Reflections in Fukushima:

The Fukushima Daiichi Accident Seven Years On

Radiation investigations in the exclusion zone of Namie and open areas of Namie and Iitate

March 2018

GREENPEACE

Contents

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A very special thanks to all house owners in Namie and Iitate, and in particular Fukushima evacuees, Ms. Kanno and Mr. Anzai who were so very generous with their time and much appreciated and necessary guidance during our survey work.

Cover photo : Ms. Mizue Kanno walking through the streets of Tsushima, in the exclusion zone of Namie, Fukushima prefecture, September 2017.
This page : Heinz Smital, Greenpeace Germany radiation specialist in Namie exclusion zone, Fukushima prefecture, September 2017.

1. Executive summary

Seven years after the start of the Fukushima Daiichi nuclear disaster and one year after the Japanese government lifted evacuation orders in areas of Namie and Iitate, radiation levels remain too high for the safe return of thousands of Japanese citizen evacuees. That is the conclusion of Greenpeace's latest extensive radiation survey in Namie and Iitate, Fukushima prefecture. As a result of being invited by local citizens, Greenpeace was able to continue its survey work in Iitate, while also extending it to select homes in the highly contaminated exclusion (difficult to return) zone of Namie.

Radiation risks, long term dose estimates and revision of targets

In the areas of Iitate and Namie where evacuation orders were lifted in March 2017, contamination will remain well above international maximum safety recommendations for public radiation exposure of 1 milisievert per year (1mSv) for many decades. Greenpeace includes projections on dose rates to mid-21st century, which show that they will still be well in excess of the current government long term target levels of 0.23 micro-Sieverts per hour (μSv/h). It is this target level that the government uses for its calculation to reach an estimated annual exposure level of 1mSv/y. The government calculation is based on citizens spending an average of 8 hours per day outside and taking account of shielding from radiation while inside a wooden house. Unless otherwise stated in the text, the Greenpeace calculation of annual human dose rates are based on radiation measurements taken at 1 meter, and what an adult's exposure would be over one full year (total of 8,760 hours) at that specific location.

In the case of radiation levels in the highly contaminated exclusion zone of Namie the situation is even more severe. It will be at least many decades more, and beyond the end of this century, before they start to even approach government targets.

The Japanese government is well-aware of scientific evidence of cancer and other health risks from low-dose radiation exposure, including in the range of 1-5 mSv/y. It has even part funded such research.[1] Yet the government has opened areas of Namie and Iitate where citizens will be exposed to rates equal to this and higher, choosing instead to ignore the science to justify its Fukushima policies.

In a clear admission of the failure of its decontamination program, the Japanese government has recently begun a process to revise the current long term decontamination target of 0.23 μSv/h. In January 2018, during discussions on dose estimates for returning evacuees, the chair of the Nuclear Regulation Authority (NRA) stated that the current target "could hinder evacuees' return home."[2] It has been insinuated that the new target would be in the 1.0 μSv/h range. The review of the target is to be conducted under the auspices of the Radiation Council of NRA.

Given the extent of contamination and the failure and limited nature of the decontamination program, radiation levels in Namie and Iitate are many decades and longer from reaching the current target.

Namie exclusion zone

The results of Greenpeace's extensive survey around houses, farmland and forest in the Namie exclusion zone reveal radiation levels that far exceed the government's long term decontamination target of 0.23 μSv/h. Average dose rates around homes between 25 km and 30 km northwest of the Fukushima Daiichi nuclear plant ranged from 1.3 – 3.4 μSv/h, with even higher levels in nearby forests and farmland. The home of Ms. Kanno in Namie, despite being subjected to an extensive decontamination program, had radiation levels with a weighted average of 1.3 μSv/h and with a maximum level of 5.8 μSv/h. In 60% of the nearby forested area current radiation levels would lead to an exposure dose of 17 mSv/y.

Radiation levels in the community of Obori in Namie, which is 20km west-north-west of the Fukushima Daiichi plant, were particularly concerning. This included measurements of 11.6 μSv/h, which would lead to an annual exposure of 101 mSv.

Greenpeace also surveyed along Route 114, which runs east-west between the Murohara and Tsushima districts of Namie and which the

government opened to through public traffic in September 2017. While our survey results were consistent with official data, less than 50 meters from the public highway we measured hot spots of 11 µSv/h (at one meter above ground level) and 137 µSv/h (at 0.1 meter). To put these figures into context, at this one location radiation readings were 287 times higher at 1 meter than background levels of 0.04 µSv/h in the prefecture before the March 2011 Fukushima Daiichi nuclear accident. At 0.1 meter they were over 3,400 times higher.

Official plans, approved by the Abe government in December 2017, are to begin decontamination in the exclusion zone of Namie, with the aim of lifting evacuation orders in 2023 for small islands or hubs.[3] From May 2018, potentially thousands of decontamination workers working in the highly contaminated exclusion zone of Namie will be subjected to unjustifiable radiation risks for a program that only decontaminates a small fraction of the overall area, and where 70-80% of the area is contaminated mountainous forest that cannot be decontaminated;[4] and where the actual effectiveness of decontamination is questionable. These plans for Namie, as well as the other areas in the exclusion zones, from a radio-protection perspective cannot be justified and there are no prospects over the coming decades that it will be safe for people to return.

Lifted evacuation areas - Namie and Iitate

In 2018, there clearly remains a radiological emergency within the areas of Namie and Iitate which were opened by the government in March 2017. To clarify the use of the word emergency: if these radiation levels were measured in a nuclear facility, immediate action would be required by the authorities to mitigate serious adverse consequences for human health and safety, property and the environment.[5] The Japanese government through its policies is doing exactly the opposite.

Greenpeace has been surveying Iitate since late March 2011, when it was the first to call for its evacuation. The results of our survey work in 2017 illustrate a highly complex radiological situation, and one very far from normal. This is illustrated by the survey of Mr. Anzai's home in Iitate where there has been no significant decline in radiation levels since 2016, and even an increase, which raises the issue of possible re-contamination through migration of radionuclides from the nearby highly contaminated forested mountain slopes. The inevitability of recontamination from the heavily contaminated forested mountains which represent 70% of Iitate, as well as an equal amount of Namie, is further evidence that the government's limited decontamination program for thousands of homes

Radiation survey results overview

Air dose at 1m height

	Place name (Weighted average of all zones)	Max (µSv/h)	Average (µSv/h)	Number of points	Above 0.23 µSv/h	Above 1 µSv/h
		2017				
Namie (Area 3 - Exclusion zone)	Kanno's House	5.8	1.3	5,105	100%	67%
	House Y	3.7	1.6	4,368	100%	95%
	House Z	8.2	3.3	3,051	100%	100%
	Obori	11.6	4.3	2,640	100%	100%
	Tsushima	2.6	1.2	2,834	100%	100%
Namie (Former Area 2 - Open area)	Route 114	6.5	1.3	3,134	90%	46%
	City centre and surroundings	2.1	0.3	6,844	59%	2%
Iitate (Former Area 2 - Open area)	Anzai's House	2	0.8	4,903	100%	22%
	House A	0.6	0.2	2,151	73%	0%
	House B	2.2	0.8	4,010	100%	36%
	House C	1.5	0.4	3,204	83%	8%
	House E	1.9	0.7	4,000	100%	16%
	House F	1.8	0.7	2,494	99%	38%

- "Long-term target" = 1 mSv/y (0.23 µSv/h)
  (Japanese Government policy and international limit for public exposure in a non-accidental situation)
- Before the accident : background = 0.04 µSv/h

has been, and will continue to be, ineffective in reducing the risks to citizens of Namie and Iitate, if they were to return to their homes.

Risking such exposures for the citizens of Namie and Iitate, including vulnerable populations of women and children, is unjustifiable. Potential exposures for children are of particular concern, as they are both more vulnerable to the impacts of ionizing radiation exposure and are at much greater risk of coming into contact with ground level radiation through play.[6] Further, should residents return, the complex radiation situation in Namie and Iitate would require very different day to day behavior to minimize exposure, compared with pre-March 2011.

Failed return policy and human rights

While the Japanese government continues to ignore the radiological reality in Namie and Iitate, their citizens clearly do not. As of December 2017, out of the 27,000 people that lived in these districts in March 2011, only 3.5% had returned.[7] Clearly, the government's policy of seeking to effectively force Fukushima citizens to return to these areas is not working. This low return rate is despite the decision to terminate housing support for self evacuees in March 2017 (as well as their removal from official records, 'disappearing' as many as 29,000)[8] and plans to terminate housing support for thousands of Iitate and Namie citizens in 2019.

Due to the efforts of civil society and United Nations (UN) member states, the Japanese government's decision to disregard public safety and violate the human rights of tens of thousands of its citizens is now more urgently on the agenda of the UN Human Rights Council in Geneva.[9] The recommendations made by member states, including Germany, at the Universal Periodic Review of Japan (third cycle) in November 2017,[10] if applied in Iitate and Namie and other areas that are the most contaminated, would immediately halt the current program of the Japanese government. Greenpeace and the International Association of Democratic Lawyers, in a recent submissions to the UNHRC, have called on the government to fully adopt the recommendations.[11] The Japanese government will announce on 16 March 2018 its decision on whether to accept or reject these recommendations.

The results of our investigations add further to the urgency for the Abe government to halt its current program of lifting evacuation orders, to comply with its domestic and international human rights obligations and to initiate a comprehensive and publicly accountable review of current policy.

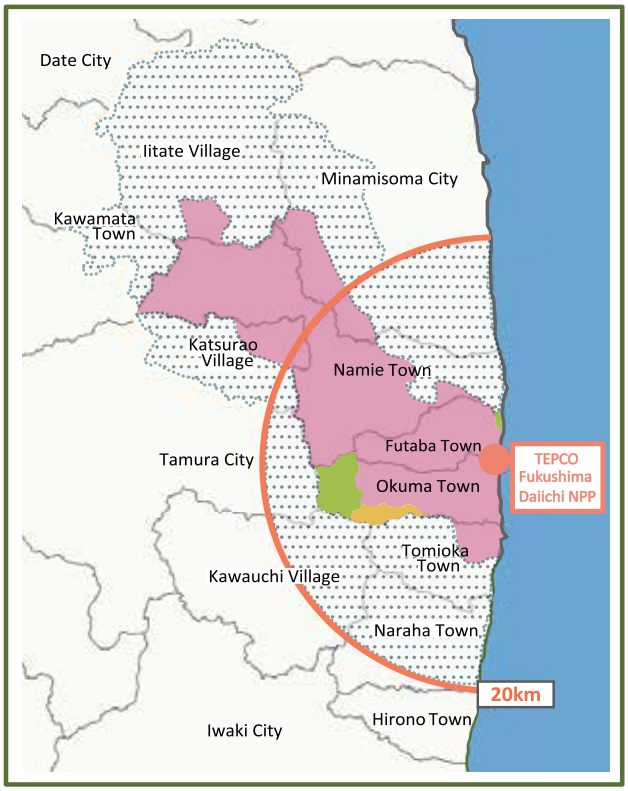
Recommendations to the Japanese government

- Adopt and immediately apply the recommendations of member states on Fukushima submitted at the United Nations Human Rights Council, including reducing the acceptable additional annual exposure level in Fukushima-impacted areas to a maximum of 1 mSv/year;
- Suspend its current return policy which ignores Fukushima citizens and which ignores science based analysis and ensure survivors are fully compensated for their losses – including continuation of compensation payments and housing support for those who choose to remain evacuated, and compensation for those returning for their loss of community, in order that individuals may freely exercise their right to choose where to live;
- Immediately clarify its long term decontamination target of 0.23 μSv/h, equal to its 1mSv/y exposure estimate, including setting a target date, and halt any plans to raise the permitted target level;
- Abandon plans to lift evacuation orders in the Namie districts of Tsushima, Murohara, Suenomori and Obori, and in the interests of worker protection, halt plans for the start of decontamination efforts in these areas in 2018;
- Establish a fully transparent process to reflect and consider residents' opinions on evacuation policy, including opening a council of citizens including all evacuees;
- Provide full financial support to evacuees, and take measures to reduce radiation exposure based on science and the precautionary principle to protect public health and allow citizens to decide whether to return or relocate free from duress and financial coercion.

