

Nuclear Waste Crisis In Fukushima Decontamination Program

Shaun Burnie¹
Greenpeace Germany

“I’m sure they’re considering this site as a final storage destination for radioactive trash. I can’t trust them, no one can, about what will happen in 30 years time,”

Okuma landowner.²



Nuclear Waste Storage, Futaba, with Fukushima Daiichi nuclear plant in background, 29 September 2017, Christian Aslund/Greenpeace Japan

Summary

As a result of the Fukushima Daiichi nuclear accident several tens of thousands of square kilometers in Fukushima prefecture and wider Japan were contaminated with significant radioactive cesium and other radionuclides.³ Decontamination programs were launched in 2012 on the basis that doing so would contribute to the reduction of radiation levels and thereby permit the lifting of evacuation orders for tens of thousands of evacuated citizens.

The original government cost estimate of 4 trillion yen for decontamination, was revised in 2016 to 6 trillion yen; however, independent assessments have estimated that the total cost could reach 30 trillion yen.⁴ In addition to the ever

rising costs, the decontamination of towns, farmland and roadside across Fukushima during the last five years, has generated vast amounts of nuclear waste. It's important to clarify that most of the landmass of Fukushima prefecture most heavily contaminated has not been decontaminated.⁵

One of the principle reasons for this is that 71 percent of areas of Fukushima prefecture are mountainous forest for which decontamination is not possible.⁶ Based on the government's own figures, it is clear that the percentage of land surface decontaminated in districts across Fukushima range from as low as 1.4 percent to 20.9 percent, but no more.⁷ This runs counter to the narrative communicated by the Japanese government. It is common practice in the official documents issued by the Japanese government when explaining its program it refers to decontamination as having been completed, and describes forest decontamination as having been completed 100 percent. Only in 2017, and after several years of criticism, was it clarified by the Government that forests decontaminated means "close to residential area".⁸

Even with only a small percentage of land decontaminated, the waste volumes generated are enormous.

As of October 2017, a total of 7.4 million bags of contaminated soil had been generated in the Special Designated Areas (SDA) of Fukushima, and as of June 2017 a further 6 million m³ (cubic meters) from areas of Fukushima prefecture that are included in the wider Intensive Contamination Survey Area (ICSA), for a total of over 13 million m³.⁹ This waste was stored at over 1000 formal Temporary Storage Sites (TSS) in Fukushima prefecture, but nuclear waste is also stored at 141,000 locations across Fukushima.

In 2017 most of this waste still remains in the local areas where it was generated, but during the past few years increasing amounts have been transported to the planned interim storage sites located at Futaba and Okuma near the Fukushima Daiichi reactor site.

During the year to the end of November 2017 a total of more than 49,552 transports of nuclear waste had taken place to the ISFs, and a total of more than 87,590 transports across Fukushima.¹⁰ Plans are for a total of 500,000 m³ to be transported in fiscal year 2017 to the ISF's. With plans to move waste to these sites intensifying during the coming years, it is projected that in 2020 6.5 million m³ of nuclear waste would be moved to Futaba and Okuma involving over 1 million transports.

With projections of 30 million m³ of waste to be generated in total over the coming years, efforts to reduce the volume of waste center on incineration plants which have been built across Fukushima. Incineration has been underway over the past years, but is now being moved to a much larger scale with plans to incinerate 10 million m³, with a resulting 1 million m³ of highly radioactive ash (100,000 Bq/m²).

The nuclear waste crisis created as a result of the 2011 Fukushima Daiichi nuclear accident and the failed policy of decontamination, further negatively impacts Fukushima citizens, including those considering returning to their former homes.



Temporary Storage Site, southern Iitate, Fukushima prefecture, 4th October 2017, Christian Aslund/Greenpeace Japan

Decontamination Program and Evacuation Orders

There is a direct correlation between the decontamination program and the government timetable for lifting evacuation orders even though decontamination is limited to a small percentage of Fukushima.

