

ONLINE RESOURCE 1

- Article Title: Effect of the discussion frame on finding a compromise: A group decision experiment about removed soil management in Japan
- Journal: Environmental management
- Authors name: Yume Souma, Yukihide Shibata, Mie Tsujimoto, Qinglin Cui, Takashi Nakazawa, Tomoyuki Tatsumi, Yoshiko Arima, Susumu Ohnuma
- Correspondence author: Yume Souma (souma.yume.l6@elms.hokudai.ac.jp)
- Description: The slides from the next page are the informational materials participants saw before the discussion began.

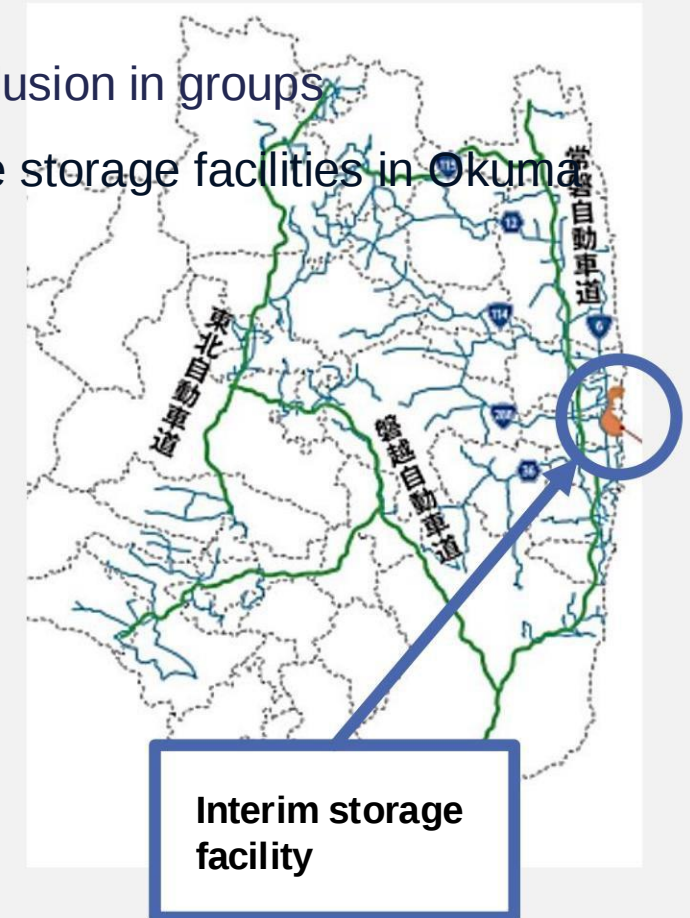
GROUP DISCUSSION EXPERIMENT REGARDING THE FINAL DISPOSAL OF REMOVED SOIL OUTSIDE THE FUKUSHIMA PREFECTURE

Hokkaido University, Faculty of Humanities and Human Sciences
Yume Souma

Informational materials

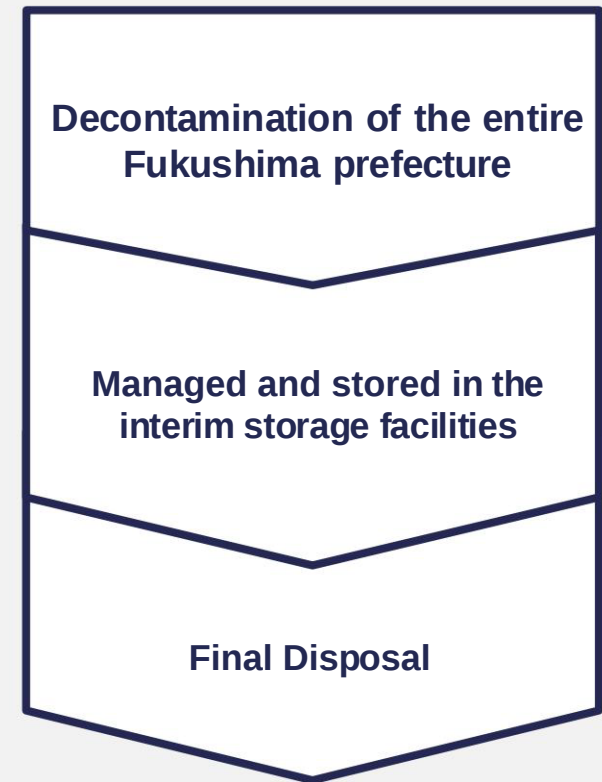
INTRODUCTION

- Today, we will discuss the "final disposal of removed soil" and reach a conclusion in groups
 - The removed soil is currently being stored and managed in intermediate storage facilities in Okuma and Futaba towns in Fukushima Prefecture
- I will explain the topic of the discussion for about 10 minutes.
 - After that, we will present the points for discussion
 - There is no correct conclusion, so we ask for your honest opinions
 - Please give your opinion and discuss