2. Introduction

Seven years after the start of the Fukushima Daiichi nuclear accident, Greenpeace has completed its latest investigation of radiation levels in areas of Fukushima prefecture. Conducted in September and October 2017, the survey focused on the districts of Namie and Iitate, the combined population of which was 27,943 at the start of the nuclear accident. In March 2017, the government lifted evacuation orders for an area of Namie and Iitate. In addition, we have surveyed radiation levels in the remaining exclusion zone in Namie, which remains closed to habitation. This area makes up 80% of the land area of Namie.

Understanding the radiological situation in these areas is important as the Japanese government continues to move forward with its plans to open up small islands in these highly contaminated areas by 2023.[12] The survey work focused on houses and the surrounding farmland and forests as well as roads. Greenpeace also surveyed Route 114, a major artery which runs east-west through the highly contaminated area of Namie, which was opened to through public traffic in September 2017. House surveys were conducted in the exclusion zone of Namie and the area of Iitate where evacuation orders were lifted in March 2017. Greenpeace was only able to conduct the house surveys in both Iitate and in the highly contaminated exclusion area of Namie as a result of invitations from citizen evacuees.



Map1: Evacuation area status as of 1 March 2018

3. Radiation survey methodology

Radiation specialists Laurence Bergot of Greenpeace France and Mai Suzuki of Greenpeace Japan, survey at elementary school, Namie, Fukushima prefecture, in area where evacuation order is lifted, September 2017.

The Greenpeace team used two different methods for survey work at each house in Namie and Iitate. Radio-cesiums (Cs-137 and Cs-134) contribute to almost all (98%) of the long-term cumulative exposure. During the Fukushima nuclear disaster, equal amounts of Cs-137 and of Cs-134 were released.

1. "Scanning": Systematic measurements:

- Ambient dose rate at 1m with a high-efficient and calibrated NaI scintillator (Georadis RT30: 2000 cps / µSv.h-1 (Cs-137) with 1 measurement each second.
- High-precision GPS (GNSS Trimble R1) with external antenna and <1m precision, with 1 set of gps-coordinates / second.
- Walking in systematic way, without searching for hot spots, where possible in a grid pattern.
- The area around the house is divided into Zones (typically: a field, path, and forests around the house) and each measured separately. We defined around 10 Zones around each house, with a minimum of 100 measurement points per Zone, and a median range of 200 - 300 points per Zone. The overall total of measurement points for each house and land area ranged typically between 3,000 - >5,000 points.
- Statistics are collected for each of these Zones (average, minimum and maximum for each Zone). The average of all the Zones of one house and land area is calculated as a weighted average, with the same weight for each Zone. This also allows a comparison between different years (as the number of measurement points for each year is not identical).

2. "Hot spots":

In addition, radiation hot spots which are areas with concentrated radioactivity and other points of interest around the houses were identified and measured as follows:

- Ambient dose rate at 10 / 50 / 100 cm using a NaI scintillator (Radeye PRD- ER) and GPS position from handheld Garmin Montana 650 were used;
- These points were collected for each of the defined Zones.

3. "Car Scanning":

To cover a wider area, we also measured radiation levels from a vehicle, driving at low and constant speed (typically 20km/h, but when traffic safety did not allow such low speed, max 40km/h). The Georadis RT30 and GNSS Trimble R1 were mounted outside the car at one meter, with one radiation measurement every second synchronised with GPS data for every second.

4. Namie exclusion zone survey results

Tsushima, inside the highly contaminated exclusion zone, Namie, Fukushima prefecture, September 2017.
© Åslund / Greenpeace

In 2018, due to high levels of radiation, 80% of Namie town (officially classified as “difficult to return to” exclusion zone), which lies to the west and northwest of the Fukushima Daiichi plant, remains closed to habitation seven years after the Fukushima Daiichi nuclear accident. It is mostly mountainous forest with small farm based communities. Due to the restricted access to the area there have only been small scale independent investigations into the radiation levels in recent years. Greenpeace returned to the Namie exclusion zone for the first time since March 2011 to conduct a large scale survey after invitations from homeowners. The area around Tsushima and Obori, as well as along the main roads in the zone, were surveyed between 20 and 29 September 2017. Below we provide a summary of the results of tens of thousands of measurements. We include the name of Ms. Kanno, however, other homeowners’ names are not included due to their wish to remain anonymous.

Ms. Kanno’s house

The ancestral home of Ms. Kanno is located in Shimo-Tsushima in the district of Namie, 30 km west-northwest of the Fukushima Daiichi nuclear plant. It was subjected to significant radiation exposure as a result of the March 2011 nuclear accident. The government selected the house for demonstrating its decontamination techniques and it was subjected to considerable effort during December 2011 and February 2012. Greenpeace conducted its radiation survey in the immediate area around the house, as well as on the family’s farmland and forest. The results demonstrate the complex nature of radionuclide contamination in the most highly contaminated areas of Fukushima prefecture.

Intervals	Number of points	% of points	mSv/y (Japan govt.)(*)	mSv/y if 8,760h/y (*)
>= 5 µSv/h	2	0%	>= 26 mSv/y	>= 43 mSv/y
< 5 and >= 3.8 µSv/h	3	0%	>= 20 mSv/y	>= 33 mSv/y
< 3.8 and >= 2 µSv/h	1,092	21%	>= 10 mSv/y	>= 17 mSv/y
< 2 and >= 1.5 µSv/h	1,194	23%	>= 8 mSv/y	>= 13 mSv/y
< 1.5 and >= 1 µSv/h	1,133	22%	>= 5 mSv/y	>= 8 mSv/y
< 1 and >= 0.5 µSv/h	1,618	32%	>= 3 mSv/y	>= 4 mSv/y
< 0.5 and >= 0.23 µSv/h	63	1%	>= 1 mSv/y	>= 2 mSv/y
< 0.23 µSv/h	0	0%	< 1 mSv/y	< 2 mSv/y
Total number of points	**5,105**	**100%**		

Table1: Radiation in all Zones at Ms. Kanno’s house (walking on- and off-road)
(*) Average dose rate of 0.04 µSv/h before March 2011 subtracted

Overall, for all 9 Zones measured at Ms. Kanno’s home the weighted average from September 2017 is 1.3 micro-Sieverts per hour (µSv/h) with a maximum level of 5.8 µSv/h (See Table 1). Annual dose rates for 21% of the area could lead to a dose of 10 milli-sieverts per year (mSv/y) based on Japanese government methodology and 17 mSv/y based on permanent exposure over one full year.[13] The International Commission on Radiological Protection (ICRP) recommendations for the public sets the maximum recommended dose at 1 mSv a year.[14]

Zone name	2017				
	Max (µSv/h)	Average (µSv/h)	Number of points	Above 0.23 µSv/h	Above 1 µSv/h
Zone 1 Around house	1.3	0.7	238	100%	9%
Zone 2 Around warehouse and path	2.1	1.1	550	100%	58%
Zone 3 Garden and farmland	1.8	0.8	383	100%	13%
Zone 4 Farmland	1.2	0.9	447	100%	24%
Zone 5 Forest behind house	2.8	1.9	902	100%	95%
Zone 6 Rice field, North	2.4	1.9	761	100%	100%
Zone 7 Rice field, South	1.9	1.5	403	100%	95%
Zone 8 Road	1.6	0.7	470	100%	14%
Zone 9 Path to rice field North	5.8	1.7	951	100%	91%
ALL Weighted average of all zones	**5.8**	**1.3**	**5,105**	**100%**	**67%**

Table2: Radiation measurement data from Kanno's house, Namie

In Zone 1, which is the immediate vicinity of the house – within 5 - 10 meters – and where the government had conducted decontamination, radiation levels were on average 0.7 µSv/h, while Zone 9, the path along the main road and entrance to the house had an average of 1.7 µSv/h and a maximum level of 5.8 µSv/h. The whole path has an average of 1.7 µSv/h, even though contaminated topsoil around the house had been removed to a significant depth, according to Ms. Kanno. 100% of the measuring points exceeded the government's current long term radiation target level of 0.23 µSv/h.

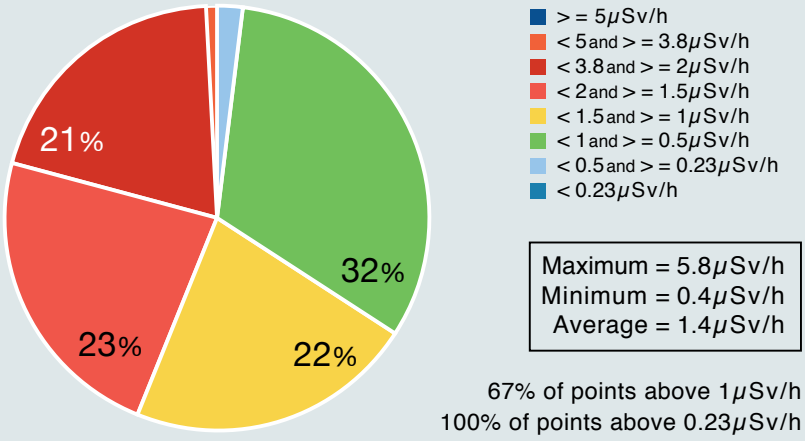


Chart1: Proportion of dose rate in all Zones from Ms. Kanno's house (5,105 points, at 1 meter height, surveyed on 20 September, 2017)

The house itself is surrounded on three sides by forest which has grown extensively since 2011. The survey results in Zone 5, accessible forest area around the house, reveal the limited impact of decontamination. The average measured 1.9 µSv/h with peak levels of 2.8 µSv/h. 60% of the forested area would lead to an exposure of 17 mSv over one year.

In Zone 6, a field belonging to Ms. Kanno's family, and which was used for growing rice, average radiation levels were 1.9 µSv/h with a maximum level of 2.4 µSv/h.

Additional data from the house survey is contained in Appendix.

House Y

Illustrating the variation in radiation levels within Area 3 of Namie are the results of the Greenpeace survey work at House Y and farm around 27 km northwest of the Fukushima Daiichi plant. The weighted average for all Zones was 1.6 μSv/h with a maximum level of 3.7 μSv/h. In contrast to the Kanno residence, the area around the home has not been decontaminated. In Zone 3, the area immediately around the house the average radiation readings were 1.8 μSv/h, with a maximum level of 3.7 μSv/h. Radiation levels in 70% of the area around the house would lead to a dose of 13 mSv/y. On farmland in Zone 4 the average levels were 1.5 μSv/h with a maximum level of 2.1 μSv/h.

Zone name	2017				
	Max (μSv/h)	Average (μSv/h)	Number of points	Above 0.23 μSv/h	Above 1 μSv/h
Zone 1 Path up to house	2.8	1.5	808	100%	97%
Zone 2 Front of house	2	1.2	395	100%	75%
Zone 3 Around house	3.7	1.8	446	100%	93%
Zone 4 Farmland	2.1	1.5	761	100%	95%
Zone 5 Field, Warehouse South	2	1.6	407	100%	100%
Zone 6 Forest	3.3	2	1,551	100%	99%
ALL Weighted average of all zones	**3.7**	**1.6**	**4,368**	**100%**	**95%**

Table3: Radiation measurement data from House Y, Namie

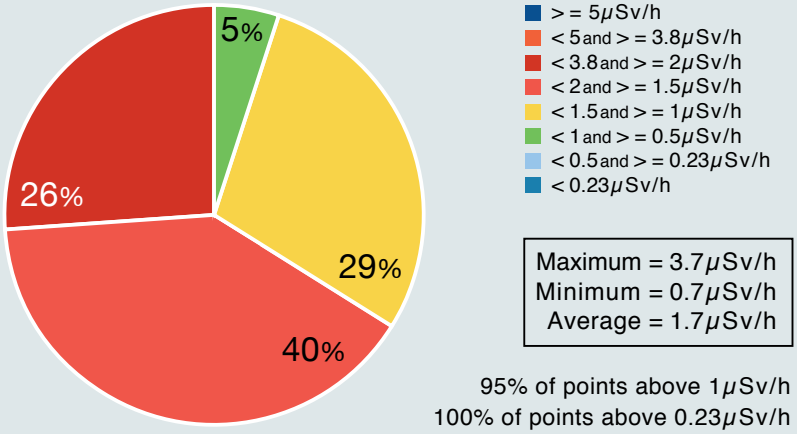


Chart2: Proportion of dose rate in all Zones from House Y
(4,368 points, at 1 meter height, surveyed on 23 September, 2017)

House Z

25 km northwest of the Fukushima Daiichi plant, the survey of House Z revealed very high levels of contamination. The average levels in Zone 2, in front of the house were 3.8 μSv/h with a maximum level of 7.6 μSv/h. Annual dose rates in 35% of this area would be in excess of 33 mSv/y, with 9% in excess of 43 mSv/y. In Zone 5, around a warehouse, the average readings were 3.4 μSv/h with a maximum level of 8.2 μSv/h. In Zone 6, along Route 114, an average of 2.7 μSv/h and a maximum level of 7.3 μSv/h were measured. It should be noted that this is a higher maximum reading than the road scanning conducted both by the Government and by Greenpeace due to the fact that this is based on a walking scan. In Zone 7, which was the family orchard, an average of 3.4 μSv/h and a maximum level of 5.2 μSv/h were measured. The weighted average for the area at this property was 3.3 μSv/h.