The areas of Fukushima prefecture most heavily contaminated by radioactive fallout were included in the Special Decontaminated Areas (SDA), which consisted of 11 municipalities in the restricted zone or the planned evacuation zone which were either within 20km of the Fukushima Daiichi nuclear plant or had annual cumulative dose rates $>20\text{mSv}$. These areas included all of Naraha, Tomioka, Okuma, Futaba, Namie, Katsurao, and Iitate, as well as some areas of Tamura, Minami Soma, Kawamata, and Kawauchi. The wider area contamination zones were included in the Intensive Contaminated Survey Area (ICSA) which consisted of 104 municipalities in 8 Prefectures that had areas whose average air dose rates exceed $0.23\mu\text{Sv}/\text{hour}$ (conservatively estimated from the long-term target of annual additional exposure dose, $1\text{mSv}/\text{year}$, under a certain condition).¹¹

While decontamination work began in 2012, it was from 2013 and particularly during 2014-2015 that decontamination efforts intensified. The first areas to be decontaminated and where evacuation orders were lifted tended to be those with less radioactive contamination within the SDA.

Decontamination Program Completed in SDA (as of October 2017)

Location / area	Date completed	Evacuation order lifted	Notes
Tamura city	June 2013	1 April 2014	
Naraha town	March 2014	5 September 2015	
Kawauchi village	March 2014	14 June 2016	
Okuma town	March 2014	Not lifted	Does not include higher contaminated area 3
Katsurao village	December 2015	12 June 2016	
Kawamata town	December 2015	31 March 2017	
Futaba town	March 2016	Not lifted	Does not include higher contaminated area 3
Iitate village	December 2016	31 March 2017	Does not include higher contaminated area 3
Tomioka town	January 2017	1 April 2017	
Minamisoma	March 2017	12 July 2016	
Namie	March 2017	31 March 2017	Does not include higher contaminated area 3

The scale of the decontamination program and its challenges, as well as delays in progressing with securing permission for both temporary and Interim Storage Facilities, led in September 2013 to the government revising its schedule of completion from March 2014 to between 2015 and 2017 depending on local conditions.¹²



Temporary Storage Site, southern Iitate, Fukushima prefecture, 4th October 2017, Christian Aslund/Greenpeace Japan

The official 2011 population of the areas targeted for decontamination in the SDA was 61,200 citizens.¹³

Decontamination Area Versus Contaminated Total Land Mass

Small fraction of contaminated areas of Fukushima have been decontaminated. Thus, as of March 2017 in the Special Decontamination Areas (SDAs) of Fukushima, including Iitate and Namie, the land surface decontaminated is 8.5 percent of the total land area, leaving the vast majority of the Fukushima SDA contaminated with radioactive cesium.

As indicated, the Japanese government has emphasized the scale of decontamination efforts and indeed they have been enormous. Greenpeace survey work conducted within the SDA's over the last six years shows that the effectiveness of decontamination is highly variable, with many areas remaining contaminated well above Government target levels.¹⁴ However in addition, the actual percentage of land decontaminated is only a small percentage of the total area contaminated. The Japanese governments communication to the people of Japan is that decontamination means decontamination, but based on the Governments own figures, the reality of decontamination is revealed.

For example, Naraha town, formerly with a population of 7000, was in the language of the Government, 100 percent decontaminated by March 2014. Total land surface targeted for decontamination was approximately 1,400 hectares. However, Naraha's total surface area is 10,300, and thus only 14.2 percent of Naraha has been decontaminated. For Tamura city the percentage of the SDA area, which is approximately 50 percent of Tamura, decontamination was only 3 percent. Of course one factor is that radioactive contamination of these areas was less than for other areas and that contamination is also not homogenous with considerable localized variation and therefore less work was required. However, survey work conducted by Greenpeace in Tamura in October 2014 showed that decontamination was only partially effective, with in many cases radiation levels exceeding the Government long term target of 0.23 μ Sv/hour. Even in areas such as Iitate and Namie which were more significantly contaminated the percentage of land decontaminated is 17.1 and 8.9 percent respectively.