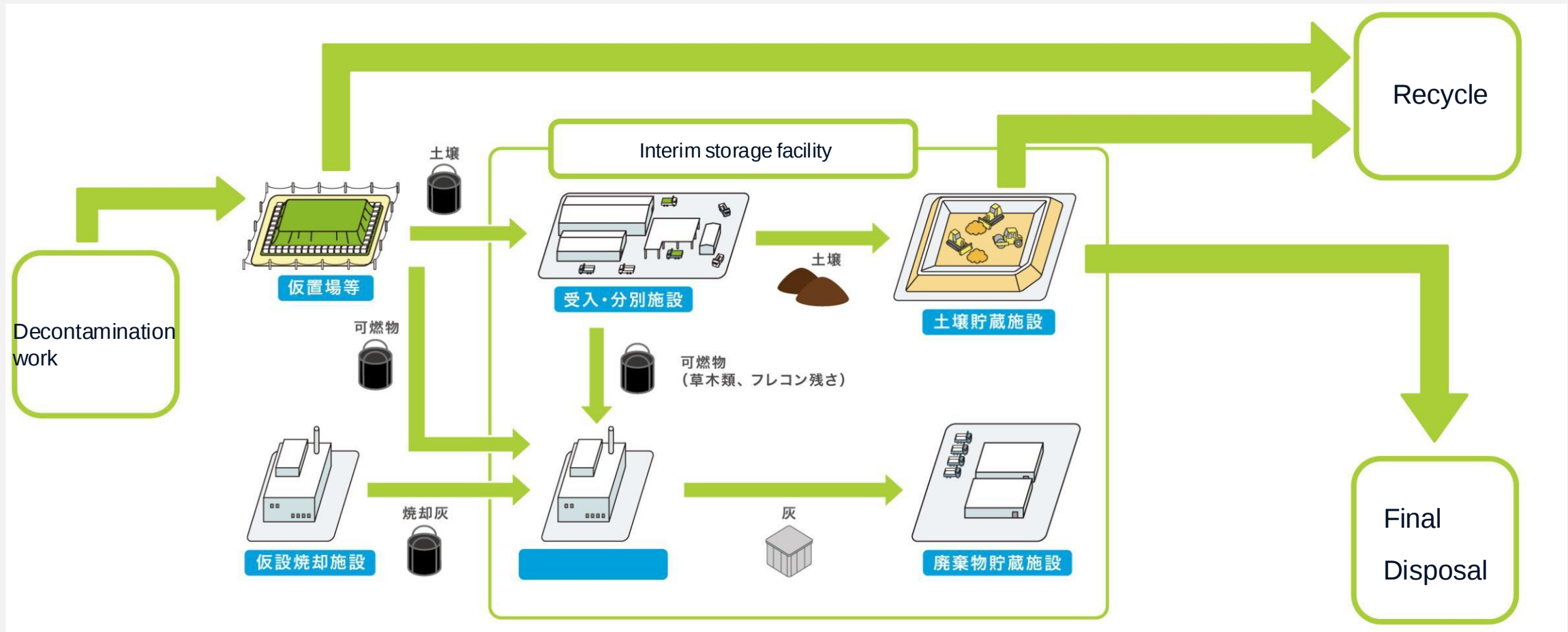


BACKGROUND

- March 2011: The accident at the Fukushima Daiichi Nuclear Power Plant resulted in radioactive waste and soil being generated mainly in Fukushima Prefecture
- Decontamination work was carried out over a wide area of Fukushima Prefecture, resulting in a huge amount of removed soil etc.
- March 2015~: Managed and stored at interim storage facilities in Okuma and Futaba towns, Fukushima Prefecture
 - **Final disposal outside Fukushima prefecture by 2045**