Zone name	2017				
	Max (μSv/h)	Average (μSv/h)	Number of points	Above 0.23 μSv/h	Above 1 μSv/h
Zone 1 Path	4.3	3.2	180	100%	100%
Zone 2 In front of house	7.6	3.8	407	100%	100%
Zone 3 Around house	5.1	3.3	261	100%	100%
Zone 4 Greenhouse-garden	4.9	3.3	794	100%	100%
Zone 5 Front warehouse	8.2	3.4	195	100%	100%
Zone 6 Main road	7.3	2.7	875	100%	100%
Zone 7 Orchard	5.2	3.4	339	100%	100%
ALL Weighted average of all zones	**8.2**	**3.3**	**3,051**	**100%**	**100%**

Table4: Radiation measurement data from House Z, Namie

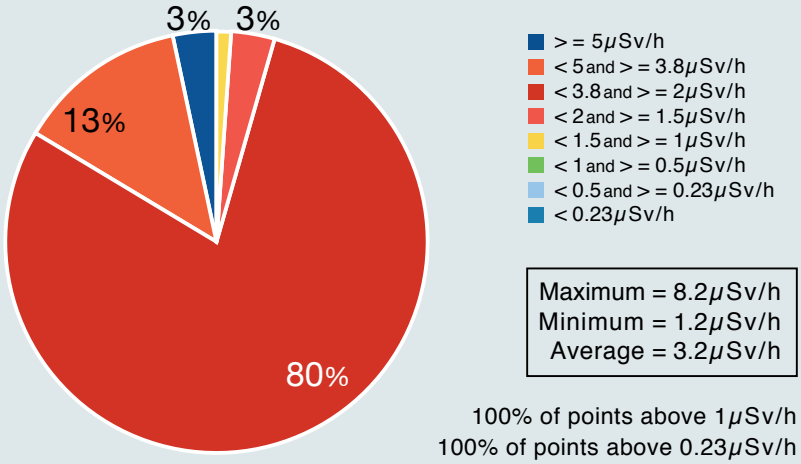


Chart3: Proportion of dose rate in all Zones from House Z
(3,051 points, at 1 meter height, surveyed on 22 September, 2017)

Tsushima

In the small community of Tsushima, 30km from the Fukushima Daiichi plant, Greenpeace surveyed the road through Tsushima with weighted average radiation readings of 1.2 μSv/h and a maximum level of 2.6 μSv/h. Tsushima, along with other areas in Namie, specifically Murohara, Suenomori and Obori, have been targeted by the government as 'reconstruction hubs' with the aim of lifting the evacuation order for an area of 660 hectares in total by 2023.[15]

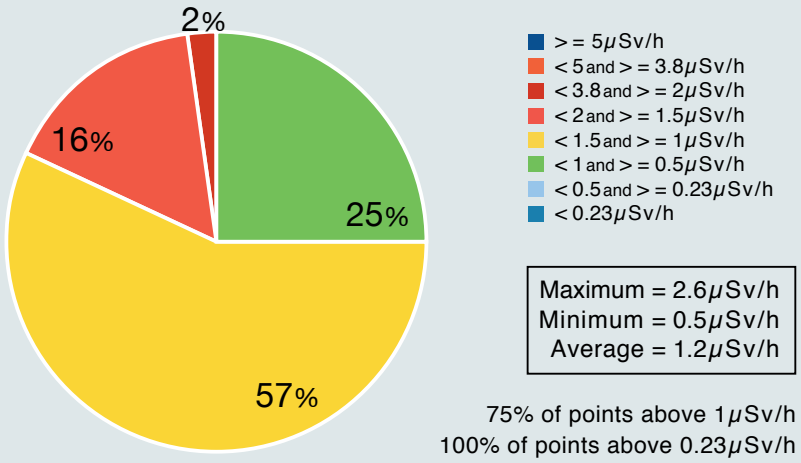


Chart4: Proportion of dose rate in Tsushima (by walking)
(2,834 points, at 1 meter height, surveyed on 25 September, 2017)

Obori

The community of Obori, around 20 km west-northwest of the Fukushima Daiichi nuclear plant, is targeted as a reconstruction hub by the Japanese government with a target date for lifting evacuation orders in a small area in March 2023.[16] Yet, in all of the survey work conducted by Greenpeace in September 2017, it was this area that showed the most extensive and consistently high radiation levels. In the community of Obori, weighted average radiation levels were 4.3 μSv/h with a maximum level of 11.6 μSv/h, at this highest level annual exposure would be 101mSv. In 34% of the area measured in Obori the average annual radiation dose was 43 mSv.

Intervals	Number of points	% of points	mSv/y (Japan govt.)(*)	mSv/y if 8,760h/y (*)
>= 5 μSv/h	897	34%	>= 26 mSv/y	>= 43 mSv/y
< 5 and >= 3.8 μSv/h	550	21%	>= 20 mSv/y	>= 33 mSv/y
< 3.8 and >= 2 μSv/h	1,049	40%	>= 10 mSv/y	>= 17 mSv/y
< 2 and >= 1.5 μSv/h	141	5%	>= 8 mSv/y	>= 13 mSv/y
< 1.5 and >= 1 μSv/h	3	0%	>= 5 mSv/y	>= 8 mSv/y
< 1 and >= 0.5 μSv/h	0	0%	>= 3 mSv/y	>= 4 mSv/y
< 0.5 and >= 0.23 μSv/h	0	0%	>= 1 mSv/y	>= 2 mSv/y
< 0.23 μSv/h	0	0%	< 1 mSv/y	< 2 mSv/y
Total number of points	**2,640**	100%		

Table5: Radiation measurement data in Obori (walking on- and off-road)
(*) Average dose rate of 0.04 μSv/h before March 2011 subtracted

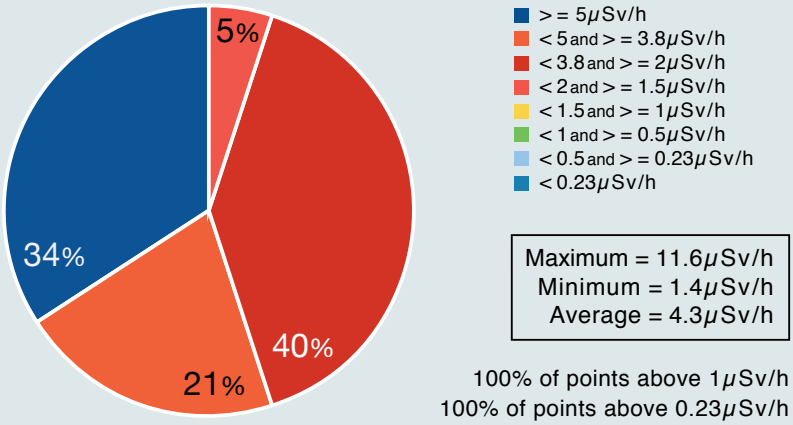


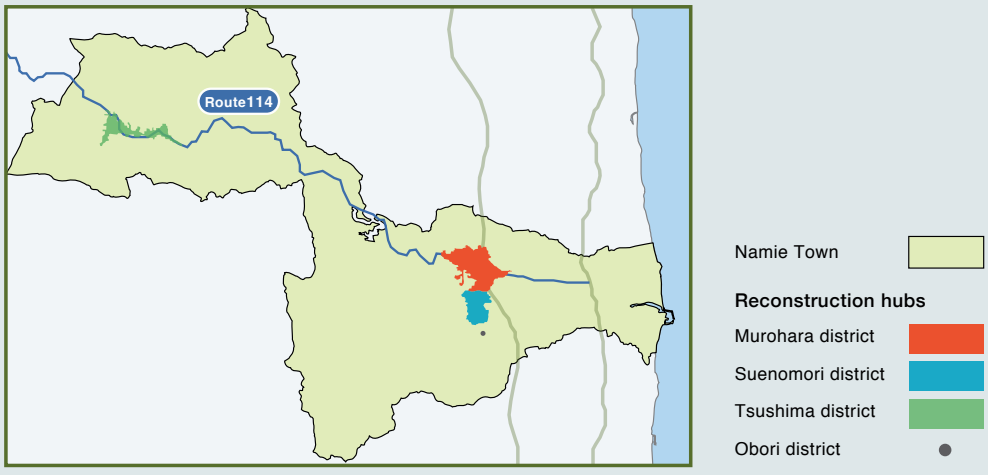
Chart5: Proportions of dose rate from Obori
(2,640 points, at 1 meter height, surveyed on 26 September, 2017)

Route 114

A 27 km stretch of Route 114, which runs east-west between Murohara and Tsushima districts in Namie, both designated as "difficult to return to" exclusion zones, was reopened to general traffic on 20 September 2017.[17] It was the first time since 2011 that restrictions had been lifted in this highly contaminated area. Between June and November 2014 decontamination operations were conducted along the route, and thereafter local residents with permits were allowed to use the road between 6am and 8pm.[18] The route is also being used to move nuclear waste to interim storage sites at Futaba and Okuma.[19]

The government's decision to reopen Route 114 came after requests from the Namie town council.[20] The justification for reopening the route to general public access is that by so doing, the movement of people and goods between Futaba district, which includes Namie and the northern part of the prefecture, including Fukushima city, will help accelerate reconstruction of the area.

The government's radiation survey, conducted in August 2017 measured an average accumulated dosage of exposure for a motorist traveling in a car at 40 kilometers per hour between Tsushima and Murohara at 1.01 μSv, "a level posing no health problems" according to the government. In the survey, mid-air radiation along the road was also measured. The maximum reading was 5.53 μSv/h.[21]



Map2: Map of Namie and location of construction hubs - Tsushima, Murohara, Suenomori, and Obori districts - and Route 114 (This map is created based on the material of the Construction Agency)

Intervals	Number of points	% of points	mSv/y (Japan govt.)(*)	mSv/y if 8,760h/y (*)
>= 5 µSv/h	15	0%	>= 26 mSv/y	>= 43 mSv/y
< 5 and >= 3.8 µSv/h	50	2%	>= 20 mSv/y	>= 33 mSv/y
< 3.8 and >= 2 µSv/h	405	13%	>= 10 mSv/y	>= 17 mSv/y
< 2 and >= 1.5 µSv/h	385	12%	>= 8 mSv/y	>= 13 mSv/y
< 1.5 and >= 1 µSv/h	605	19%	>= 5 mSv/y	>= 8 mSv/y
< 1 and >= 0.5 µSv/h	938	30%	>= 3 mSv/y	>= 4 mSv/y
< 0.5 and >= 0.23 µSv/h	439	14%	>= 1 mSv/y	>= 2 mSv/y
< 0.23 µSv/h	306	10%	< 1 mSv/y	< 2 mSv/y
Total number of points	**3,143**	100%		

Table6: Greenpeace Route 114 road scanning (from outside vehicle at 1m height) survey results
(*) Average dose rate of 0.04 µSv/h before March 2011 subtracted

Greenpeace conducted road scanning along Route 114 to Tsushima in September 2017. The results are generally consistent with the measurements conducted by the government. However, the weighted average levels are higher at 1.3 µSv/h, with a maximum level of 6.5 µSv/h.

