

Supplementary Material

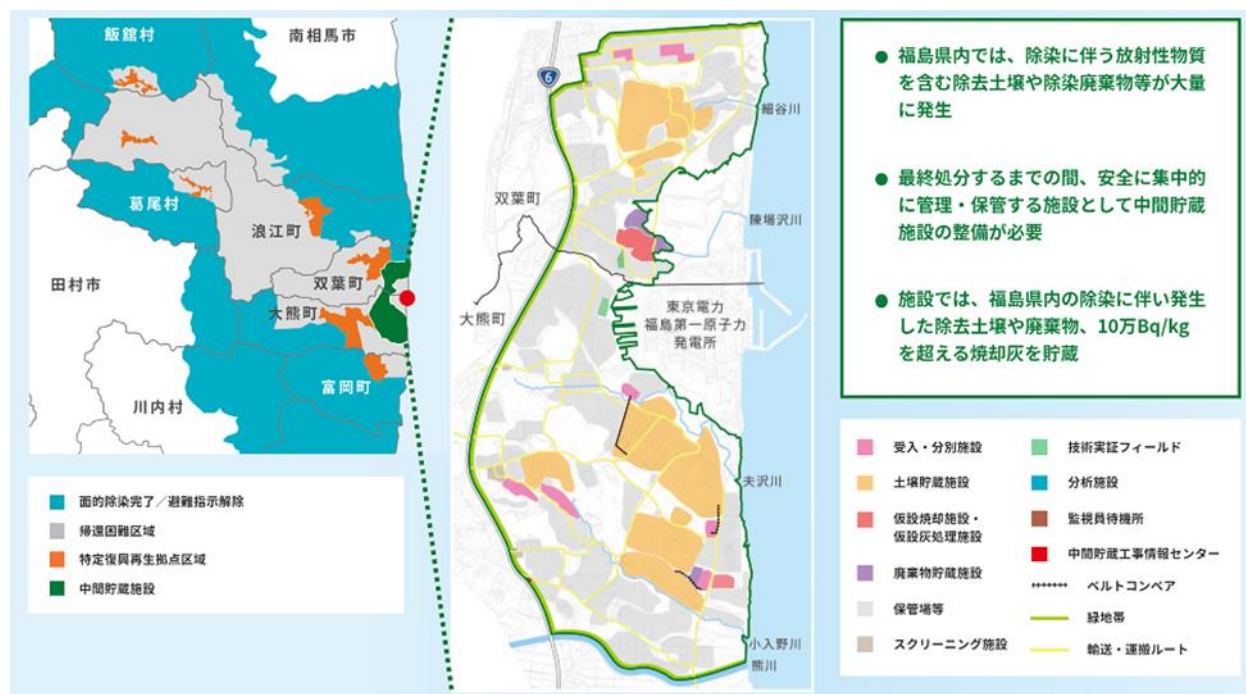
Appendix A. Explanation about removed soil in pre-questionnaire (Japanese and English)

1. 除去土壌とは

2011年3月11日に発生した東京電力福島第一原子力発電所の事故により、放射性物質が環境中に放出されました。放出された放射性物質は風によって飛散し、地表へ降下して広範囲の環境汚染が生じました。環境省は福島県において、生活環境を取り戻すために住宅地や農地の放射線量を下げる目的で表土のはぎ取りなどの除染を行いました。これにより、生活する空間において受ける放射線の量は低減しました。

この除染に伴い大量の“除去土壌”が発生しました。除去土壌は当初、福島県内各地の仮置き場や除染現場で保管されていましたが、安全な保管や復興を進めるため、中間貯蔵施設へ運び込まれました。