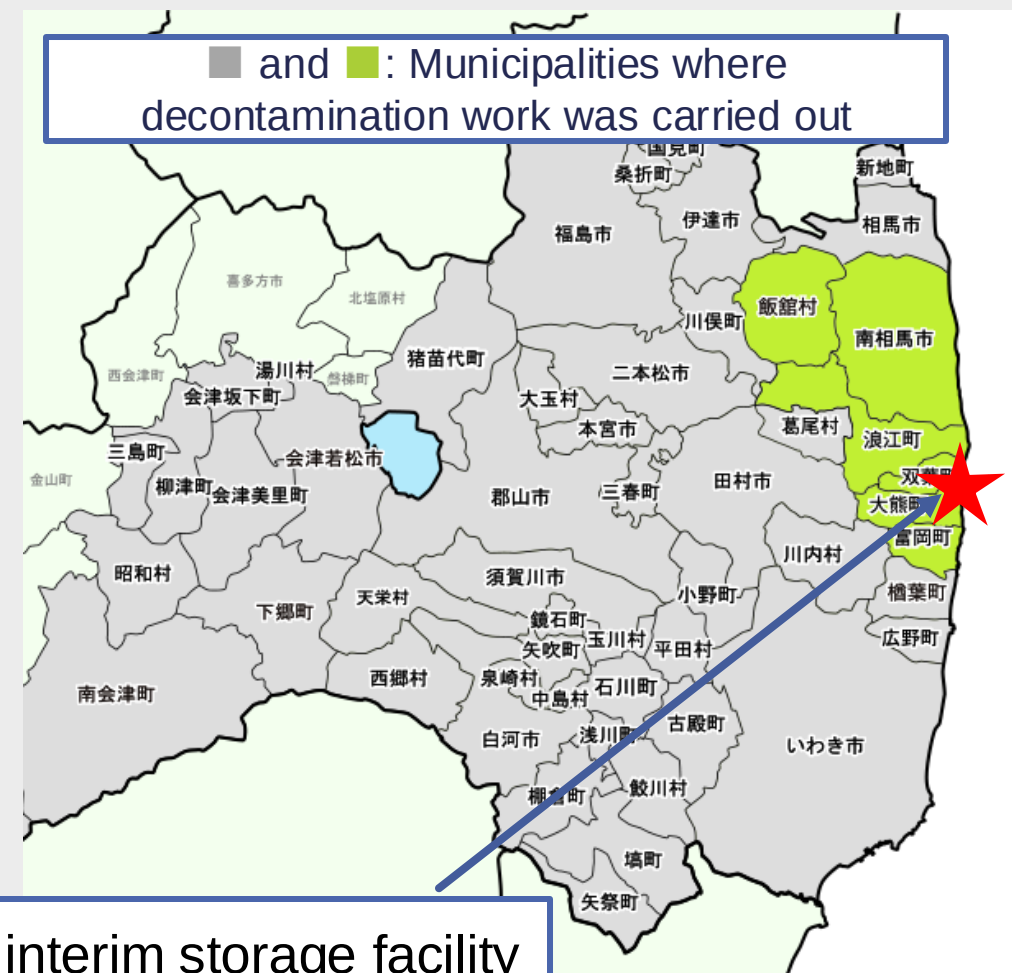
FLOW FROM DECONTAMINATION WORK TO FINAL DISPOSAL



<http://josen.env.go.jp/chukanchozou/about/> (arrows and text added)

DECONTAMINATION WORK AFTER THE NUCLEAR ACCIDENT

- Decontamination work following the nuclear accident is taking place over a wide area of Fukushima Prefecture
 - Decontamination work generates huge amounts of removed soil, etc.
- A facility is needed to safely and centrally manage and store these wastes until final disposal and store these wastes until final disposal
 - Interim storage facilities were built in Okuma and Futaba towns in Fukushima Prefecture



OVERVIEW OF THE INTERIM STORAGE FACILITY

- Location : Okuma Town and Futaba Town, Fukushima prefecture
- Site area: Approximately 16 km²
(Approximately the same area as Shibuya Ward, Tokyo, Japan)
- Approximately 80% is privately owned before the accident
 - There were fields and shrines
 - People's lives were rooted there



Interim storage facility (top: Futaba town, bottom: Okuma town)

<http://josen.env.go.jp/chukanchozou/transportation/index.html> <http://josen.env.go.jp/chukanchozou/about/> https://www.jesconet.co.jp/interim_infocenter/