The reopening of Route 114 in September 2017 by the government is in part intended to change individual and broader societal perception of the risks of radiation in Fukushima. As such, it is consistent with their overall strategy to attempt to normalize the public view of the most contaminated areas of Fukushima. It also directly affects public behavior.

Greenpeace witnessed two citizens working at a building at a house along Route 114. Through no fault of their own they were unaware that there were significant radiation levels. They had no personal dosimeters or protective clothing. Radiation levels at the location included, in front of the house, a weighted average of 3.8 µSv/h with a maximum level of 7.6 µSv/h.

Hot spots at the front of the building, less than 10 meters from where a Fukushima citizen was working, were 11 µSv/h at 1 meter height and 137 µSv/h at 0.1 meter. At ground level itself the readings were in excess of 200 µSv/h. In the first instance the principal risks are for citizens who would return to such areas to live over an extended period, rather than those visiting for a few hours. However, there is no safe threshold for radiation for which there is not a potential risk to health. In a Zone only meters from Route 114 the radiation levels are such that if they were to be observed in a nuclear facility or laboratory, they would require strict control and emergency management, and public access would be prohibited.

Conclusion

80% of Namie remains designated by the Japanese government as a ”difficult to return to” exclusion zone. The Greenpeace survey results demonstrate that for good reason this area remains prohibited from habitation. However, it is clear that the government is determined to continue with its failed policy of decontamination and the lifting of evacuation restrictions. Indeed, in the autumn of 2017, plans were announced for opening small areas or hubs in the “difficult to return to” exclusion zones in Namie – specifically Tsushima, Murohara, Suenomori, and Obori districts.[22] In December 2017, they were approved by both the Reconstruction Ministry and the Abe government.[23] The plans cover 661 hectares, equivalent to 3% of the “difficult to return to” exclusion area of Namie. Work will commence in May 2018 with the goal of lifting the evacuation order for the these areas in March 2023.

The Greenpeace survey results show that given the current radiation dose rates, with slow decay times and an ineffective decontamination program, there is no possibility that these areas will be safe for habitation within the coming decades and longer.

Aerial view of Obori, in Futaba district, inside the highly contaminated exclusion zone in Namie, Fukushima prefecture, September 2017.

5. Lifted evacuation areas - Namie and Iitate

Aerial view of large nuclear waste storage area with Namie town in background, 10 km north of the Fukushima Daiichi nuclear plant, September 2017.
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On 31 March 2017 the Japanese government lifted the evacuation orders for Area 2 in Iitate and Namie Town. The population of these districts north and north-west of the Fukushima Daiichi nuclear plant was 6,509 and 21,434 in March 2011.[24] Greenpeace had conducted radiation surveys in Namie and Iitate in 2011. In September 2017, Greenpeace extended its survey to the central area of Namie town where the majority of the population formerly lived. As with the results of our surveys in Iitate conducted in 2015 and 2016, we found that radiation levels in the area of Namie where the evacuation order has been lifted are significantly higher than the government's current long term target level of 0.23 μSv/h.

Namie Town


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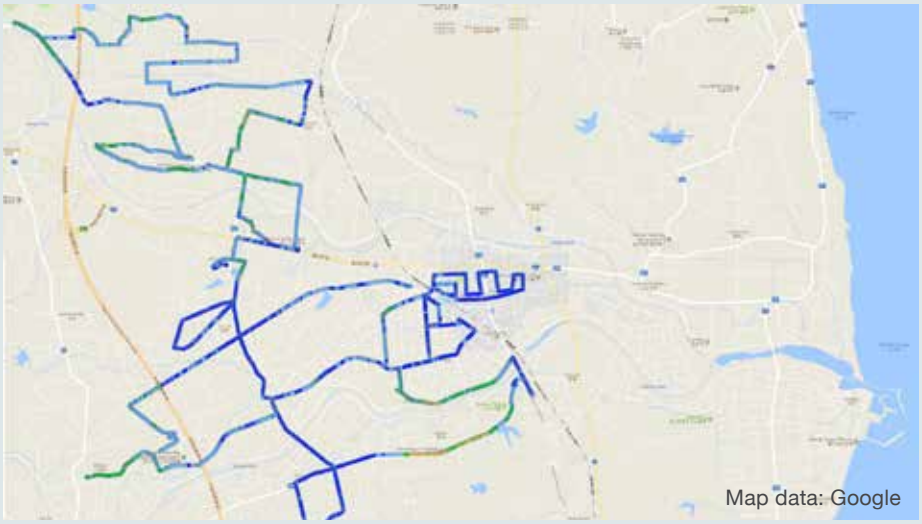
Namie Town is 10 km north-northwest of the Fukushima Daiichi nuclear plant, and has clearly had extensive decontamination conducted from 2014 and completed in March 2017. However, this has failed to reduce radiation levels to the government's current long term target of 0.23 μSv/h. The Greenpeace road scanning in Namie in the formerly restricted Area (See Map 3) showed weighted average radiation levels at 0.3 μSv/h, with a maximum of 2.1 μSv/h, and with 59% of all measurement points higher than the government target of 0.23 μSv/h. In 19% of the area surveyed in Namie town, radiation levels would give an annual radiation dose of 4 mSv. Moving to the north and south of the major built up areas of Namie town, radiation levels were considerably higher than in the central district.

Along the Takase river average levels were 1.4 μSv/h with a maximum of 2.7 μSv/h. In 42% of the area surveyed radiation levels would give an annual radiation dose of 13 mSv, and in 97% of the area the annual exposure would be 4 mSv.



Map3: Road scanning route in Namie in the formerly restricted Area (from outside vehicle at 1m height)

Zone name		2017				
		Max (μSv/h)	Average (μSv/h)	Number of points	Above 0.23 μSv/h	Above 1 μSv/h
Zone 1	North west	2.1	0.4	2,088	89%	2%
Zone 2	South west	1.8	0.4	3,336	56%	3%
Zone 3	South west	1.9	0.2	721	38%	1%
Zone 4	Centre of Namie	0.5	0.1	699	5%	0%
ALL	**Weighted average of all zones**	**2.1**	**0.3**	**6,844**	**59%**	**2%**

Table 7: Greenpeace road scanning (from outside vehicle at 1m height) survey results for Namie Area 2 (Zone 1 and 2 – surveyed on 25 September, Zone 3 and 4 – surveyed on 29 September)

In a small forested area opposite the child care facility and school in Namie, the average radiation level was 2 μSv/h with a maximum of 3.1 μSv/h (see Map 4). In 89% of the area the annual dose would be 13 mSv or more. Hotspots in the forest reached up to 5 μSv/h.

Map 4: Radiation scanning (by walking) route opposite childcare facility and school in Namie

Conclusion

The conclusion of our survey work in the newly opened area of Namie is that despite major decontamination efforts, the radiation levels were consistently higher than the government long term target of 0.23 μSv/h; with examples of elevated levels along roads and next to forests that clearly are not safe from a radiation exposure perspective. Amongst other reasons, the radiation risks that persist in Namie are reflected in the returning population statistics where, as of December 2017, only 440 former residents as of March 2011 (equal to 2.2% of the population) had returned to Namie.[25]

Namie town, Fukushima prefecture, 10 km north of the Fukushima Daiichi nuclear plant, September 2017.
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Iitate, Mr. Anzai's house

In October 2017, Greenpeace surveyed seven houses in Iitate as well as conducting road scanning across the district. We include the name of Mr. Toru Anzai; however, other homeowners' names are not included due to their wish to remain anonymous.

Mr. Anzai's house is located in the south east of Iitate, 35 km from the Fukushima Daiichi nuclear power plant. Mr. Anzai evacuated from his home on 24 June 2011.

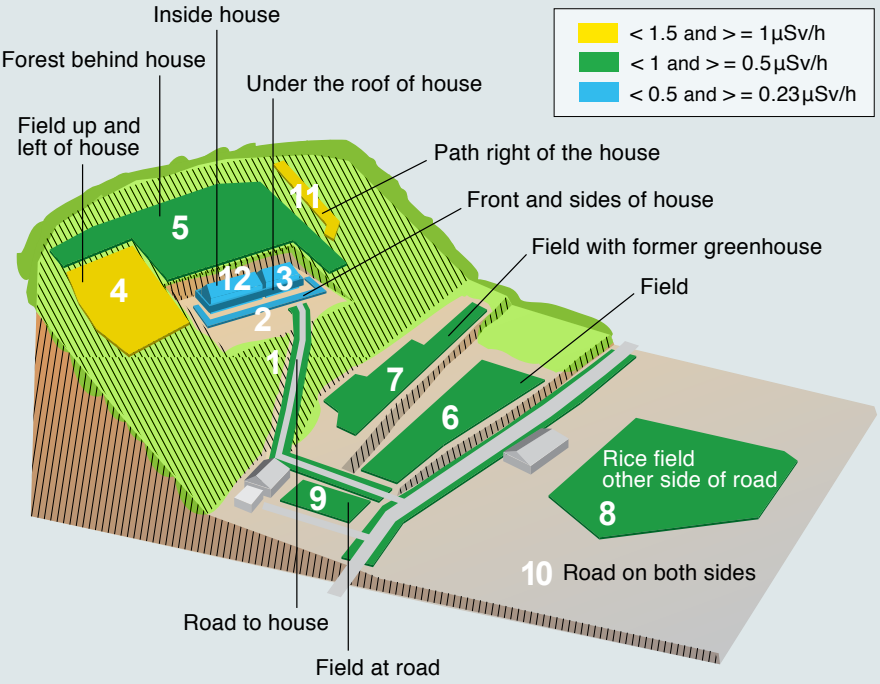

Diagram1: Schematic of Mr. Anzai's house in Iitate, showing the designated Zones for the Greenpeace radiation survey team.

Mr. Anzai's house, and the surrounding area, was decontaminated by the authorities during the period 2014 - 2015. This involved scraping away a layer of more than 5 cm of topsoil, which was then removed from the site and stored as radioactive waste. In some cases, the surface was covered over with uncontaminated soil. The survey results from Mr. Anzai's house in 2015 - 2017 are shown in Table 8.

Diagram 1 shows the location and boundaries of the 11 survey Zones around Mr. Anzai's house. A total of 4,688 measurement points were taken in October 2017. When conducting the survey in October 2015 decontamination work was still in progress, which led us to conclude in 2016 that the measured decrease was a combined effect of further decontamination, decay and erosion.

In 100% of all measurements taken in October 2017 the levels exceeded the government target of 0.23 µSv/h, with 22% in excess of 1 µSv/h. For all the Zones outside Mr. Anzai's house, the weighted average from October 2017 was 0.8 µSv/h, which compares with 0.7 µSv/h in November 2016, and 69% of the 2015 weighted average of 1.1 µSv/h. In 2015, decontamination was still ongoing and the levels recorded in 2016, when decontamination was completed, have remained almost stable when compared with 2017. A maximum of 2 µSv/h was measured in Zone 9.

In 2016, the most significant decrease in radiation compared to 2015 on Mr. Anzai's land was measured in Zone 8, a rice field, which had been decontaminated (5 cm of topsoil removed) and subsequently covered with a layer of uncontaminated soil. The new soil layer shields quite effectively the residual radiation underneath. A significant decrease of radiation from an average of 1.4 µSv/h

in October 2015 to 0.3 μSv/h in November 2016 was measured. In the September 2017 survey, the average levels in Zone 8 had increased to 0.5 μSv/h, with a maximum of 1.2 μSv/h. This variation since 2016 may be due to erosion of the topsoil, possible migration of contaminated soil, or some other unknown factor. The fact that this has been identified confirms the complex nature of the radio-ecology in the most contaminated areas of Fukushima prefecture. Greenpeace's planned survey in 2018 should help to clarify these issues.


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The decontamination effectiveness was much less effective in Zone 5. As can be seen in Diagram 1, the farmhouse is located in front of a steep sided forest. This is similar to many houses in Iitate, which are also located in close proximity to hillside forests. It is not possible to decontaminate these forests.