中間貯蔵施設は、福島県大熊町・双葉町に設置されています。中間貯蔵施設へ運び込まれた除去土壌の量は、約1400万 m^3 、東京ドームおよそ11杯分に相当します。



出典：環境省 中間貯蔵施設情報サイト <http://josen.env.go.jp/chukanchozou/>

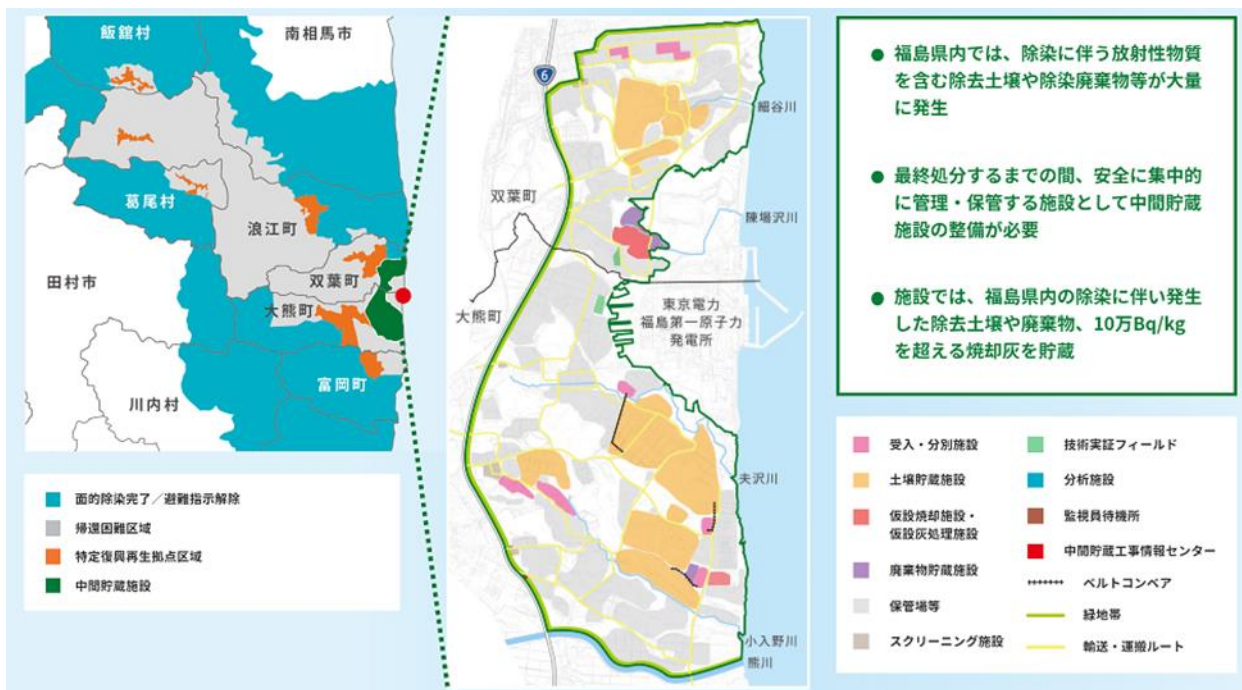
以下の質問について、前のページの説明に合致する選択肢をお選び下さい。

- 現在、除去土壌は福島県内各地の仮置き場に保管されている
- 現在、除去土壌は福島県大熊町・双葉町の間貯蔵施設に保管されている

1 What is removed soil?

The accident at the Fukushima Daiichi Nuclear Power Station occurred on March 11, 2011, and radioactive materials were released into the environment as a result. The released radioactive materials were carried by the wind and deposited on the ground, causing widespread environmental contamination. The Ministry of the Environment carried out decontamination work in Fukushima Prefecture, including the removal of topsoil, to lower radiation levels in residential areas and farmland and to restore the living environment. This decontamination process successfully reduced radiation levels in residential areas.

This process generated large amounts of **removed soil**. Initially, the removed soil was stored in temporary storage and decontamination sites throughout Fukushima Prefecture. Then, it was transported to interim storage facilities to ensure safe storage and promote reconstruction. The interim storage facilities are located in Okuma and Futaba Towns, Fukushima Prefecture. The amount of removed soil transported to the interim storage facility was approximately 14 million m³, equivalent to approximately 11 Tokyo Domes.



Source: Ministry of the Environment, <http://josen.env.go.jp/chukanchozou/> (in Japanese).

For the questions below, please select the option that matches the explanation on the previous page:

○Removed soil is currently stored in temporary storage sites throughout Fukushima Prefecture.

○Removed soil is currently stored at intermediate storage facilities in Okuma and Futaba Towns, Fukushima Prefecture.