ABOUT OKUMA TOWN AND FUTABA TOWN IN FUKUSHIMA

- Population of Okuma and Futaba town

	At the time of the earthquake	Number of evacuees (as of December 1, 2022)
Okuma town	11,505 people	9,616 people
Futaba town	6,939 people	6,639 people

- In 2017, evacuation orders were lifted in the difficult-to-return areas, making it possible to live there.
 - "Specific Reconstruction and Regeneration Base Areas" were established in Okuma Town and Futaba Town.
 - Evacuation orders for the designated reconstruction and revitalization base areas of Okuma Town will be lifted in June 2022, and for Futaba Town in August of the same year
 - However, there are still areas in both towns that are considered difficult-to-return zones

<https://www.town.okuma.fukushima.jp/soshiki/jumin/22955.html>

<https://www.town.fukushima-futaba.lg.jp/10291.htm>

STATEMENTS BY THE MAYORS OF OKUMA AND FUTABA TOWNS

FROM THE MINISTRY OF THE ENVIRONMENT'S "FUKUSHIMA AND THE ENVIRONMENT BEYOND" DIALOGUE FORUM (MAY 2021)

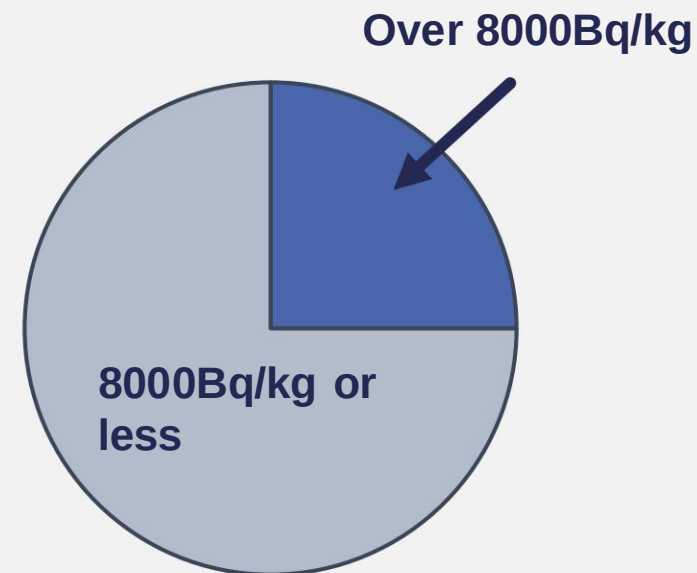
- When the topic of accepting an interim storage facility arose, each townspeople had their own feelings for their hometown
 - Some people wanted to protect their ancestral land
 - Some said they couldn't return.
- Accepting the residents into the facility would mean giving up land, homes, and property that had been passed down from their ancestors, a further blow to those still living in evacuation shelters due to the disaster
- I still cannot forget the anger, sadness, and pain on the faces of the townspeople
- To rebuild Fukushima, it is necessary to take on the removed soil somewhere.
 - We made the difficult decision to accept the request, thinking that it would be too much for the landowners to handle. There are as many different thoughts and worries as there are landowners.
 - Nevertheless, many people cooperated, and as a result, progress is being made in restoring the environment in Fukushima Prefecture, which was damaged by the nuclear accident.

AMOUNT OF REMOVED SOIL, ETC. AND RADIOACTIVE CONCENTRATION

- The amount of removed soil and other materials delivered to the interim storage facility is approximately 13.38 million m³ (as of December 2022)
 - Equivalent to about 11 Tokyo Domes
- The radioactive concentration of radioactive cesium in the removed soil is over 8000 Bq/kg, about 25% of the total, and approximately 75% is below 8000 Bq/kg
 - 8000 Bq/kg is a number that is not above the international standard for safety (1 mSv/year) when exposure is assessed assuming all processes up to final disposal.