As is standard practice throughout the contaminated regions, an area up to 20 meters from Mr. Anzai's house into the forest has been 'decontaminated'. In Zone 5, including a non-decontaminated area, we measured a decrease from an average of 1.4 μSv/h in 2015 to 1.0 μSv/h in 2016, and 0.9 μSv/h in September 2017. This is possibly due to radioactive decay, erosion or some other unknown factor. The maximum measurement was 1.6 μSv/h, compared with 1.5 μSv/h in 2016. The radiation levels on the steep slope close to the house are quite important as they have a direct impact on the radiation levels inside the house. Also, we expect that radioactivity from the non-decontaminated forest might re-contaminate the already decontaminated area below and closer to the house.

Zone name		Max (μSv/h)			Average (μSv/h)			Average % of previous year			Number of points			Above 0.23 μSv/h			Above 1 μSv/h		
		2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015
Zone 1	Road to house	0.9	0.8	1.4	0.6	0.6	1.1	105%	58%	n/a	255	264	481	100%	100%	100%	0%	0%	78%
Zone 2	Front and sides of house	0.8	0.7	1.3	0.4	0.3	0.6	116%	60%	n/a	372	301	234	98%	87%	100%	0%	0%	4%
Zone 3	Under the roof of house	0.6	0.7	1.2	0.4	0.4	0.7	101%	57%	n/a	186	169	573	98%	98%	100%	0%	0%	11%
Zone 4	Field up and left of house	1.4	1.5	2.3	1.1	1.1	1.9	99%	61%	n/a	365	283	524	100%	100%	100%	88%	88%	100%
Zone 5	Forest behind house	1.6	1.5	2.2	0.9	1	1.4	90%	75%	n/a	644	358	814	100%	100%	100%	48%	53%	71%
Zone 6	Field	1.1	1.1	2	0.8	0.8	1.2	105%	69%	n/a	370	327	1126	100%	100%	100%	8%	2%	73%
Zone 7	Field with former greenhouses	1.4	1.6	n/a	0.8	0.8	n/a	105%	n/a	n/a	607	578	n/a	100%	100%	n/a	16%	18%	n/a
Zone 8	Rice field other side of road	1.2	0.6	1.7	0.5	0.3	1.4	145%	23%	n/a	510	239	332	100%	98%	100%	3%	0%	100%
Zone 9	Field at road	2	1.5	n/a	0.9	1	n/a	96%	n/a	n/a	183	103	n/a	100%	100%	n/a	22%	30%	n/a
Zone 10	Road on both sides	1.4	1	2.6	0.7	0.6	1.3	115%	48%	n/a	857	194	592	100%	100%	100%	4%	1%	95%
Zone 11	Path right of the house	1.6	1.5	n/a	1.1	1	n/a	111%	n/a	n/a	339	245	n/a	100%	100%	n/a	65%	50%	n/a
Zone 12	Inside house	0.7	n/a	0.9	0.3	n/a	0.5	n/a	n/a	n/a	215	n/a	817	100%	n/a	100%	0%	n/a	0%
ALL	**Weighted average of all zones**	**2**	**1.6**	**2.6**	**0.8**	**0.7**	**1.1**	**101%**	**68%**	**n/a**	**4,903**	**3,061**	**5,493**	**100%**	**98%**	**100%**	**22%**	**23%**	**58%**

Table8: Radiation measurement data from Mr. Anzai's house, Iitate - 2015-2017

Table 8 underlines the complex nature of the radiological condition of the most contaminated areas of Fukushima prefecture. In 8 of the 11 Zones for which we have complete data at Mr. Anzai's home, radiation levels have not declined during the period from 2016-2017, but have remained the same, or even slightly increased. Explanations for these results include re-contamination through migration of radionuclides from the nearby contaminated forested mountain slopes, and possibly some variation in the precise survey area. The inevitability of re-contamination from the forested mountains, which represent 70% of Iitate, as well as an equal amount of Namie, is further evidence that the government's limited decontamination program for thousands of homes has been, and will continue to be, ineffective in reducing the risks to citizens of Fukushima if they were to return to their homes.

Additional data from the house survey is contained in Appendix.

House A

Greenpeace conducted surveys of this central Iitate house and property in October 2015 and November 2016. Prior to the Greenpeace survey in October 2015 all areas measured, including the house itself, had already been designated as decontaminated. Radiation levels outside the house (including a public road to a shrine) were 14% lower in 2016 compared to 2015 (weighted averages) and 25% lower in 2017. The weighted average was 0.2 μSv/h in October 2017, compared with 0.3 μSv/h and 0.4 μSv/h in 2016 and 2015 respectively.

As Table 9 shows, the highest contamination is still found around the covered car park (Zone 3), where radiation had accumulated on the ground under the perimeter of the roof as a result of rain runoff. The maximum dose rate at a height of 1m decreased from 1.3 to 0.7 μSv/h between 2015 and 2016. By October 2017 there was a further reduction to 0.5 μSv/h. It should be noted that after the first government decontamination at the house, there has been at least one "hot spot" decontamination effort during the period 2015 to 2017. Equally the reduction could be as a result of dispersal through weathering, including heavy rain. Along the road from the house to the shrine (Zone 6), there was a reduction in the average radiation levels from 0.4 to 0.3 μSv/h.

As the house is located in a central area of the village, the risk for re-contamination from non-decontaminated areas (principally forested mountains) is low. As we stated in the Greenpeace report "No Return to Normal" published in February 2017,[26] there has been an expected reduction in radiation levels, while 73% of all measurements still exceed the government's current long term target of 0.23 μSv/h in October 2017.

Zone name		Max (μSv/h)			Average (μSv/h)			Average % of previous year			Number of points			Above 0.23 μSv/h			Above 1 μSv/h		
		2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015
Zone 1	Under roof of house	0.3	0.4	0.5	0.2	0.2	0.2	90%	86%	n/a	113	272	104	12%	26%	52%	0%	0%	0%
Zone 2	Front of house and car park	0.3	0.5	0.4	0.2	0.2	0.2	80%	96%	n/a	148	280	77	22%	41%	45%	0%	0%	0%
Zone 3	Under roof car park	0.5	0.7	1.3	0.3	0.3	0.4	89%	75%	n/a	98	132	48	37%	54%	71%	0%	0%	6%
Zone 4	Small field	0.4	0.6	0.6	0.3	0.4	0.4	72%	96%	n/a	233	245	143	98%	100%	100%	0%	0%	0%
Zone 5	Big field	0.3	0.6	0.5	0.2	0.3	0.3	71%	91%	n/a	193	321	151	42%	90%	97%	0%	0%	0%
Zone 6	Road to shrine	0.6	1.1	1.5	0.3	0.4	0.6	84%	70%	n/a	1,366	1,440	466	87%	93%	100%	0%	0%	7%
Zone 7	Inside house	n/a	0.2	0.2	n/a	0.1	0.1	n/a	94%	n/a	n/a	382	105	n/a	0%	0%	n/a	0%	0%
ALL	**Weighted average of all zones**	**0.6**	**1.1**	**1.5**	**0.2**	**0.3**	**0.4**	**80%**	**86%**	**n/a**	**2,151**	**3,072**	**1,094**	**73%**	**79%**	**89%**	**0%**	**0%**	**4%**

Table9: Radiation measurement data from House A, Iitate

House B

For this house in the southern part of Iitate, the 2016 and 2017 measurements were made in more detail and more extensively than in 2015, which explains the larger number of Zones. The weighted overall average in October 2017 was 0.8 μSv/h which remains the same as in 2016, with a maximum of 2.2 μSv/h.

Zone name		Max (μSv/h)			Average (μSv/h)			Average % of previous year			Number of points			Above 0.23 μSv/h			Above 1 μSv/h		
		2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015	2017	2016	2015
Zone 1	Road	2.2	0.8	2.7	0.6	0.5	1.3	123%	39%	n/a	545	199	254	100%	100%	100%	2%	0%	78%
Zone 2	Path to house	0.8	0.6	n/a	0.5	0.5	n/a	113%	n/a	n/a	91	68	n/a	100%	100%	n/a	0%	0%	n/a
Zone 3	Front and side house	0.8	1	n/a	0.4	0.6	n/a	77%	n/a	n/a	168	96	n/a	100%	100%	n/a	0%	1%	n/a
Zone 4	Under the roof	1.6	1.6	2.2	0.8	0.7	1.1	102%	67%	n/a	203	215	240	100%	100%	100%	33%	26%	56%
Zone 5	Back side of house	1.6	1	2.3	1	0.8	1.5	128%	53%	n/a	139	68	415	100%	100%	100%	52%	1%	90%
Zone 6	Field left of house	1.1	2.2	n/a	0.9	1.1	n/a	77%	n/a	n/a	143	433	n/a	100%	100%	n/a	13%	76%	n/a
Zone 7	Field greenhouse	1.2	1.2	2	0.7	0.8	1.1	99%	68%	n/a	198	279	404	100%	100%	100%	8%	5%	77%
Zone 8	Field with trees	1	1.6	n/a	0.8	1.2	n/a	67%	n/a	n/a	174	183	n/a	100%	100%	n/a	0%	81%	n/a
Zone 9	Rice field	1.4	n/a	n/a	0.7	n/a	n/a	n/a	n/a	n/a	403	n/a	n/a	100%	n/a	n/a	7%	n/a	n/a
Zone 10	Field	1.2	1.5	1.8	0.9	0.8	1.5	120%	54%	n/a	252	804	560	100%	100%	100%	43%	29%	100%
Zone 11	Field	0.6	n/a	n/a	0.5	n/a	n/a	n/a	n/a	n/a	172	n/a	n/a	100%	n/a	n/a	0%	n/a	n/a
Zone 12	Forest left from house	1.9	1.3	n/a	1.2	0.7	n/a	178%	n/a	n/a	521	155	n/a	100%	99%	n/a	78%	29%	n/a
Zone 13	Path in forest	1.7	n/a	n/a	0.8	n/a	n/a	n/a	n/a	n/a	218	n/a	n/a	100%	n/a	n/a	22%	n/a	n/a
Zone 14	Forest behind house	1.9	n/a	2.7	1.3	n/a	2	n/a	n/a	n/a	783	n/a	404	100%	n/a	100%	85%	n/a	100%
ALL	**Weighted average of all zones**	**2.2**	**2.2**	**2.7**	**0.8**	**0.8**	**1.4**	**104%**	**55%**	**n/a**	**4,010**	**2,500**	**2,277**	**100%**	**100%**	**100%**	**36%**	**32%**	**80%**

Table10: Radiation measurement data from House B, Iitate

House C

This house is located in the northern (and generally less contaminated) part of Iitate. There were no measurements made in 2015. The decontamination for a designated area had been finalized before our measurements in November 2016. The weighted overall average in October 2017 was 0.4 µSv/h compared with 0.5 µSv/h in 2016, and a maximum of 1.5 µSv/h. Table 11 shows the fields that had been decontaminated and covered with a layer of non-contaminated soil. The forest is an area (Zone 11) above the house and was mostly not decontaminated. As in 2016, we measured an average of 0.7 µSv/h in this area. For Zone 9, which is a small field close to the road, we suspect that some further decontamination had taken place between the measurements in 2016 and 2017.

Zone name		Max (µSv/h)		Average (µSv/h)		Average % of previous year		Number of points		Above 0.23 µSv/h		Above 1 µSv/h	
		2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016
Zone 1	Road	0.3	0.6	0.2	0.3	79%	n/a	177	309	69%	88%	0%	0%
Zone 2	Under roof	0.3	0.4	0.2	0.2	92%	n/a	157	181	38%	49%	0%	0%
Zone 3	Around house	0.4	0.8	0.3	0.3	77%	n/a	142	543	55%	73%	0%	0%
Zone 4	Field left	0.4	0.8	0.3	0.4	67%	n/a	126	232	98%	100%	0%	0%
Zone 5	Field back	0.5	0.7	0.3	0.5	60%	n/a	159	478	87%	100%	0%	0%
Zone 6	Field right	0.6	0.6	0.4	0.4	91%	n/a	154	169	100%	100%	0%	0%
Zone 7	Around office and path	0.6	0.7	0.3	0.4	90%	n/a	348	533	92%	92%	0%	0%
Zone 8	Factory field	0.7	1.1	0.3	0.4	65%	n/a	569	1,242	53%	78%	0%	0%
Zone 9	Field near factory	0.6	1.1	0.4	0.8	48%	n/a	159	189	100%	100%	0%	6%
Zone 10	Forest path left house	1.4	1.6	0.8	0.9	94%	n/a	352	1,329	100%	100%	11%	33%
Zone 11	Forest around house	1.5	1.1	0.7	0.7	109%	n/a	861	911	100%	99%	26%	3%
ALL	**Weighted average of all zones**	**1.5**	**1.6**	**0.4**	**0.5**	**78%**	**n/a**	**3,204**	**6,116**	**83%**	**90%**	**8%**	**8%**

Table11: Radiation measurement data from House C, Iitate

House D

In 2016, we also monitored House D which was not decontaminated and which was dismantled between our monitoring in 2016 and October 2017. We thus did not monitor this house again.

