

Recommendations

On Cross-regional Processing of Disaster Wastes



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Science Council of Japan

Committee on Supporting Reconstruction
after the Great East Japan Earthquake

These recommendations compile and publish the results of deliberations of the Committee on Supporting Reconstruction after the Great East Japan Earthquake, Science Council of Japan.

Committee on Supporting Reconstruction after the Great East Japan Earthquake

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Summary

1. Background of the Recommendations

The Great East Japan Earthquake resulted in a large amount of disaster wastes due to the subsequent large scale Tsunamis. As of March 12, 2012, the amount was estimated to be 4.76 million tons in Iwate Prefecture, 15.69 million tons in Miyagi Prefecture, and 2.08 million tons in Fukushima Prefecture, or a total of 22.53 million tons in the three prefectures which were the major disaster-stricken areas. The goal was set of completing the processing/disposal of the disaster wastes by the end of March 2014. However, at present only 7.1%, or 1.60 million tons, of the disaster wastes have been processed/disposed of.

The disaster wastes should be, in principle, processed within the prefectures through reuse, including being used in disaster prevention facilities in the disaster-stricken areas, etc., but proceeding as scheduled with the cross-regional processing will be an issue with processing the wastes. The present governmental policy is to proceed with the cross-regional processing of the disaster wastes in Iwate and Miyagi Prefectures but limiting it to that in which the concentration of radioactive materials has been verified to be sufficiently low.

These recommendations therefore discuss ways of processing the disaster wastes in Iwate and Miyagi Prefectures. These recommendations then 1) examine a method of cross-regional processing from the point of view of safety and verifying whether it is a safe processing method or not, 2) point out matters requiring special attention with monitoring, the provision of information, and explanations in thereby obtaining sufficient understanding from the disaster-stricken areas, the municipalities involved in the cross-regional processing, and all the residents, and 3) point out the necessary recommendations.

2. Present situation and issues

At present a standard value for the concentration of radioactive cesium in the disaster wastes to be processed by municipalities has been set within guidelines on promoting the cross-regional processing of disaster wastes, etc., and as long as all the workers work in conditions below that standard value their additional annual exposure dose can be expected to below the the standard value provided by the ICRP. In addition, with sufficient care, for example not engaging in excavation work, etc. the additional annual exposure dose of the general public can be retained at less than 1/100 of the exposure dose from background radiation that people are normally exposed to. The exposure dose of the residents living in the neighborhood of furnaces through inhaling dust and the exposure dose through intake of agricultural products, stock farm products, and cultured fish from the neighborhood have been

estimated to be less than 1/10,000.

In addition, the monitoring methods/procedures used to measure the concentration of radioactive material established by the Ministry of the Environment are in line with the cautious approach of verifying it not only at the time of shipment but also at the time of receipt. The processing of the disaster wastes is considered to not adversely affect people's health as long as it is carried out in accordance with the present procedures.

The processing of the disaster wastes will, however, require significant consideration with respect to eliminating the worries of the residents of the recipient municipalities about both health effects from the radioactive materials and the basic principles of managing radioactive materials to a sufficient extent. The processing of the disaster wastes will also significantly affect municipalities concerned in all the aspects of the cost, people's health, and employment, etc. Enabling the disaster-stricken municipalities and recipient municipalities to reach an agreement in a convincing manner and then proceed with the cross-regional processing will therefore require consideration being given to [1] seriously respecting the general rule of processing the wastes within the prefecture concerned, [2] making the effort to precisely identify the amount of the disaster wastes, [3] ensuring accountability via information being thoroughly disclosed to the residents of the recipient municipalities, and [4] constant monitoring of possible radioactive material leaks.

3. Content of the recommendations

Recommendation 1:

The disaster-stricken municipalities should precisely identify the composition and amount of the disaster wastes, reuse as much as possible within the region, and then renew their disposal plans from the stance of disposing/incinerating the residue or implementing cross-regional processing. The government should strengthen their technical advice and financial support in thereby supporting formulation of the plan and its implementation.

Recommendation 2:

The government should provide financial support for the additional expense of removing impurities, etc. when the disaster wastes will be used in the development of bases for disaster-prevention forests and higher ground that thus functions as tidal protection, and make the effort to enhance sorting technologies, etc. in thereby increasing the amount of reusable disaster wastes.