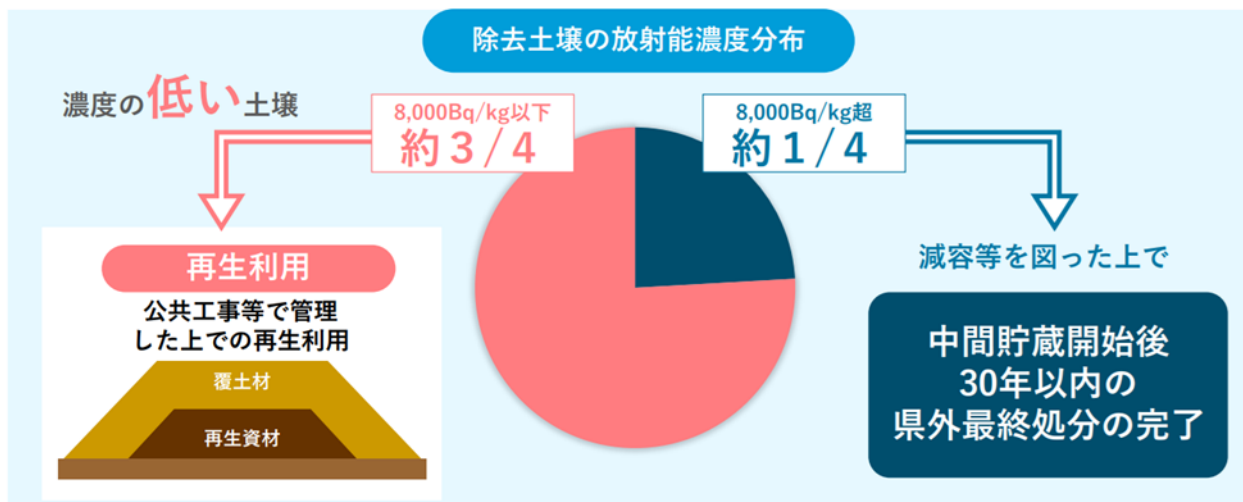
2. 最終処分と再生利用

除去土壌は、中間貯蔵開始後 30 年以内（つまり 2045 年まで）に福島県外で“最終処分”を完了するために必要な措置を講ずることが国の責務として法律に明記されています。ただし、まだどこでどのように処分するかの詳細は決まっていません。

県外最終処分に向けては、まず最終処分量を低減することが鍵となります。除去土壌の量は膨大であり、全てを最終処分しようとするとう大な土地が必要となるためです。そこで、除去土壌のうち、比較的放射能濃度が線量の低い土壌を資材として“再生利用”することを試みています。

再生利用できる除去土壌は、土壌の放射能濃度が 8000Bq/Kg 以下のものです。8000Bq/Kg という基準は、再生利用をした施設の周辺住民や利用者、作業者の追加被ばく線量が国際的に安全基準として勧告されている値（放射線防護の国際基準「年間 1 mSv」）を超えないように定められました。この基準で除去土壌のうち約 4 分の 3 は再生利用できるものに該当します。

※Bq（ベクレル）はその物質が持っている放射線を出す能力の大きさを指す単位です。一方、Sv（シーベルト）は被ばく線量の単位で、人体が受ける放射線の影響を示します



出典：中間貯蔵除去土壌等の減容・再生利用技術開発戦略検討会（第 13 回）参考資料 2 東日本大震災からの被災地の復興・再生に向けた環境省の取組
http://josen.env.go.jp/chukanchozou/facility/effort/investigative_commission/pdf/proceedings_220330_05.pdf