House E

This house is located in the southern part of Iitate. Decontamination had been finalized before the measurements in November 2016. The weighted overall average for all Zones has declined from 1.1 µSv/h in 2016 to 0.7 µSv/h in October 2017. The higher contamination, as in 2016, was very close to the house (Zone 4), with the maximum level at 1.7 µSv/h and an average of 0.8 µSv/h; as well as in Zone 13 in the forest behind the house with an average of 1.1 µSv/h and a maximum of 1.9 µSv/h. As with other houses, 100% of measurements in the area were in excess of the long term government target of 0.23 µSv/h.

Zone name		Max (µSv/h)		Average (µSv/h)		Average % of previous year		Number of points		Above 0.23 µSv/h		Above 1 µSv/h	
		2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016
Zone 1	Path to house	0.9	1.1	0.6	0.6	95%	n/a	333	297	100%	100%	0%	1%
Zone 2	Solar field	1.1	1.4	0.5	0.6	75%	n/a	450	500	100%	100%	1%	4%
Zone 3	Front of house	1.5	0.7	0.5	0.5	103%	n/a	213	106	100%	100%	2%	0%
Zone 4	Side and behind house	1.7	3	0.8	1.4	57%	n/a	258	447	1%	100%	23%	65%
Zone 5	Rice paddy	0.8	n/a	0.4	n/a	n/a	n/a	216	n/a	93%	n/a	0%	n/a
Zone 6	Path left of house	1.6	2.3	0.8	1.2	66%	n/a	181	191	100%	100%	11%	62%
Zone 7	Greenhouse close to house	1.9	2.7	0.9	1.2	80%	n/a	369	390	100%	100%	37%	66%
Zone 8	Far greenhouse	0.8	2	0.6	1.2	46%	n/a	299	370	100%	100%	0%	91%
Zone 9	Farmland	0.9	n/a	0.5	n/a	n/a	n/a	217	n/a	100%	n/a	0%	n/a
Zone 10	Under the roof of house	0.9	n/a	0.5	n/a	n/a	n/a	108	n/a	100%	n/a	0%	n/a
Zone 11	Field	1.6	3	0.8	1.4	58%	n/a	364	848	100%	100%	33%	70%
Zone 12	Field	1	n/a	0.5	n/a	n/a	n/a	296	n/a	99%	n/a	0%	n/a
Zone 13	Forest behind house	1.9	n/a	1.1	n/a	n/a	n/a	349	n/a	100%	n/a	59%	n/a
Zone 14	Path right of house to grave	1.8	n/a	0.8	n/a	n/a	n/a	347	n/a	100%	n/a	24%	n/a
ALL	**Weighted average of all zones**	**1.9**	**3**	**0.7**	**1.1**	**67%**	**n/a**	**4,000**	**3,149**	**100%**	**100%**	**16%**	**52%**

Table12: Radiation measurement data from House E, Iitate

House F

This house is also located in the southern, more contaminated, part of Iitate. The situation is very similar to the house of Mr. Anzai, with example a decrease of 15% in the steep forest (Zone 1) and an increase of 13% in the field below that forest (Zone 2). Radiation levels in 2017 remained on average stable compared to 2016. Almost all points (99%) remain above the long-term government target of 0.23 µSv/h and 38% are above 1 µSv/h, an increase from 32% in 2016. The weighted overall average for all Zones has declined from 0.8 µSv/h in 2016 to 0.7 µSv/h in October 2017. In 2016, the Zone 1 mushroom forest had an average of 1.6 µSv/h with a maximum of 2 µSv/h, while in 2017 it was 1.4 µSv/h with a maximum of 1.8 µSv/h. In Zone 2, a decontaminated field, the average was 0.7 µSv/h (the same as in 2016), with maximum levels increasing from 1.6 to 1.7 µSv/h.

Zone name		Max (µSv/h)		Average (µSv/h)		Average % of previous year		Number of points		Above 0.23 µSv/h		Above 1 µSv/h	
		2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016
Zone 1	Forest mushrooms	1.8	2	1.4	1.6	85%	n/a	759	536	100%	100%	97%	100%
Zone 2	Field decontaminated	1.7	1.6	0.7	0.7	113%	n/a	465	407	100%	100%	28%	11%
Zone 3	Greenhouse	1.3	1.6	0.8	0.9	87%	n/a	409	177	100%	100%	6%	2%
Zone 4	Back of house	n/a	1.4	n/a	0.9	n/a	n/a	n/a	165	n/a	100%	n/a	42%
Zone 5	Front of house	0.9	1.1	0.4	0.6	71%	n/a	210	303	97%	100%	0%	3%
Zone 6	Under roof	0.7	0.7	0.4	0.5	89%	n/a	89	133	79%	98%	0%	0%
Zone 7	Pond and greenhouse	1.2	1.2	0.9	0.8	110%	n/a	167	221	100%	100%	27%	14%
Zone 8	Field decontaminated	1.1	0.9	0.5	0.5	109%	n/a	395	409	100%	100%	1%	0%
ALL	**Weighted average of all zones**	**1.8**	**2**	**0.7**	**0.8**	**93%**	**n/a**	**2,494**	**2,351**	**99%**	**100%**	**38%**	**32%**

Table13: Radiation measurement data from House F, Iitate

Conclusion

As of 1 December 2017, the population of Iitate was 505 citizens (7.9% of the 2011 population).[27] One factor in this low return rate is undoubtedly the high radiation levels in the district. The Greenpeace survey results provide conclusive evidence that citizens of Iitate are right to be concerned about the safety implications if they were to choose to return.

6. Radiation hot spots

Radiation hot spot reading of 215 micro-sieverts per hour, at ground level, Namie exclusion zone, Fukushima prefecture, September 2017.

In addition to systematic scanning of the radiation levels in each Zone, the Greenpeace radiation survey team also took measurements of hot spots in both Namie and Iitate in September and October 2017.

Clearly, hot spots are not representative of the weighted average radiation levels at the surveyed house Zones. However, these hot spots highlight that, in addition to the generally elevated levels of radiation throughout the area, there are many places where levels are tens of times and, in the case of one location in Namie, 50 times higher (at one meter) than the government's long term-term decontamination target of 0.23 µSv/h.

Namie

House	Location	Dose rate (µSv/h)		
		1m	0.5m	0.1m
Ms. Kanno's house	Zone 9 – Path to rice field North	3.94	5.5	14.6
House Y	Zone 3 – Around house	4.33	6.25	16.1
House Z	Zone 5 – Warehouse front	11.5	24.5	137

Table14: Radiation hot spots in Namie – September 2017

It was at the House Z property that the Greenpeace survey team measured the highest overall radiation hot spots. At the base of a warehouse, levels ranged from 11.5 µSv/h at 1 meter height to 137 µSv/h at 0.1 meter. At ground level itself the readings were in excess of 200 µSv/h. These are extreme levels of radioactive contamination. To put these figures into context, at this one location radiation readings were 287 times higher at one meter than background levels of 0.04 µSv/h in the prefecture before the March 2011 Fukushima Daiichi nuclear accident, and at 0.1 meter they were over 3,400 times higher.

As Greenpeace began their survey work at property Z, two Fukushima residents were working near the warehouse hot spot but were unaware of any radiation risks and consequently had no personal dosimeters, nor had they taken any protective measures. This area was in close proximity to the main highway, Route 114, which the Japanese government reopened to through traffic in September 2017. This property was consistently the most radioactive in terms of hot spots. Along Route 114, in Zone 6 on to the south of the house, hot spots were 16 µSv/h at 1 meter and 61 µSv/h at 0.1 meters.

At Ms. Kanno's house, hot spots ranged from 2 µSv/h to 14.6 µSv/h along a road to a rice field.

Iitate

House	Location	Dose rate (µSv/h)		
		1m	0.5m	0.1m
Mr. Anzai's house	Zone 10 – Road on both sides	1.2	1.98	6.56
House A	Zone 5 – Big field	0.57	1.47	8.48
House B	Zone 4 – Under the roof	2.09	3.41	9.2
House C	Zone 10 – Forest path left house	1.43	2.46	4.39
House D (House demolished in 2017)	n/a	n/a	n/a	n/a
House E	Zone 7 – Greenhouse close to house	2.17	4.17	16.9
House F	Zone 3 – Greenhouse	1.37	2.16	3.51

Table15: Radiation hot spots in Iitate – October 2017

As expected, the radiation hot spots in Iitate are all lower than those found in the exclusion zone in Namie. There has been a significant reduction in the upper values of these hot spots since 2016, which suggests the effect of weathering, particularly after heavy rains and snow melt; and possible further decontamination efforts specifically targeting hot spots. In all cases, the radiation levels remain well above the government long term target of 0.23 µSv/h.

7. Human rights and Japanese government policy

Mr. Toru Anzai, Iitate, Fukushima prefecture, October 2017.
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In November 2017, the human rights of Fukushima citizens were addressed by the United Nations Human Rights Council (UNHRC)[28] in Geneva. At the UNHRC Universal Periodic Review of the status of human rights in Japan (third cycle), member states made important recommendations which, if adopted, would effectively reverse current Japanese government policy.[29] Germany, Austria, Portugal, Mexico (see below) and Belgium called on the Japanese government to address the rights of Fukushima citizens. In 2017, Greenpeace reported on the disproportionate impact of the Fukushima Daiichi nuclear accident on women and children.[30] Germany, Austria and Portugal in their recommendations also emphasized the rights of women and children, urging the government to continue its financial and other support for Fukushima survivors. The German government additionally urged the Japanese government to implement the annual international recommended maximum of 1 mSv/y standard for its resettlement policy, which is in line with the findings of the Special Rapporteur on the Right to Health following his mission to Japan for Fukushima survivors in 2012. If this recommendation was applied by the Japanese government, it would require the reversal of the decision to lift evacuation orders for Iitate and Namie, and effectively halt its current ineffective and unjust program in Fukushima.

The Japanese government will announce at the March 2018 UNHRC session in Geneva as to whether it will accept or reject the Fukushima related recommendations.

The conclusion of our survey work in Namie and Iitate is that it is more urgent than ever that the Japanese government adopt a human rights centered approach to the Fukushima nuclear crisis. Fully accepting the recommendations made by member states at the United Nations would be an important first step.

Column [31]

Austria

Continue providing support for the voluntary evacuees from the high radiation areas of Fukushima, with housing, financial and other life/assisting means and with periodic health monitoring of those affected, in particular those who were children at the time of the accident.

Portugal

Apply the Guiding Principles on Internal Displacement to all those impacted by the Fukushima Daiichi nuclear disaster in order to ensure full and equal participation for both women and men in decision making processes regarding their settlement.

Germany

Respect the rights of persons living in the area of Fukushima, in particular of pregnant women and children, to the highest level of physical and mental health, notably restoring the allowable dose of radiation to the 1 mSv/year limit, and by continuing support to the evacuees and residents.

Mexico

Guarantee access to health services for those affected by the Fukushima nuclear accident, as well as for the generations of survivors of the use of nuclear weapons.

Recommendations submitted by United Nation member states to the UNHRC Universal Periodic Review, Japan (third cycle), November 2017.