Recommendation 3:

The processing/disposal standards, which are based on the Act on Special Measures concerning the Handling of Contamination caused by Radioactive Materials and Guidelines on the Promotion of cross-regional processing of disaster wastes, are fulfilled by the concentration of radioactive materials contained in the disaster wastes in Iwate and Miyagi Prefectures and of a sufficiently low level that will not pose any health hazard in many cases, and thus either processing within the prefecture of concern or cross-regional processing is possible. The standards, however, do differ depending on the processing methods used such as whether the disaster wastes will be reused or not. To proceed with cross-processing, therefore, the government will need to develop an environment in which cross-regional processing can smoothly progress through making the necessary arrangements to ensure that the requests of the disaster-stricken regions match the conditions of the recipient regions with regard to type of disaster wastes and the concentration of radioactive materials.

Recommendation 4:

With the processing of the disaster wastes, and regardless of whether it is processed within the prefecture or cross-regionally processed, the government and municipalities should constantly confirm whether the content of radioactive materials and other hazardous materials is below the safety standards or not both before delivery and after disposal, while also ensuring to disclose that data. In enabling municipalities to provide sufficient risk communication to residents, in particular, the government should 1) completely disclose all relevant information, including the processes used to establish standards, etc., 2) provide technical and financial support with regard to measurement of the content, including radiation dose measurements, etc., and 3) guarantee opportunities for process verification to take place by neutral experts, etc.

1 Large amount of disaster wastes and the necessity of processing them

The Great East Japan Earthquake resulted in an extremely large amount of disaster wastes due to the subsequent large scale Tsunamis. As of March 19, 2012, the amount was estimated to be 4.76 million tons in Iwate Prefecture, 15.69 million tons in Miyagi Prefecture, and 2.08 million tons in Fukushima Prefecture, or a total of 22.53 million tons in the three prefectures which were the major disaster-stricken areas ^{27*} ²⁸ When compared to the amount of general wastes generated in a normal year in each prefecture the amount of disaster wastes can be considered to be the equivalent of the amount of general waste generated in 10.5 years in Iwate Prefecture, 18.7 years in Miyagi Prefecture, and 2.7 years in Fukushima Prefecture²⁹. With regard to these disaster wastes governmental guidelines (“Guidelines (Master Plan) for Disaster Waste Management after the Great East Japan Earthquake”, May 2011, Ministry of the Environment) and prefectural/municipal implementation plans were formulated with the goal of completing their processing/disposal by the end of March 2014 through being utilized in the development of disaster prevention bases (being reused, as embankment, or as landfill), incineration within their own jurisdiction and disposal of the ash, or via cross-regional processing, etc.

However, the present situation is that at present only 7.1% or 1.60 million tons of the disaster wastes have been processed/disposed of, although a large amount of the disaster wastes in the three prefectures were delivered to temporary storage sites in 288 regions. It was pointed out that the presence of the disaster wastes could interfere with the relocation of villages, land readjustments, fishing port developments in some cases, result in fires or hygiene problems in the summer, or reduce the vitality of the disaster victims in their new lives when they make them recall memories of the disaster. For these reasons proceeding with their smooth processing while responding to these problems is of course necessary. In doing so, and as described later, utilization in the development of disaster prevention facilities within the disaster-stricken prefectures and placing higher priority on incineration, etc. within the prefecture where it can then generate industrial vitality and employment are considered appropriate. In contrast to this, however, cross-regional processing outside the disaster-stricken prefectures is also expected to occur. Cross-regional processing outside the disaster-stricken areas was carried out with 14% of the total amount of the disaster wastes resulting from the

²⁷ *: The original was written in Japanese and SCJ provides informal English translation for non-Japanese readers.

²⁸ Progress Status of the Disaster Waste Processing in Coastal Municipalities (March 18, 2012, Ministry of the Environment) *

²⁹ “Waste disposal in Japan” (February, 2012, Survey on Disposal of General Waste, FY 2011 edition, Ministry of the Environment) *

Great Hanshin-Awaji Earthquake. The most recent public opinion poll also showed the understanding of the majority of the public to be 75-85% in support of the idea of “municipalities of their residence outside the disaster-stricken areas accepting the processing of debris from the disaster-stricken areas”³⁰.