以下の質問について、前のページの説明に合致する選択肢をお選び下さい。

○除去土壌を全て再生利用する方針である

○除去土壌のうち、安全性が確認できる基準である 8000Bq/Kg 以下の土壌を再生利用する方針である

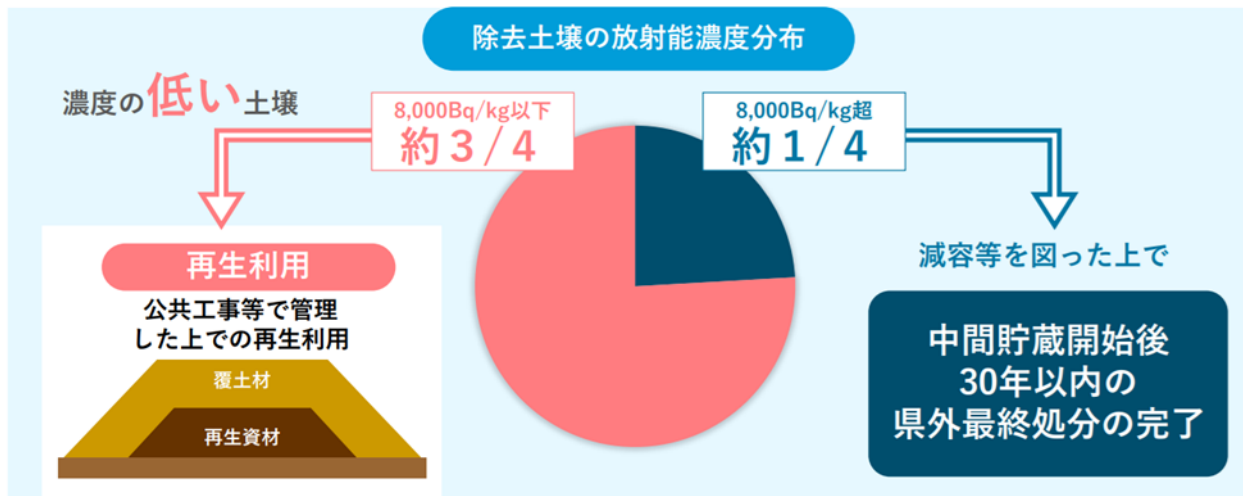
2 Final disposal and recycling

The law stipulates that the government is responsible for taking the necessary measures to complete the **final disposal** of removed soil outside Fukushima Prefecture within 30 years of the start of interim storage (that is, by 2045). However, the location and implementation of the final disposal have not yet been determined.

The key to final disposal outside the prefecture is to reduce the amount of soil that must be disposed of. The amount of soil removed is enormous, and its final disposal requires a vast amount of land. Therefore, the government plans to **recycle** soil with a relatively low radioactivity concentration from among the removed soil.

The removed soil that can be recycled has a soil radioactivity concentration of 8,000 Bq/kg or less. The standard of 8,000 Bq/kg was established to ensure that the annual additional exposure dose to residents and users near recycling facilities and workers engaged in recycling the removed soil did not exceed the value recommended internationally as a safety standard (the international standard for radiation protection: 1 mSv per year). Based on this standard, approximately three-quarters of the removed soil can be recycled.

*Bq (becquerel) indicates the amount of radiation a substance receives. Sievert (Sv) is a unit of exposure dose that indicates the effect of radiation on the human body.



Source: Strategy Committee for Technology Development of Volume Reduction and Recycling of Interim Storage-Removed Soil (13th). Reference material 2: Ministry of the Environment's efforts towards the reconstruction and revitalization of disaster-stricken areas after The Great East Japan Earthquake.

http://josen.env.go.jp/chukanchozou/facility/effort/investigative_commission/pdf/proceedings_220330_05.pdf (in Japanese)

For the questions below, please select the option that matches the explanation on the previous page:

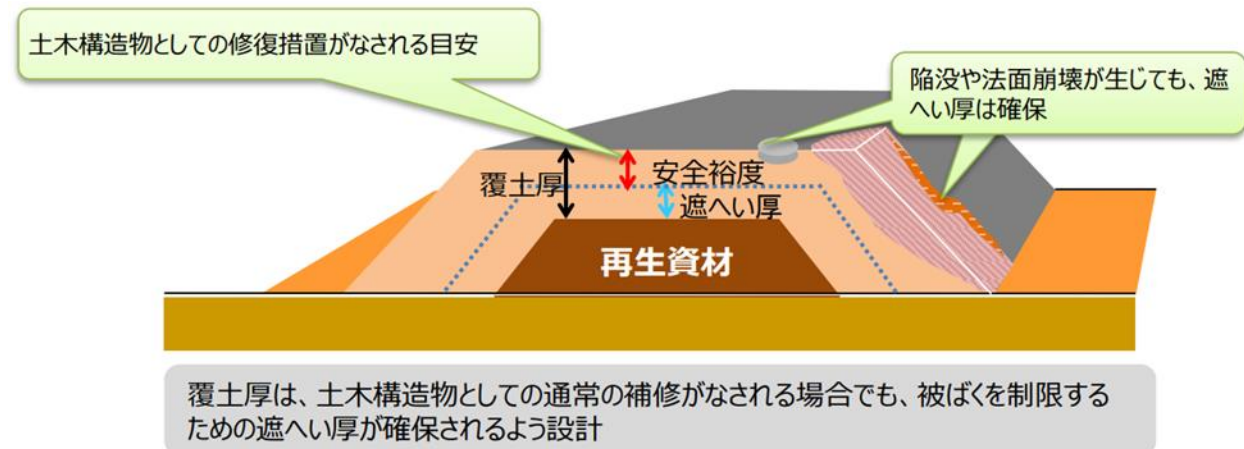
- ☐ The government plans to recycle all removed soil.
- ☐ The government plans to recycle removed soil that has a level below 8,000 Bq/Kg, which is a safety standard.