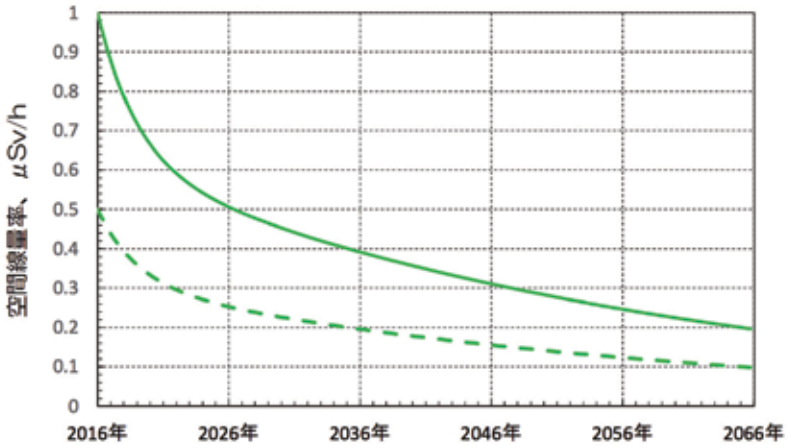
8. Projections on long term dose rates and government plans for revising decontamination radiation target

In our Fukushima survey report in February 2017, we highlighted the work of Tetsuji Imanaka of Kyoto University Research Reactor Institute.[32] His analysis, published in October 2016, calculated the long-term radiation exposures dose rate (μSv/h) over 50 years for former Iitate residents, if they were to return. This takes the decay of both Cs-134 (half-life: 2y) and Cs-137 (half-life: 30y) into account. In an area with a dose rate of 1 μSv/h in 2016, the level would be roughly 0.2 μSv/h in 2066. This is close to the current long term decontamination target of 0.23 μSv/h of the Japanese government, which itself is higher than the 0.04 μSv/h pre-2011 Fukushima Daiichi accident level.

The results of our latest survey in the area of Iitate where evacuation orders were lifted in March 2017, further confirms that dose rates in the immediate vicinity of peoples homes will only decline slowly towards the long term decontamination target of 0.23 μSv/h through to the second half of this century. Of course with higher contamination levels, particularly in the forests which make up 70% of Iitate and cannot be decontaminated, a longer timeframe is to be expected. Applying the Imanaka methodology to the survey area of Namie where evacuation orders were lifted in March 2017, it is reasonable to project the same timeframe as for Iitate. Follow up surveys during the coming years will confirm this. It is worth emphasizing that as the survey results show, weighted average levels in the Takase river area of Namie were 1.4 μSv/h with a maximum of 2.7 μSv/h. In 42% of the area surveyed in this area radiation levels would today give an annual radiation dose of 13 mSv, and in 97% of the area the annual exposure would be 4 mSv, assuming a person would stay there for a full year without any shielding of example a building. Thus, the timeframe for radiation levels to reach the current long term decontamination target of 0.23 μSv/h, in this area of Namie, would be considerably longer than the projection based on a current level of 1 μSv/h. To put it another way, in 50 years, starting from 2016, to reduce the radiation levels by a factor of 5, meaning that someone returning in the mid 2060's to an area where radiation levels are today 4 mSv/y could possibly still be exposed to a level of 0.8 mSv/y, or 3.5 times the long-term decontamination target of the Japanese government.

Chart6: Prediction of air dose rate transition in the cases, 1 μSv/h and 0.5 μSv/h on 1st January 2016.

The original chart title is 放射線量率の推移予想：2016年1月1日に1μSv/h の場合と 0.5μSv/h の場合, from the report titled 飯舘村上飯樋地区の空間放射線の現状調査報告 on 29th October 2016. http://www.rri.kyoto-u.ac.jp/NSRG/Fksm/kamiiitoi2016-10-9.pdf



When applying the same methodology to the survey area of the "difficult to return to" exclusion zone of Namie the implications for the current plans of the government to lift evacuation orders as early as 2023 in the Tsushima and Obori areas are even more serious from a radio-protection and human rights perspective. The weighted average levels ranged from 1.3 to 3.3 μSv/h in the house surveys, including in the Tsushima community, and were 4.3 μSv/h (and maximum of 11.6 μSv/h) in the community of Obori. The timeframe for even reaching the 0.23 μSv/h government target in these areas is clearly many more decades into the future and beyond the end of this century, not by 2023 when the government plans lift evacuation orders for small so called hubs.

The fact that the Japanese government is determined to continue to expose Fukushima citizens to unacceptable levels of radiation emerged in January 2018, specifically with the revision of the current long term decontamination target of 0.23 μSv/h. The government is confronted with the reality of the failure and limited nature of its decontamination program, and where radiation levels in Namie and Iitate are many decades and longer from reaching the current target.

In January 2018, during discussions on dose estimates for returning evacuees, the chair of the Nuclear Regulation Authority (NRA), Toyoshi Fuketa, questioned the setting of the 0.23 μSv/h current long term target (for which it has never defined an actual date), when he said "That was decided right at the start of the nuclear disaster, so it can't be helped that it's a cautious number... If we don't revise (that calculation) properly, it could hinder evacuees' return home."[33] A review is to be conducted under the auspices of the Radiation Council of Nuclear Regulation Authority (NRA).

The Greenpeace survey work clearly shows that there are no prospects of reaching the 0.23 μSv/h target – something the government is tacitly admitting by launching a review process to review the unattainable target upwards. However, rather than admitting that its decontamination program is a failure and that radiation levels will remain for many decades too high for people to safely return, the government appears instead to be determined to revise upwards the dose rates for its long term decontamination target.

School in Namie town, Fukushima prefecture, 10 km north of the Fukushima Daiichi nuclear plant, October 2017.
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9. Conclusion and recommendations

Ms. Kanno at her house in Shimo-Tsushima watches Greenpeace radiation survey team around her house, September 2017.

Seven years after the start of the Fukushima Daiichi nuclear disaster, the radiation levels in areas of Namie and Iitate where evacuation orders were lifted in March 2017 remain too high for the safe return of thousands of evacuees. In the "difficult to return to" highly contaminated exclusion zone in Namie, the radiation levels clearly show that there is no prospect of a safe return becoming possible over the long term.

As a result of being invited by local citizens, Greenpeace was able to continue its survey work in Iitate and extend it into the "difficult to return to" exclusion zone of Namie. The results of our extensive survey around houses, farmland and forest, as well as along Route 114 and other roads, show the radiation risks to be severe. Official plans to lift evacuation orders in 5 years time in 2023 for small pockets or hubs in areas of Namie - specifically Tsushima, Murohara, Suenomori, and Obori – cannot be justified from a public radiation exposure perspective and should be abandoned.

A particular concern highlighted by our survey work is that if plans proceed to begin decontamination work in Namie in spring 2018, many thousands of poorly paid decontamination workers will be unjustifiably exposed to high levels of radiation.[34] These workers will be subjected to these risks for a program that only decontaminates a small fraction of the overall area, where the actual effectiveness of decontamination is questionable limited and for a policy that will fail to make the areas safe for citizens to return.

In 2018 there clearly remains a radiological crisis not just within the restricted exclusion zones but also within the non-restricted areas of Namie and Iitate. To clarify the use of the word emergency: if these radiation levels were measured in a nuclear facility and not at the homes of citizens of Namie and Iitate, immediate action would be required by the authorities to mitigate serious adverse consequences for human health and safety, property or the environment.[35]

Failing return policy and evacuees

While the Japanese government continues to ignore the radiological reality in Namie and Iitate, their citizens clearly do not. As of December 2017, only 3.5% of the 2011 population of these two districts had returned.[36] Clearly the government's policy of seeking to effectively force Fukushima citizens to return to these areas is failing, with nearly 26,000 people remaining as evacuees.

The government is aware that their policy is not working and in a rare concession to the human rights of thousands of citizens, the Japanese government extended the period of housing support for the citizens of Iitate that was originally scheduled to be terminated in March 2018, one year after the lifting of evacuation orders. Rent free housing is now due to end in March 2019 for officially designated evacuees from the areas of Iitate and Namie for which evacuation orders were lifted in March 2017.[37]

No such support now exists for so called "self evacuees" who lived outside the mandatory evacuation zones in 2011 but left their homes due to their concerns over radiation risks. In addition to losing housing support in March 2017, they also were no longer included in the official record as evacuees. Thus as many as 29,000 people disappeared from the statistics.

It is worth noting that in 2011, the French nuclear safety agency, IRSN, recommended that a wider area of Fukushima should have had its population evacuated, including those living in the prefectural capital, Fukushima City.[38,39] If this recommendation had been applied, an additional 70,000 citizens would have been under evacuation order – no doubt many of those who in the end self-evacuated and who are ignored and discriminated against by Japanese authorities. Housing supported ended for these evacuees in March 2017,[40] since when a number of those living in public housing are under threat of legal action and eviction.

Eight families, all self evacuees, in Yamagata prefecture have had legal action initiated against them;[41] while the Fukushima prefectural government is taking legal action against other self evacuees.[42]

Even with more citizens choosing to return during 2018, which of course is absolutely their right, the vast majority of citizens are likely not to return. Unless the Japanese government ends its current policy of ending terminating housing support, reverses its decision to end housing support for so called self evacuees, tens of thousands of

evacuees will continue to suffer from unjustified financial coercion.

Radiation risks

The radiation surveys conducted by Greenpeace demonstrate that there is a significant radiation risk for returning citizens to Iitate and Namie. The International Commission on Radiological Protection (ICRP) recommendations[43] for the general public sets a maximum dose of 1 mSv/year in normal situations, and in the range of 1-20 mSv/y under post-nuclear accident situations, such as that resulting from Fukushima Daiichi. The ICRP recommends that governments select the lower part of the 1–20 mSv/year range for protection of people living in contaminated areas, and "to reduce all individual exposures associated with the event to as low as reasonably achievable."

Instead, the Japanese government has chosen the highest value of the ICRP recommendations and have applied it to all citizens in Fukushima, including infants, children and women, who are more sensitive to radiation. 20 mSv/y is the general limit for nuclear industry workers and should not be applied to ordinary citizens of Fukushima.

Furthermore, the high end of the 20 mSv/y range is intended for the early phase of the existing situation, not seven years after the start of the Fukushima Daiichi accident. As radioactive decay lowers radiation levels faster in the first years, and now that shorter-lived isotopes, specifically Cs-134, have decayed away, radiation levels will be quite constant over the coming years. Thus, applying the upper range to 20 mSv/y in 2018 and in the coming years would expose the returning population to a far too high level of radiation, much higher than that intended by ICRP-111.

Epidemiological studies monitoring the health effects of long-term exposure to low-ionizing radiation conclude that there is no low-threshold limit for excess radiation risk to non-solid cancers such as leukemia.[44] The additive radiation risk for solid cancers continues to increase throughout life with a linear dose-response relationship, which is the international basis for radio-protection standards set by the ICRP.[45]

The Japanese government is well-aware of scientific evidence of the cancer and other health risks from low-dose radiation exposure in the range of 1-5 mSv/y, including in studies part funded[46] by the Japanese government itself. As recently reported in the largest ever epidemiological study on low dose radiation and chronic exposure to ionizing radiation, *"this study provides strong evidence of an association between protracted low dose radiation exposure and leukaemia mortality...at present, radiation protection systems are based on a model derived from acute exposures, and assumes that the risk of leukaemia per unit dose progressively diminishes at lower doses and dose rates. Our results provide direct estimates of risk per unit of protracted dose in ranges typical of environmental, diagnostic medical, and occupational exposure."*

The government of Japan chooses to ignore the science to justify its Fukushima policies.

Radiological status

The results of our survey work illustrate a highly complex radiological situation, and one very far from normal.

The example of Mr. Anzai's home where there has been no significant decline in radiation levels, and in fact some increase, raises the issue of re-contamination through migration of radionuclides from the nearby contaminated forested mountain slopes. The inevitability of recontamination from the heavily contaminated forested mountains which represent 70% of Iitate, as well as an equal amount of Namie, is further evidence that the government's limited decontamination program for the thousands of homes has been, and will continue to be, ineffective in reducing the risks to citizens of Fukushima if they were to return to their homes.

Greenpeace also surveyed along Route 114, which runs east-west between the Murohara and Tsushima districts of Namie and which the government reopened to through public traffic in September 2017. While our survey results were consistent with official data, less than 50 meters from the highway we measured hot spots, including 11 μSv/h at 1 meter height to 137 μSv/h at 0.1 meter, and over 200 μSv/h at ground level. These are extraordinarily high levels of contamination.

Risking such exposures for the citizens of Namie and Iitate, including the vulnerable populations of women and children, is unjustifiable. Potential exposures for children are of particular concern, as they are both more vulnerable to the impacts of ionizing radiation exposure and are at much greater risk of coming into contact with ground level radiation through play. Further, should residents return, the complex radiation situation in Namie and Iitate would require very different day to day behavior to minimize exposure, compared with pre-March 2011.