In proceeding with that cross-regional processing, however, worries about the possibility of the wastes containing radioactive materials released due to the Fukushima Daiichi Nuclear Power Plant accident, in particular, are obstructing the progress of the cross-regional processing. The results of airborne monitoring by the Ministry of Education, Culture, Sports, Science and Technology³¹ revealed that areas with a radiation dose rate in the air of 0.1 $\mu\text{Sv/h}$ or higher are mostly distributed over the region extending from Fukushima Prefecture to the northern Kanto Region, and a few areas with a higher radiation dose rate in Iwate and Miyagi Prefectures excluding some areas in the northern part of Miyagi Prefecture. A map of the concentration of radioactive cesium also indicates low contamination in the peripheral areas within a 100-kilometer radius of the Fukushima Daiichi Nuclear Power Plant³². The abovementioned data suggests the possibility of the disaster wastes containing radioactive materials to significantly vary between both Iwate/Miyagi Prefectures and Fukushima Prefecture. The present government policy is to proceed with cross-regional processing of the disaster wastes in Iwate and Miyagi Prefectures, but to limit it to that in which the concentration of radioactive materials has been verified to be sufficiently low³³.

These recommendations therefore discuss ways of processing the disaster wastes in Iwate and Miyagi Prefectures. These recommendations then aim to 1) examine a method of cross-regional processing from the point of view of safety and verifying whether it is a safe processing method or not, 2) pointing out matters requiring special attention with the monitoring, provision of information, and explanations in thereby obtaining sufficient understanding within the disaster-stricken areas, the municipalities involved in the cross-regional processing, and the residents, and 3) then providing the necessary recommendations.

³⁰ National public opinion poll of the Yomiuri Shimbun, March 3, 2012, etc. *

³¹ “Results of Fourth Airborne Monitoring Survey by MEXT”, press release document provided by the Ministry of Education, Culture, Sports, Science and Technology, December 16, 2011.

³² FY 2011 Strategic Funds for the Promotion of Science and Technology “Results of Study on Distribution of Radioactive Substances due to the accident at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc.”, March 13, 2012. *

³³ The government policy excludes disaster waste in Fukushima Prefecture from being subjected to cross-regional processing. The government is responsible for processing disaster wastes within Fukushima Prefecture with a high concentration of radioactive materials and municipalities for processing those with a low concentration.

2 Evaluation of radioactive materials contained in the disaster wastes

As described above the status of the deposition of radioactive materials in Iwate/Miyagi Prefectures significantly differs from that in Fukushima Prefecture. However, radioactive materials were also deposited in both these prefectures, although at low concentrations, and are therefore contained in the disaster wastes as revealed by measured data from the respective regions. It is also possible that wastes containing radioactive materials would get transferred or mixed with other wastes during the course of their classification or transportation. Standards and procedures for managing the wastes to be processed with regard to radioactive materials have therefore been established.

At present guidelines used to promote cross-regional processing of the disaster wastes, etc.³⁴ classify disaster wastes subject to cross-regional processing into the following three types:

- [1] incombustible,
- [2] combustible, and
- [3] recyclable.

Standard values for the total concentration of radioactive cesium for each type are set to be:

- [1] 8,000 Bq/kg or less,
- [2] 240-480 Bq/kg or less (however, consideration shall be given to retaining the concentration of ash resulting from the concentration due to incineration at 8,000 Bq/kg or less), and
- [3] 100 Bq/kg or less (in the final product), respectively.

The standard value of 8,000 Bq/kg will be commonly applied to both type [1] and [2] wastes that are processed and stored outside the disaster-stricken areas. With this concentration the annual exposure dose of workers working at processing sites near wastes with this concentration for eight hours a day and half their work hours of 250 days per year is estimated to be 0.78 mSv. This is the result of a calculation that involves multiplying the standard concentration value by the dilution factor of the radiation source, the shielding factor with external exposure, annual work hours, the radiation dose scale factor per unit concentration/hour, and the decay rate³⁵. The annual work hours used here are assumed to be the maximum work hours when in contact with maximum standard value wastes, and thus the

³⁴ The “Act on Special Measures for Handling Environmental Contamination by Radioactive Materials Emitted due to the Nuclear Power Plant Accident caused by the Tohoku Region Pacific Offing Earthquake on March 11, 2011” (Act No. 110 of 2011), Ordinance for Enforcement of the said Act (Ordinance of the Ministry of the Environment No. 33 of 2011), and “Promotion of Cross-Regional Processing of Disaster Wastes (Guidelines for Promoting Cross-Regional Processing of the Disaster Wastes Caused by the Great East Japan Earthquake)” (August 11, 2011, Ministry of the Environment). *

³⁵ A Disaster Waste Safety Evaluation Committee document (9th), November 15, 2011. *

annual exposure dose of 0.78 mSv can also be regarded as being the maximum value.

