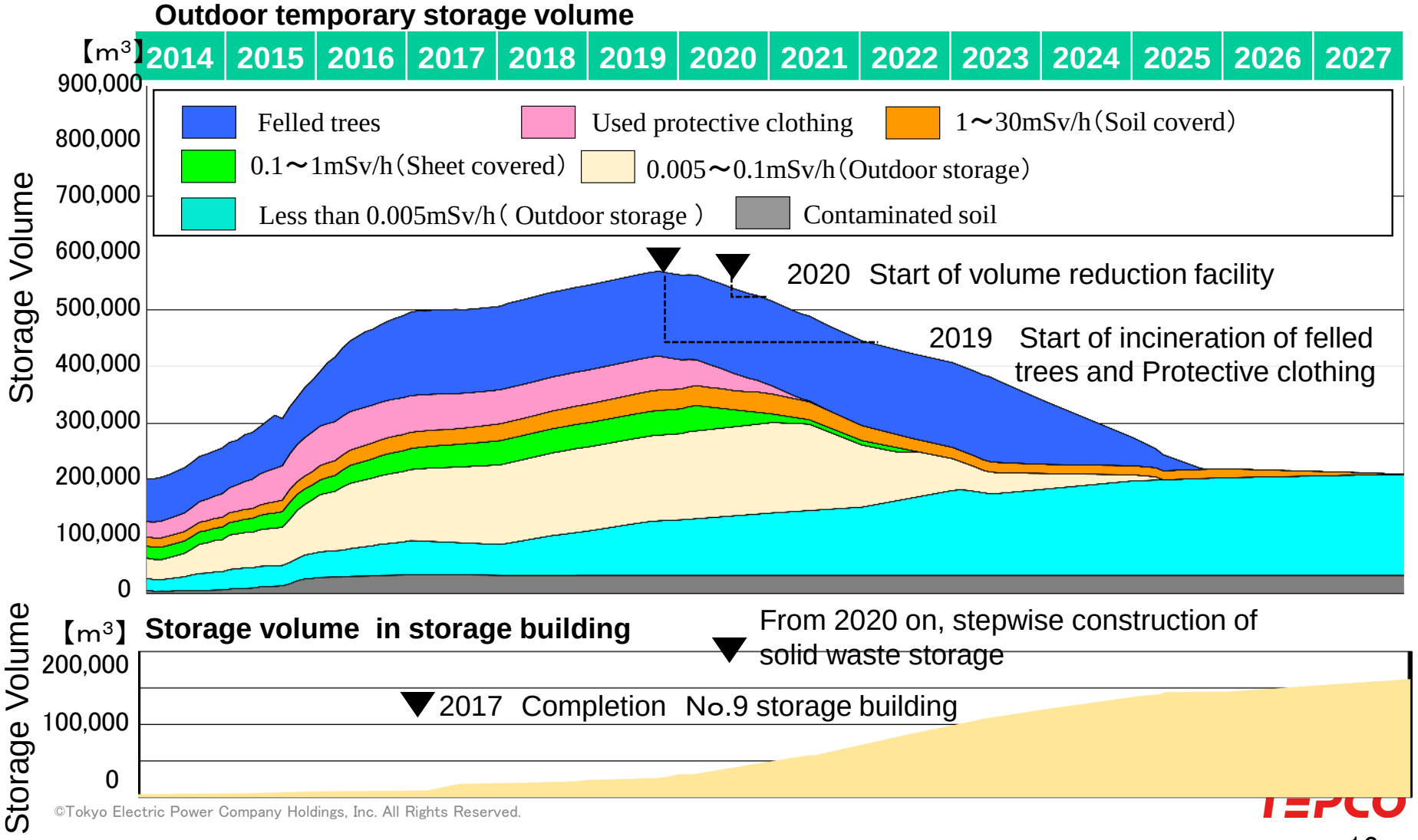
5. Future Challenge・・Forecast of Waste Generation (Before additional Measures)

Without additional volume reduction, solid waste storage volume will reach about 750,000m^3 on 2028.



5. Future Challenge・・Forecast of Waste Generation (After additional Measures)

By 2028, outdoor temporary storage areas eliminated except those for low contaminated rubble and contaminated soil



5. Future Challenge・・Improvement of Waste Storage Method

- To improve waste storage conditions continuously, followings will be challenged:
  - Eliminate / reduce temporary storage area
    - Develop in-site reuse and recycle route for low contaminated metal and concrete
    - Research / develop decontamination technology for contaminated soil
  - Stabilize waste form
    - Consider stabilization technology to the secondary waste arising from contaminated water treatment system by eliminating the water

5. Future Challenge‥ Toward Waste Proessing and Disposal

- Promoting characterization
  - Necessary to analyze waste especially long lived nuclides which are important to investigate processing and disposal of waste.
  - Promote preparation of analytical labs with more capacity jointly with JAEA in order to meet the varieties of and vast volume of waste generated from decommissioning work.
- Development of waste processing and disposal methodology
  - Develop appropriate waste processing and disposal methodology meeting the individual results of waste characterization.
- Renewing waste categorization
  - Based on the results of characterization and development of waste processing and disposal methodology, renew waste categorization on storage and incorporate into management of storage

Thank you for your attention.