As of October 2017 a total of 15,700 hectares or 157 km² had been decontaminated across the SDA's of Fukushima, while their total surface area was 1.8 million hectares or 1,842.7km². Thus in the SDA's of Fukushima, including Iitate and Namie the total land surface decontaminated is 8.5 percent of the land area.

Location	Total Land Area (hectares/km2)	Land Area SDA Decontaminated (not including houses) - (hectares/km2)	Percentage Decontaminated	Notes
Tamura city ¹⁵	45,800/458	639/6.3	1.5-3%	
Naraha town	10,300/103	1,470/14.7	14.2 %	
Kawauchi village	1,970/19.7	368/3.6	18.2%	
Okuma town	7,800/78.7	361/3.6	4.6%	Most of Okuma remains in Area 3 and has not been decontaminated
Katsurao village	8,400/84.2	1,325/13.2	15.6%	
Kawamata town	12,760/127.6	1,181/11.8	9.2%	
Futaba town	5,140/51.4	114.6/1.1	2.2%	Most of Futaba remains in Area 3 and has not been decontaminated
litate village	23,010/230.1	3,930/39.3	17.1%	An area of litate remains in Area 3 and has not been decontaminated
Tomioka town	6,840/68.4	1,430/14.3	20.9%	
Minamisoma	39,850/398.5	3,270/32.7	8.2%	
Namie	22,300/223.1	2,000/20	8.9%	An area of Namie remains in Area 3 and has not been decontaminated



Workers unloading nuclear waste at Temporary Storage Site (TSS), central Iitate, Fukushima prefecture, 3rd October 2017, Christian Aslund/Greenpeace Japan

Temporary Storage Sites (TSS) and other Storage Areas

The storage of nuclear waste generated from decontamination is located at Temporary Storage Sites (TSS) and other locations in Fukushima prefecture. As of October 2017 there were 255 TSS in the Special Decontamination Areas (SDAs) of Fukushima, and as of June 2017, 862 TSS in the Intensive Contamination Survey Areas (ICSAs) inside Fukushima prefecture for a total of 1180 Temporary Storage Sites. In addition to these, are the much larger number of locations where smaller volumes of waste remains in storage, awaiting transport to the TSS, where as of October 2017 and within Fukushima prefecture nuclear waste was being stored at 141,294 locations.

The Ministry of Environment budgeted approximately 2.6 trillion yen (= USD \$24 billion) in fiscal year to March 2016 for decontamination of both the SDA and the ICSA. A total of 16,000,000m³ of contaminated soil and wastes is estimated to have been removed most of which is stored at Temporary Storage Sites (TSS) or over one hundred and forty one thousands other locations. In the Fukushima SDA a total of 13 million man hours of work was required. As of January 2017, the latest official figures, indicate that 1 million m³ of contaminated soil had been transported to the ISF or to incineration plants. For the ICSA inside Fukushima prefecture, a total of 17 million man hours of labour had been expended in decontamination, at total cost to date of 1.2 trillion yen. Waste generated and stored at TSS and elsewhere in Fukushima was 6.8 million m³ (400,000 m³ in ICSA outside Fukushima prefecture). Of this, 1.1 million m³ had been transported from the TSS and other sites to the ISF or to incinerators.

Thus, as of January 2017, 2.1 million m³ of nuclear waste soil had been transported to the ISF sites and to incineration plants.

The Ministry of Environment is responsible for weekly and monthly monitoring of the nuclear waste at the TSS, less clear is the monitoring routines for the waste located at the hundred and forty thousands sites.

One consequence of these vast storage areas is its impact on the return to agricultural production. The available land for storage of nuclear waste is in direct competition for agricultural land. In the less contaminated areas of Fukushima farmers have come under pressure to lease their land for temporary waste storage. In Katsurao, where evacuation orders were lifted in most areas in June 2016 the total area of rice fields in the village has dropped from 130 hectares operated by roughly 270 households in 2010 -- prior to the Fukushima meltdowns -- to around 6 hectares operated by 11 households in 2016.¹⁶ Nearly 30 percent of the village's rice fields totaling some 220 hectares now serve as temporary storage sites for radioactive soil and other waste.