The Japanese people are considered to be normally exposed to background radiation of 1.5 mSv (the global average being 2.4 mSv) from radioactive materials in cosmic rays or originally existing in the soil or the human body. ICRP established a radiation dose limit of 1 mSv/year as the limit of additional dose of anthropogenic radiation, including that of industrial origin, etc., that people can be exposed to³⁶. Workers working under the conditions described above therefore will not exceed the standard additional annual exposure dose.

In contrast to this, a similar calculation being used for the external exposure of the above mentioned workers after setting the depth of soil cover and volume of buried wastes, etc. results in the estimated annual exposure dose of the residents living in the former final disposal sites, with sufficient care including not to make any excavation, being 0.01 mSv³⁷, which is less than 1/100 of the exposure dose due to background radiation that people are normally exposed to. In addition, the exposure dose of the residents living in the neighborhood of furnaces through inhaling dust and the exposure dose through intake of agricultural products, stock farm products, and cultured fish from the neighborhood are estimated to be less than 1/10,000³⁵.

When combustible disaster wastes are incinerated, cesium originally contained in the wastes is concentrated in ash (fly ash, in particular) and molten materials produced. When the amount of fly ash produced is equivalent to 3% of the amount of disaster wastes in mechanical stoker type incinerators the concentration factor is 33.3 times, and thus disaster wastes with a cesium concentration of 240 (or approximately 8,000/33.3) Bq/kg will not produce any ash with a cesium concentration of over 8,000 Bq/kg. However, ash may get concentrated by up to 100 times at maximum through being melted and the volume reduced in thereby extending the lifespan of landfill sites. The precautionary clause of “consideration shall be given to retaining the concentration of ash resulting from the concentration due to incineration at 8,000 Bq/kg or less” therefore needs to be carefully observed.

In addition, thorough monitoring using appropriate procedures is essential in proving that radioactive materials contained in the disaster wastes will not pose any health hazards. Because of this the Ministry of the Environment established monitoring methods/procedures for measuring the concentration of radioactive materials at the respective times of shipping, incineration, and landfill by combining nuclear species analysis and radiation dose rate

³⁶ Japanese translated edition of the ICRP recommendations, March 2011, <http://www.scj.go.jp/ja/info/jishin/pdf/t-110405-3j.pdf>; “For a Better Understanding of Measures for Radiation Protection” (Comment of the President of Science Council of Japan), June 2011, <http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-21-d11.pdf>

³⁷ A Disaster Waste Safety Evaluation Committee document (12th), March 12, 2012. *

measurements and with the composition of the wastes taken into account³⁸. As long as the present procedures are carefully followed the concentration of radioactive materials in the disaster wastes processed will remain low, even when compared to the normal concentration level in the natural environment, and thus can be considered to be at a level that will not pose any health hazards.

In contrast to this the standards in [3] are referred to as the clearance standards for recycling and the requirement of managing the effective radiation dose to be below 0.01 mSv/year applies when distributing products in which the disaster wastes were used.

At present greater attention is being attached to monitoring cesium, but the public also worries about strontium and other nuclear species. The results of measuring nuclear species in the soil have revealed their contribution to the radiation dose to be estimated to be small³⁹. However, verification through actual measurements at the representative facilities is also worth discussing.

³⁸ “Promotion of Cross-Regional Processing of the Disaster Wastes” (August 11, 2011, Ministry of the Environment; latest revision of January 11, 2011) *.

³⁹ According to the FY 2011 Strategic Funds for the Promotion of Science and Technology “Results of Study on Distribution of Radioactive Substances due to the accident at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc.” (March 13, 2012) a soil sample in which strontium 90 was detected the average proportion of the deposited amount of strontium 90 to that of cesium was 2.6×10^{-3} .

3 Matters requiring special attention with the cross-regional processing

The processing of the disaster wastes, however, will also require consideration being paid to eliminating the worries of the residents of recipient municipalities about both the health effects of radioactive materials and the basic principles which are used to manage radioactive materials to a sufficient extent. Certainly the processing of the disaster wastes will significantly affect the municipalities with regard to the expense, people's health, and employment, etc. Discussion of these points must therefore take place and attention paid to the following in thereby enabling the disaster-stricken municipalities and recipient municipalities to reach an agreement in a convincing way before proceeding with the processing.