*Becquerel: The higher the number, the more radiation is emitted

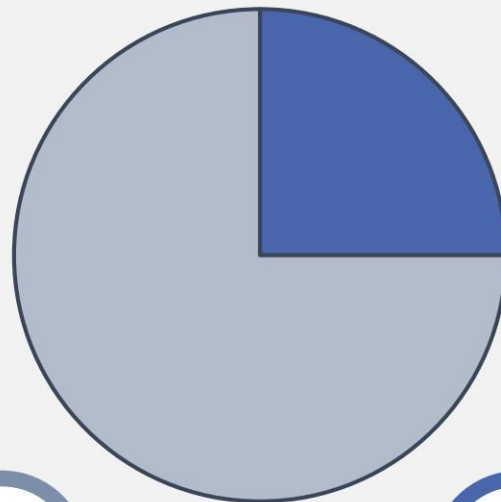
*Sievert: Unit of radiation exposure dose received by the human body. The higher the number, the greater the impact of radiation on the human body



SEPARATING REMOVED SOIL

Removed soil below
8000 Bq/kg

Removed soil with
more than 8000Bq/kg



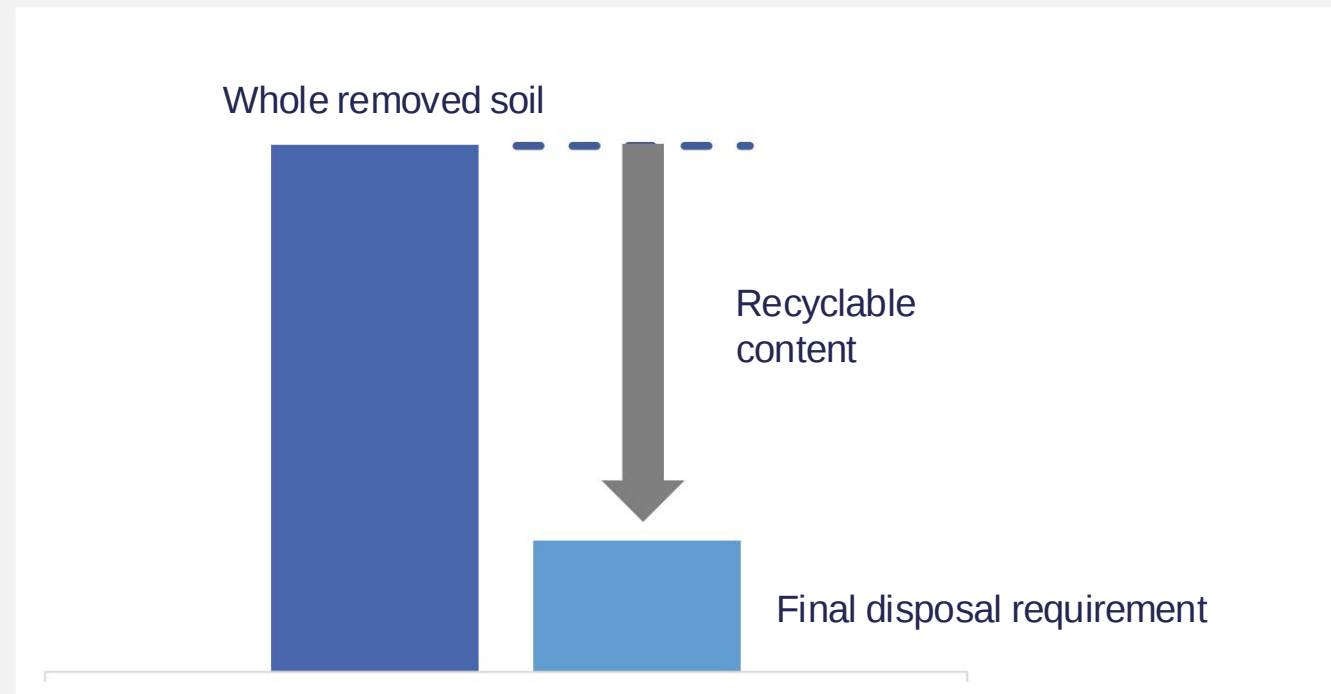
Recycling in
public works projects and farmland



Completion of final disposal outside the
prefecture within 30 years (by 2045)
after the start of usage of interim
storage facility