3. 再生利用の方法と実証事業

再生利用では、管理の責任や体制が明確になっている公共事業など（例：堤防や道路を建設する際の盛土や農地）に土壌を使用します。安全な再生利用の方法は除去土壌にかかわる研究者や技術者が検討を重ねています。

再生利用の際には、下図のように、除去土壌の飛散・流出防止のために覆土を行い、適切に管理します。除去土壌に覆土をすることで、放射線が遮へいされます（50cm の覆土により 99%以上の放射能がカットできます）。

再生利用については、2017 年から福島県南相馬市で盛土を造成する実証事業が、2018 年からは福島県飯舘村で農地利用を行う実証事業がそれぞれ行われました。その結果、盛土の施行や農地利用の前後で空間線量率などに大きな変動は見られず、収穫した作物の放射性セシウムの濃度も一般食品の基準値を大きく下回り、安全性が確認されています。



出典：中間貯蔵除去土壌等の減容・再生利用技術開発戦略検討会（第12回） 参考資料2 東日本大震災からの被災地の復興・再生に向けた環境省の取組
http://josen.env.go.jp/chukanchozou/facility/effort/investigative_commission/pdf/proceedings_210326_04.pdf

以下の質問について、前のページの説明に合致する選択肢をお選び下さい。

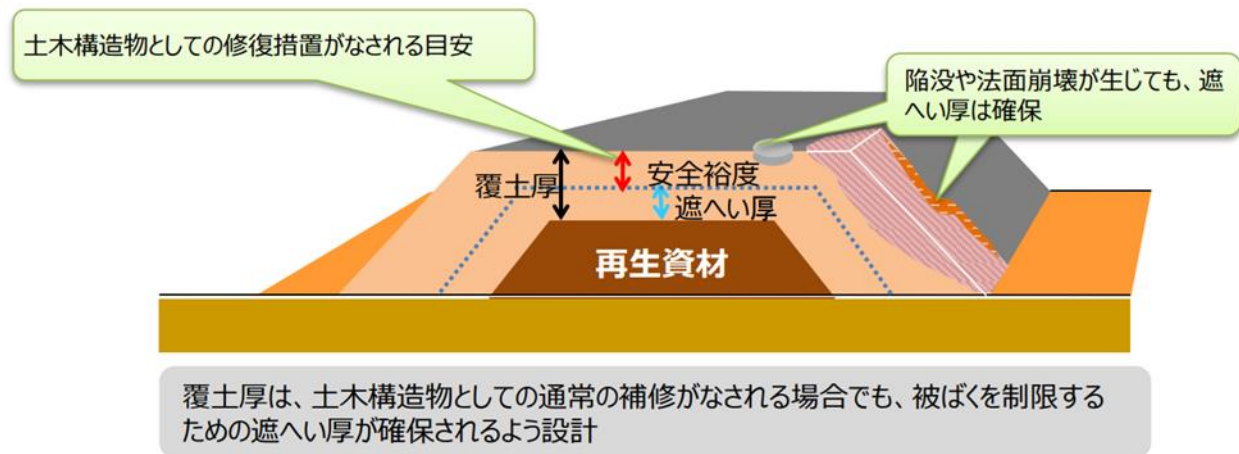
- 再生利用については福島県南相馬市・飯舘村で実証試験が行われ、安全性が確認された
- 再生利用については福島県南相馬市・飯舘村で実証事業が行われたが、安全性は確認されていない

3 Recycling methods and demonstration tests

In recycling, the removed soil is used for public works projects where management responsibilities and systems are clearly defined (e.g., embankments for constructing levees and roads, and farmland). Researchers and engineers involved in soil removal continue to explore methods to safely recycle soil.