Nuclear waste incineration Plant, southern Iitate, Fukushima prefecture

4th October 2017, Christian Aslund/Greenpeace Japan

Interim Storage Facilities (ISF) – Futaba and Okuma

After nearly seven years the Interim Storage Facility (ISF), at Okuma near to the Fukushima Daiichi plant, formally opened in October 2017. Together with the ISF at Futaba, it is planned that both ISFs will eventually store an estimated 16-22 million m³ of nuclear waste for a maximum of 30 years, after which it is supposed to be moved to an as yet unknown permanent disposal site. With tens of thousands of transports in 2017, there are predicted to be one million nuclear transports in 2020.

The prospects that after this amount of waste is moved to Futaba and Okuma it will be moved again to a final waste site is remote.

In October 2011, the Ministry of the Environment officially announced and explained the Basic Principles for the planned Interim Storage Facility (ISF) to the heads of relevant municipalities.¹⁷ The materials for storage is limited to soil and waste generated in Fukushima prefecture with final disposal to be carried out outside Fukushima Prefecture within about 30 years from the start of the interim storage. In December 2011 a request was issued to 8 towns in Futaba County and Fukushima Prefecture to examine location sites in Futaba county. In March 2012 it was explained to the 8 towns and Fukushima Prefecture that the ISFs may be located separately in 3 towns (Futaba, Okuma and Naraha). In August 2012 the Ministry proposed the sites for investigation to 8 towns and Fukushima Prefecture.

The proposed site in Naraha was rejected by the mayor in January 2014, following local opposition concerned that the land was ancestral and fears that they will never be able to return to their land if the storage facilities become permanent.¹⁸

In February 2014, the Governor of Fukushima requested the national government to consolidate the ISF in Okuma and Futaba.

The Abe Government announced in December 2013 that in exchange for hosting the ISFs the central government plans to provide a tax grant to the host municipality and compensation to individuals whose land will be used in the project. The Japanese government is responsible for securing, maintain and manage the ISFs, and in 2012 indicated a target date for opening of the facility as January 2015, which was not achieved.

However, by November 2015, and after a year of pilot transports, nuclear waste at the so called stock yards in Okuma was 15,073 m³ and in Futaba: 8,500 m³¹⁹; but at that time only small fraction of the land required to build the ISFs had been secured from their owners. The creation of stock yards allowed the delivery of waste to the sites prior to the formal opening of the IFSSs (in October 2017). By December 2017, the volume of waste transported to Okuma and Futaba was 155,332 and 156,483 bags, with each bag generally being one cubic meter.²⁰

About 2,400 landowners were sought in Futaba and Okuma to secure land for the ISFs but this has proceeded slowly due to number of factors, including finding the people who were all displaced following evacuation in 2011, concern that the storage will become a permanent disposal site. Plans for buying land in Fukushima were abandoned in June 2014, due to public opposition, and the plan was changed to a leasing system for the land over the projected lifetime of the sites.²¹

By 2017 the Government had still failed to secure all the necessary land for the proposed IFSS's at Futaba and Okuma. As of November 2017, the government had signed contracts covering 735²² hectares of the IFSSs, with the total privately owned land required being 1270 hectares.

During the early process to secure approval for the ISFs there were justified concerns within Fukushima prefecture that the 16 square kilometers sites in Okuma and Futaba will end up being the final disposal site given the lack of

alternative locations in Japan. Following meetings between the Fukushima prefectural Governor and mayors of Futaba and Okuma in August 2017 where the proposed ISFs were accepted, while also calling for conditions to be applied:

- a law should be passed stipulating that the waste will be moved outside the prefecture within 30 years of the opening of waste sites;
- a budget to provide 301 billion yen (\$2.89 billion) in grants to the local governments;
- detailed measures should be presented to maintain and manage the transportation routes and secure the safety of local communities along those routes;
- securing the safety of the interim storage facility and transportation of the waste;
- and, reaching a safety agreement between the central government and the governments of Fukushima Prefecture, Okuma and Futaba over the waste storage.