RELATIONSHIP BETWEEN RECYCLING AND FINAL DISPOSAL

- Recycling reduces the amount of soil that requires final disposal



THE GOVERNMENT'S BASIC APPROACH TO FINAL DISPOSAL

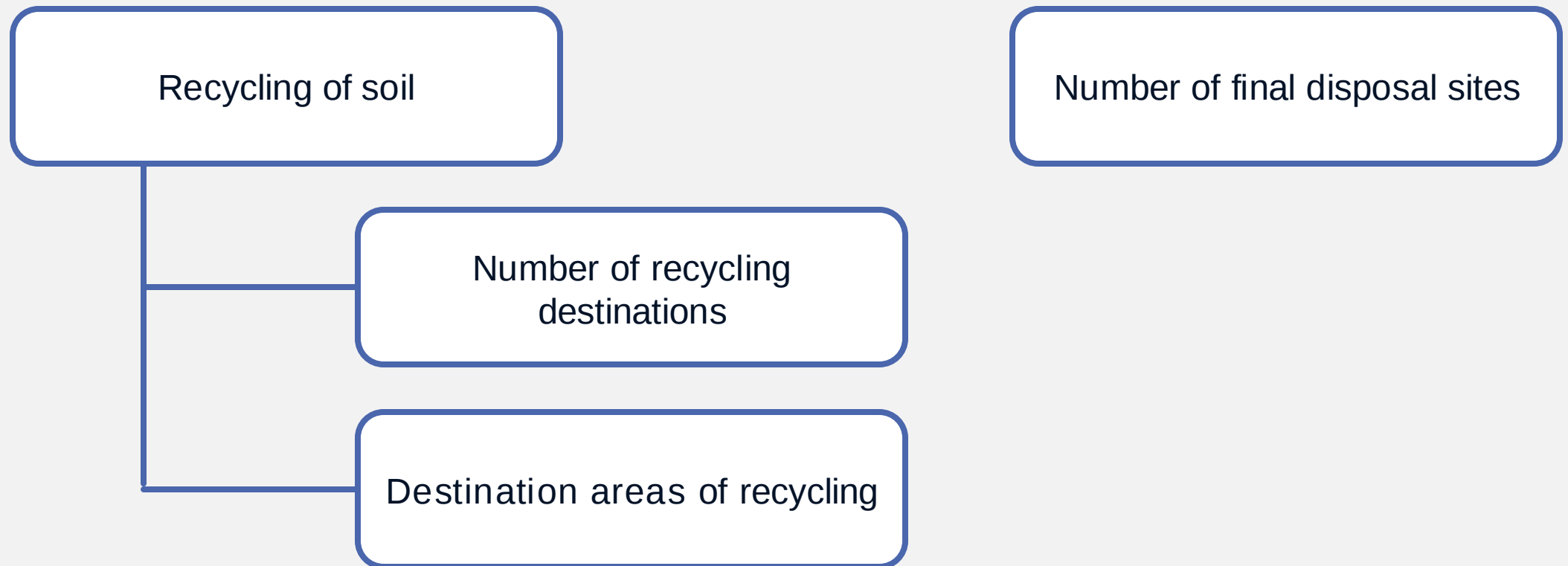
- The law clearly states that it is the national responsibility to complete final disposal outside Fukushima Prefecture within 30 years of the start of interim storage (by 2045)
 - To make it easier to realize final disposal outside the prefecture, the amount of waste required for final disposal must be reduced, and the final disposal site must be the scale of the facility needs to be reduced
- To reduce the amount of waste required for final disposal, the government's policy is to use removed soil with low radioactive concentrations as reclaimed material (recycling), assuming safety is ensured
- Regarding final disposal, the specific method and area for disposal have not yet been decided.

CRITICISM OF THE LAW

- It is unclear how the law was decided
 - The Cabinet decision stated that "after a comprehensive assessment, final disposal will take place outside Fukushima Prefecture." (Minutes of the 187th Diet, House of Representatives Environment Committee, No. 5, p. 13 (October 31, 2014))
- The legal basis for recycling is unclear
 - "Recycling" corresponds to disposal (but is not "final disposal")

POINTS RELATED TO THE FINAL DISPOSAL

- Two points that are relevant when discussing the disposal of removed soil:



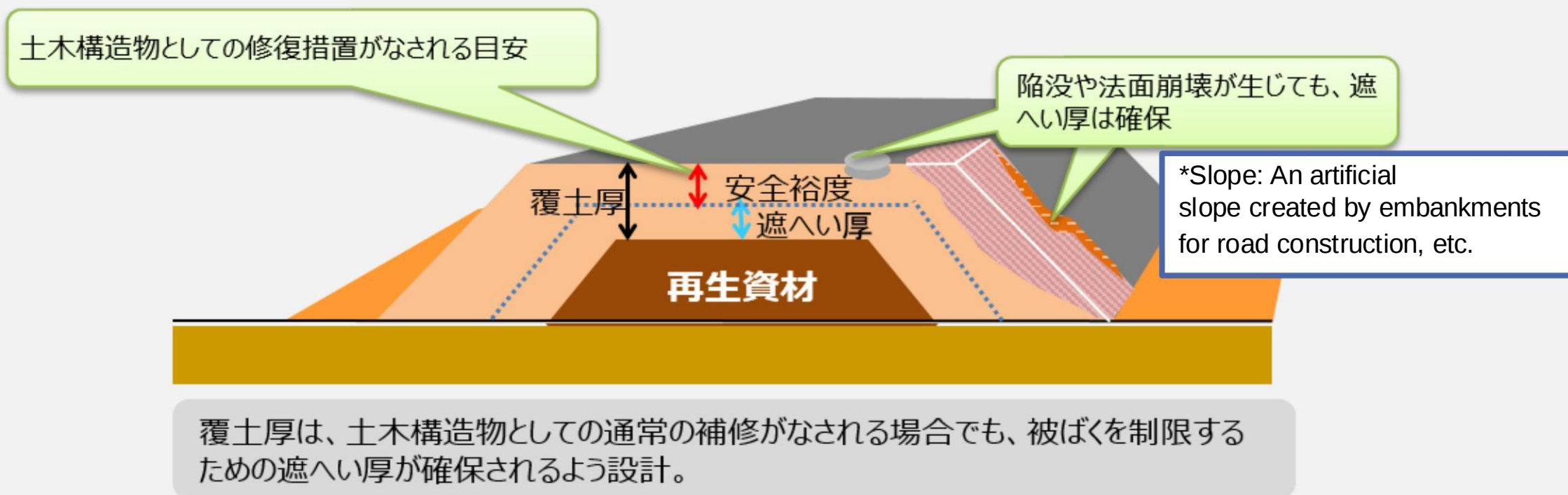
POINT 1: RECYCLING

- The differences and similarities between recycling and final disposal are as follows:

	nature	Removed soil concentration	Management	Transportation costs
Recycling	Can be effectively used as materials and resources	Below 8000 Bq/kg	Relatively easy	unchanged (the further away from Fukushima the higher the level)
Final Disposal	There is no other option than to bury it	Over 8000 Bq/kg	Strict management for a long time	

POINT 1: RECYCLING

- Recycling applications: considering using it for embankment materials for roads, levees, and farmland
 - Demonstration projects are already underway in several municipalities in Fukushima Prefecture



EXAMPLES OF RECYCLING DEMONSTRATION PROJECTS

- Safety has been confirmed in each area



Recycling demonstration project at the eastern temporary storage site in the Yukitsu area of Minamisoma City, Fukushima Prefecture

http://josen.env.go.jp/chukanchozou/facility/recycling/project_minamisoma/
http://josen.env.go.jp/chukanchozou/facility/recycling/project_iitate/



Recycling demonstration project in Nagadoro district, Iitate village, Fukushima prefecture

HOW MANY PLACES AND TO WHAT EXTENT WILL RECYCLING TAKE PLACE?

- Where will recycling take place?
 - Can be done in one place or multiple places

	load	management	stakes Involved Holders and residents
One place	The removed soil is concentrated in the receiving area. The physical and psychological burden is great	Concentrated in one place	Relatively few
Multiple locations	The removed soil is divided and sent to the receiving area. Reduces physical and psychological stress	Multiple locations need management	Relatively more

- To what extent will recycling be carried out?
 - In principle, this is possible throughout Japan
 - Recycling is different from the final disposal, so it is possible in Fukushima Prefecture

POINT 2: NUMBER OF FINAL DISPOSAL SITES

- The number of final disposal sites is yet to be decided
 - It is considered similar to recycling, but final disposal involves an element of risk

	load *Same as recycling	Management *Same as recycling	Stakeholders and residents involved *Same as recycling	Risk of final disposal *The risk of recycling is considered to be sufficiently small to begin with.
One place	The removed soil will be concentrated, placing a heavy physical and psychological burden on the receiving area	Concentrated in one place	Relatively few	The risks of removed soil are concentrated in one place
Multiple locations	The removed soil will be divided, reducing the physical and psychological burden on the receiving areas.	Required at multiple locations	Relatively more	The risk of removed soil is distributed to multiple locations