[1] Seriously respect for the general rule of processing within the prefecture

The government shall respect the general rule of subjecting disaster wastes that cannot be processed within the prefecture only to cross-regional processing, and give consideration to not regarding cross-regional processing as a prerequisite. In addition, the necessary technical/financial support will need to be provided in thereby enabling the disaster-stricken municipalities to effectively reuse the disaster wastes or incinerate it at the disaster sites. Attempts, such as application of advanced selection technologies, that enable reducing the amount of the disaster wastes that will be subjected to incineration or used as landfill to facilitate rapid processing and reusing the disaster wastes to the fullest extent possible are expected to occur. Use of the disaster wastes in disaster prevention facilities, including disaster prevention forests and embankments for thus creating higher ground, etc., can be considered effective and therefore actively promoted.

[2] Making the effort to precisely identify the amount of disaster wastes

At present an estimate of the amount of disaster wastes in the respective regions is being used, but the amount of disaster wastes that are present by type needs to be precisely identified in the future in parallel with the processing work. This will then enable the prefectural processing plans and the overall disaster waste processing plans to be refined. At present the amount being requested by Iwate and Miyagi Prefectures to be cross-regionally processed is 4.01 million tons (0.57 million tons by Iwate Prefecture and 3.44 million tons by Miyagi Prefecture), or which is 12.0% and 21.9%, respectively, of the entire amount. If the percentage reused or processed/disposed of within the prefectures can be raised as a result of the processing plans being refined in the future the cross-regional processing could be further limited. In addition, cross-regional processing can also proceed according to plans that better conform to the actual situation.

[3] Ensuring accountability via thorough information disclosure to the residents of recipient municipalities

Taking into consideration the possibility of the disaster wastes containing radioactive materials, asbestos, and other hazardous materials the government will need to: 1) completely disclose all relevant information, including the processes used to establish standards, etc., in thereby enable municipalities to provide sufficient risk communication to residents, 2) provide technical and financial support with regard to measurement of the content, including radiation dose measurements, etc., and 3) guarantee opportunities for process verification by neutral experts, etc. As described in 2 the concentration of radioactive materials in the disaster wastes processed is considered to be low as long as the present procedures are followed. However, the government needs to ensure accountability in thereby enabling the residents of recipient municipalities to precisely understand its content and avoid any undue worry.

[4] Constant monitoring for radioactive material leaks

The government and recipient municipalities will need to constantly monitor the possible reemission (leakage) of radioactive materials from incineration facilities and landfill facilities and ensure to disclose that data to the public. In addition, methods of rapidly controlling the situation where wastes with a concentration exceeding the standard value is mixed in or the concentration of ash is high with respect to standards based on the Act on Special Measures also need to be established in advance.

4 Recommendations

Science Council of Japan recommends the following with respect to the processing/disposal of disaster wastes in disaster-stricken Iwate and Miyagi Prefectures.

Recommendation 1:

The disaster-stricken municipalities should precisely identify the composition and amount of the disaster wastes, reuse them as much as possible within the region, and then renew their disposal plans from the stance of disposing/incinerating the residue or implementing cross-regional processing. The government should strengthen their technical advice and financial support in thereby supporting formulation of the plans and their implementation.

Recommendation 2:

The government should provide financial support for the additional expense of removing impurities, etc. when using the disaster wastes in the development of bases for disaster-prevention forests and higher ground that functions as tidal protection, and make the effort to enhance sorting technologies, etc. in thereby increasing the amount of reusable disaster wastes.

Recommendation 3:

The processing/disposal standards, which are based on the Act on Special Measures concerning the Handling of Contamination by Radioactive Materials and Guidelines on the Promotion of cross-regional processing of disaster wastes, are satisfied by the concentration of radioactive materials contained in the disaster wastes produced in Iwate and Miyagi Prefectures and which is sufficiently low that it will not pose any adverse health hazard in many cases, and thus either processing within the prefecture concerned or cross-regional processing is possible. The standards, however, do differ depending on the processing methods used such as whether the disaster wastes will be reused or not. In proceeding with cross-processing, therefore, the government will need to develop an environment in which cross-regional processing can smoothly progress through making arrangements that ensure requests of the disaster-stricken regions match the conditions of the recipient regions with regard to the type of disaster wastes and the concentration of radioactive materials.

Recommendation 4:

In processing with the disposal of the disaster wastes, and regardless of whether the processing takes place within the prefecture or is cross-regional processing, the government

and municipalities should constantly confirm that the content of radioactive substances and other hazardous substances is below the safety standards both before delivery and after disposal, and then ensure to disclose that data. In enabling municipalities to provide sufficient risk communication to residents the government should 1) completely disclose all relevant information, including the processes used to establish standards, etc., 2) provide technical and financial support with regard to measuring the content, including radiation dose measurements, etc., and 3) guarantee opportunities for process verification by neutral experts, etc.