These conditions were accepted by the Government and in October 2014, an amendment bill for the Japan Environmental Safety Corporation (JESCO) Law in order to legislate the final disposal of contaminated soil and waste outside Fukushima prefecture was approved by the Cabinet and submitted to the Diet. The amendment of JESCO Law was enacted on 19th November 2014.²³

The nuclear wastes designated for storage at the Okuma and Futaba ISFs are:²⁴

Waste Type	Activity in Becquerels per kilogram (Bq/kg)	Estimated Volume – cubic meters (m³)
contaminated soil	<8,000	10.06 million
contaminated soil	8,000-100,000	10.35 million
contaminated soil	> 100,000	10,000
incinerated waste ash	>100,000	1.55 million
other wastes	>100,000	20,000

The scale of the decontamination program and its challenges, as well as delays in progressing with securing permission for both temporary and Interim Storage Facilities, led in September 2013 to the government revising its schedule of completion from March 2014 to between 2015 and 2017 depending on local conditions.²⁵



Nuclear waste transport, central Itate, Fukushima prefecture, 30th September 2017,
Shaun Burnie/Greenpeace Germany

Final Disposal Site – Tomioka

In contrast to the Futaba and Okuma ISFs, Tomioka in November 2017 opened a permanent landfill disposal site for contaminated waste.²⁶ Tomioka is located 11km to the south of the Fukushima Daiichi plant. The government proposed in December 2013 that Fukushima Prefecture dispose of the waste at a then-privately owned site, which the prefectural government accepted in 2015.²⁷ The site will permanently store specified waste including sewage sludge, incinerated grass and rice straw ash with radioactive cesium activity of between 8,000-100,000 Bq/kg. In total, the 9.4 hectare site is to receive 650,000 m³ of waste over the next decade for indefinite storage.²⁸ In 2016 the Ministry of the Environment nationalized the private industrial site and classified it as a designated waste final disposal site. Despite the site opening, the government has failed to secure a safety agreement in one of the two administrative districts of Naraha town where a road passes to the Tomioka disposal site due to local opposition.

Area 3 Decontamination – 2018

The government has announced its ambitions to open up small areas, so called 'hubs' in the highly contaminated Area 3 zones of Namie, Futaba and Okuma in the time period 2022-23. This reconstruction work as described is due to begin during the second quarter of 2018. In the estimated volumes of waste planned to be transported to the ISF's in Okuma and Futaba (16-22 million m³) it does not include nuclear waste generated in this planned decontamination program, which the

Environment Ministry describes as “difficult to estimate” at the moment.²⁹

Conclusion

The enormous decontamination program initiated by the Japanese government has failed to significantly reduce radiation levels in many areas across Fukushima. Justified on the grounds of permitting the lifting of evacuation orders for tens of thousands of evacuees, it has instead only decontaminated small areas of the landmass of the most heavily contaminated districts while creating a vast nuclear waste stockpile for which there is no long term solution. Transporting the nuclear waste to the ISFs and incineration plants over the coming years will require several million transports. The prospects are that if all the waste is eventually relocated to Okuma and Futaba it will not be removed within the agreed 30 year timeframe, they will thus likely become permanent nuclear dumps.

The nuclear waste crisis underway in Fukushima is but one of the multiple tragedies inflicted on the people of Fukushima as a result of the March 2011 triple reactor meltdown. Japanese government policy is to continue along this path, expanding its failed decontamination into the highest contaminated areas in Namie, Iitate, Futaba and Okuma in the next few years, while continuing to pressurize evacuees to return to their former homes. It is clear that on multiple levels the Japanese government is violating the human rights of thousands of Fukushima evacuees. Greenpeace is committed to continuing to support efforts of the United Nations Human Rights Council to challenge these violations and to reverse its current policy of coercive policy of evacuee return.

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