During recycling, as shown in the figure below, the removed soil is covered with other soil to prevent it from scattering or flowing out and is managed appropriately. By covering the removed soil with other soil, radiation is shielded (more than 99% of the radioactivity could be shielded by covering 50 cm of the other soil).

Regarding recycling, a demonstration test to create an embankment was conducted in Minamisoma, Fukushima Prefecture in 2017, and a demonstration test to utilize farmland was conducted in Iitate, Fukushima Prefecture in 2018. No major changes were observed in the air dose rate before and after creating the embankment and utilizing the farmland, and the radioactive cesium concentration in the harvested crops was well below the standard value for general food, confirming its safety.



Source: Strategy Committee for Technology Development for Volume Reduction and Recycling of Interim Storage-Removed Soil (12th). Reference material 2: Ministry of the Environment's efforts towards the reconstruction and revitalization of disaster-stricken areas after The Great East Japan Earthquake.

http://josen.env.go.jp/chukanchozou/facility/effort/investigative_commission/pdf/proceedings_210326_04.pdf (in Japanese)

For the questions below, please select the option that matches the explanation on the previous page:

○Regarding recycling, demonstration tests were conducted in Minamisoma and Iitate, Fukushima Prefecture, and safety was confirmed.

○Regarding recycling, demonstration tests were conducted in Minamisoma and Iitate, Fukushima Prefecture, but safety was not confirmed.

Appendix B. The specific questions in questions

Questions were recorded on a scale of 1 to 5 (1 = agree, 5 = disagree), with the exception of questions about interest and knowledge.

Interest:

(pre-questionnaire) Before answering this question, how interested are you in the issue of soil removal?

(post-questionnaire) How interested are you in the issue of soil removal?

Interest was recorded on a scale of 1 to 4 (1 = interested, 4 = not interested).

Sense of the involved party:

(1) Do you feel that the issue of soil removal concerns you?

(2) Do you feel involved in soil removal?

Knowledge about removed soil:

(1) The effects of radiation can be prevented by covering the building with soil.

(2) Because radioactive cesium is strongly adsorbed by soil, it has little impact on groundwater.

(3) Exposure to radioactive materials on the ground surface is called internal exposure.

(4) Evacuation orders are still issued for the entire areas of Okuma and Futaba, where interim storage facilities are located, and no single resident can return home.

(5) The final disposal of the removed soil outside Fukushima Prefecture was decided by the cabinet.

Knowledge of the removed soil was assessed by the number of correct answers to five questions. Participants responded to the questions by selecting “true,” “false,” or “I do not know.” The correct answers to the first, second, and fifth questions are “true,” and the correct answers to the third and fourth questions are “false.”

Risk perception regarding the recycling:

- (1) Recycling the removed soil is frustrating
- (2) Recycling removed soil can cause life-threatening damage.
- (3) Recycling the removed soil can cause many victims at once.
- (4) Damage may occur due to the recycling of the removed soil.
- (5) It is possible that radioactive materials leak during recycling the removed soil.

Risk perception regarding the final disposal:

- (1) The final disposal of the removed soil is frustrating.
- (2) The final disposal of the removed soil can cause life-threatening damage.
- (3) The final disposal of the removed soil may cause many victims.
- (4) Damage may occur due to the final disposal of the removed soil.
- (5) Radioactive materials may leak during the final disposal of the removed soil.

Trust:

- (1) Government can make appropriate decisions.
- (2) The government should make decisions considering the public.
- (3) Government can be trusted.
- (4) Researchers and engineers involved in the treatment of removed soils can make appropriate decisions.
- (5) Researchers and engineers involved in the treatment of removed soils should make public decisions.
- (6) The researchers and engineers involved in the treatment of the removed soil can be trusted.

Acceptance of removed soil:

- (1) The recycling policy is accepted.

- (2) The final disposal policy outside Fukushima Prefecture is accepted.
- (3) If it was decided to recycle in the area where I live, I would be able to accept it.
- (4) The final disposal of removed soil in the area where I lived would be acceptable.