Human rights and the United Nations

Due to the efforts of civil society and member states, the Japanese government's decision to disregard public safety and violate the human rights of tens of thousands of its citizens is now more urgently on the agenda of the United Nations Human Rights Council in Geneva. The recommendations made by member states, including Germany, at the Universal Periodic Review of Japan (third cycle) in November 2017, if applied in Iitate and Namie and other areas that are the most contaminated, would immediately halt the current program of the Japanese government. Greenpeace and the International Association of Democratic Lawyers in submissions to the UNHRC have called on the government to fully adopt the recommendations.[47] The Japanese government will announce on 16 March 2018 its decision on whether to accept or reject these recommendations.

The results of our investigations add further to the urgency for the Abe government to halt its current program of lifting evacuation orders, to comply with its domestic and international human rights obligations and to initiate a comprehensive and publicly accountable review of current policy.

Recommendations to the Japanese government and Fukushima Prefecture

- Adopt and immediately apply the recommendations of member states on Fukushima submitted at the United Nations Human Rights Council, specifically from the Governments of:

  Austria "6.215 - Continue providing support for the voluntary evacuees from the high radiation areas of Fukushima, with housing, financial and other life/assisting means and with periodic health monitoring of those affected, in particular those who were children at the time of the accident."

  Portugal "6.216 - Apply the Guiding Principles on Internal Displacement to all those impacted by the Fukushima Daiichi nuclear disaster in order to ensure full and equal participation for both women and men in decision making processes regarding their settlement."

  Germany "6.217 - Respect the rights of persons living in the area of Fukushima, in particular of pregnant women and children, to the highest level of physical and mental health, notably restoring the allowable dose of radiation to the 1 mSv/year limit, and by continuing support to the evacuees and residents."

  Mexico "6.218 - Guarantee access to health services for those affected by the Fukushima nuclear accident, as well as for the generations of survivors of the use of nuclear weapons."

- Suspend its current return policy which ignores Fukushima citizens and which ignores science based analysis, including potential lifetime exposure risks;

- Immediately clarify its long term decontamination target of 0.23 μSv/h, equal to 1 mSv annual exposure based on the government's calculation, including setting a target date, and halt any plans to raise the permitted target level;

- Abandon plans to lift evacuation orders in the Namie districts of Tsushima, Murohara, Suenomori and Obori, and in the interests of worker protection, halt plans for the start of decontamination efforts in these areas in 2018;

- Establish a fully transparent process to reflect and consider residents' opinions on evacuation policy, including opening a council of citizens including all evacuees;

- Provide full compensation and financial support to evacuees, and take measures to reduce radiation exposure based on science and the precautionary principle to protect public health and allow citizens to decide whether to return or relocate free from duress and financial coercion.

Endnotes

1. The Lancet, “Ionizing radiation and risk of death from leukemia and lymphoma in radiation- monitored workers (INWORKS): an international cohort study”, Klervi Leuraud, David B Richardson, Elisabeth Cardis, Robert D Daniels, Michael Gillies, Jacqueline A O’Hagan, Ghassan B Hamra, Richard Haylock, Dominique Laurier, Monika Moissonnier, Mary K Schubauer-Berigan, Isabelle Thierry-Chef, Ausrele Kesminiene, National Institute for Occupational Safety and Health (NIOSH) Public Health England’s Centre for Radiation, Chemical and Environmental Hazards (PHE-CRCE), University of North Carolina (UNC), Center for Research in Environmental Epidemiology (CREAL), Drexel University - School of Public Health, Pompeu Fabra University (UPF), CIBER-BBN, IRSN laboratory Ionizing Radiation Epidemiology Laboratory (LEPID), Lancet Haematol, 22 June, 2015 see http://dx.doi.org/10.1016/ S2352-3026(15)00094-0. Funding for the study was provided by Funding - Centers for Disease Control and Prevention, Ministry of Health, Labour and Welfare of Japan, Institut de Radioprotection et de Sûreté Nucléaire, AREVA, Electricité de France, National Institute for Occupational Safety and Health, US Department of Energy, US Department of Health and Human Services, University of North Carolina, Public Health England, as well as the Centers for Disease Control and Prevention (5R030H010056-02) and the Ministry of Health, Labour and Welfare of Japan (GA No 2012-02-21-01)
2. NRA, Nuclear Regulation Authority of Japan, 17 January 2018, see http://www.nsr.go.jp/data/ 000216371.pdf (in Japanese)
3. On 22 December, 2017, the Japanese Government Reconstruction Agency approved the “Namie-machi Specific Reconstruction and Recovery Base Area Reconstruction and Rehabilitation Plan” based on the Fukushima Reconstruction Revitalization Special Measures Law, see http://www.jcci.or.jp/ news/trend-box/2018/0115130735.html. Namie, joins Futaba and Okuma as designated for reconstruction hubs, with lifting of evacuation orders planned for 2022, see Kyodo, “Futaba unveils plan to set up reconstruction hubs in 555-hectare area”, 3rd August 2017, see http://www.fukushimaminponews.com/ news.html?id=849; and Okuma Town, “The Okuma Reconstruction Plan An Interim Report December, 2013 Okuma Town”, December 2013, see http://www.town.okuma.fukushima.jp/fukkou/sites/fukkou/files/ attachments/December_2013_Okuma_Reconstruction_Interim_Report.pdf
4. Greenpeace Germany, “Nuclear Waste Crisis In Fukushima Decontamination Program” December 2017, see http://www.greenpeace.org/japan/Global/japan/pdf/Waste_brief_20171214.pdf and Greenpeace Japan, “Radiation Reloaded: Ecological Impacts of the Fukushima Daiichi Nuclear Accident 5 years later”, February 2016, see http://www.greenpeace.org/japan/Global/japan/pdf/GPJ-Fukushima- Radiation-Reloaded-Report.pdf
5. For example, the European Union defines an “emergency” as a non-routine situation or event involving a radiation source that necessitates prompt action to mitigate serious adverse consequences for human health and safety, quality of life, property or the environment, or a hazard that could give rise to such serious adverse consequences – see Council Directive 2013/59/euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing directives 89/618/euratom, 90/641/euratom, 96/29/euratom, 97/43/euratom and 2003/122/euratom; in terms of radiation dose levels, “member states should ensure that these workplaces are notified and that, in cases where the exposure of workers is liable to exceed an effective dose of 6 mSv per year or a corresponding time-integrated radon exposure value, they are managed as a planned exposure situation and that dose limits apply, and determine which operational protection requirements need be applied. The EC directive classifies exposed workers as those receiving an effective dose of 6 mSv per year.” see https://ec.europa.eu/energy/sites/ener/files/documents/CELEX-32013L0059-EN- TXT.pdf
6. Greenpeace Japan, “Unequal Impact: Women’s & Children’s Human Rights Violations and the Fukushima Daiichi Nuclear Disaster”, March 2017, see http://www.greenpeace.org/japan/Global/japan/ pdf/Uequal-impact-en.pdf
7. Fukushima Prefecture government, ‘Situation in Iitate”, 21 December 2017, see http:// www.pref.fukushima.lg.jp/site/portal/26-13.html (in Japanese) and Fukushima Prefecture government, “Situation in Namie”, 26 December 2017, see http://www.pref.fukushima.lg.jp/site/portal/26-11.html (in Japanese).
8. Asahi Shimbun, “Elimination of Fukushima evacuees from list slammed”, 28 August 2017, see http://www.asahi.com/ajw/articles/AJ201708280053.html
9. The disproportionate and negative impacts of the Fukushima Daiichi nuclear accident were detailed in our submission to the HRC in March 2017, and in supporting documentation, see Greenpeace Japan, “Submission to the UN Human Rights Council by Greenpeace Japan: The Fukushima Daiichi nuclear disaster and violations of survivors’ human rights”, 30 March 2017, see http://www.greenpeace.org/japan/Global/japan/pdf/Greenpeace.Japan_UPR_Final.pdf
10. UNHRC, “Human Rights Council Working Group on the Universal Periodic Review” Twenty- eighth session 6-17 November 2017 Compilation on Japan Report of the Office of the United Nations High Commissioner for Human Rights”, November 2017, A/HRC/WG.6/28/JPN/2, see for documentation - http://www.ohchr.org/EN/HRBodies/UPR/Pages/JPIndex.aspx and broadcast of event http://webtv.un.org/ search/japan-review-28th-session-of-universal-periodic-review/5644308605001/

11. Greenpeace, “Joint submission to UNHRC: IADL and Greenpeace International on the Fukushima Nuclear Crisis and Human Rights”, Human Rights Council Thirty-seventh session 26 February-23 March 2018 Agenda item 3 A/HRC/37/NGO/X, General XX, February 2018, Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development, 2 February 2018.
12. On 22 December, 2017, the Japanese Government Reconstruction Agency approved the “Namie-machi Specific Reconstruction and Recovery Base Area Reconstruction and Rehabilitation Plan” based on the Fukushima Reconstruction Revitalization Special Measures Law, see http://www.jcci.or.jp/ news/trend-box/2018/0115130735.html. Namie, joins Futaba and Okuma as designated for reconstruction hubs, with lifting of evacuation orders planned for 2022, see Kyodo, “Futaba unveils plan to set up reconstruction hubs in 555-hectare area”, 3rd August 2017, see http://www.fukushimaminponews.com/ news.html?id=849; and Okuma Town, “The Okuma Reconstruction Plan An Interim Report December, 2013 Okuma Town”, December 2013, see http://www.town.okuma.fukushima.jp/fukkou/sites/fukkou/files/ attachments/December_2013_Okuma_ Reconstruction_Interim_Report.pdf
13. This higher estimate is on the basis that someone was in that area for 8,760 hours in one year; the Japanese government 0.23 μSv/y long term target would give a dose of 1 mSv/y based on citizens spending an average of 8 hours per day outside and taking account of shielding from radiation while inside a house. The methodology used by the Japanese authorities for many people is an underestimation. Residents in this agriculture and forestry-dependent region mostly worked and lived outside prior to the Fukushima nuclear disaster, particularly during the spring, summer, and autumn seasons. Even during the winter period, work is conducted outside, for example in the forest. The maximum figure here is based on if a person was to spend the entire year of 8,760 hours at this location.
14. The ICRP sets a recommended public dose limit of 1 mSv in a year, with a higher value being allowed in special circumstances as in the case of the Fukushima Daiichi nuclear accident, provided the average over five years does not exceed 1 mSv per year, see ICRP 111: Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency, available at http:// www.icrp.org. See also, OECD, Nuclear Energy Agency: Evolution of ICRP Recommendations 1977, 1990 and 2007. Changes in Underlying Science and Protection Policy and their Impact on European and UK Domestic Regulation, ISBN 978-92-64-99153- 8, 2011, see https://www.oecd-nea.org/rp/reports/2011/ nea6920-ICRP-recommendations.pdf.
15. Reconstrcution Agency, “Regarding Authorization of Namie town Specific Reconstruction and Recovery Base Area Plan”, 22nd December 2017 see http://www.reconstruction.go.jp/topics/main-cat1/sub-cat1-4/saiseikyoten/material/20171222_kouhyou_namie_tokuteifukkosaiseikyotenkuikifukkousaiseikeikaku.pdf (in Japanese)
16. Ibid
17. Ministry of Economy, Trade and Industry, “On the application of the special transit transportation system in the “difficult-to-return” zone of National Route 114, Prefectural Route 34 and Prefectural Route 49”, 15 September 2017, see http://www.meti.go.jp/earthquake/nuclear/kinkyu/hinanshiji/2017/0915.html (in Japanese); and Fukushima Minpo, “Route 114 stretch in Namie town reopened after hiatus of 6, half years”, 21 September 2017, see http://www.fukushimaminponews.com/news.html?id=857.
18. Fukushima Minpo, “Reopened after 6 years and a half Namie’s No. 114 National Highway”, 21 September 2017, see http://www.minpo.jp/pub/topics/jishin2011/2017/09/post_15431.html (in Japanese)
19. Greenpeace, “Nuclear Waste Crisis In Fukushima Decontamination Program”, December 2017, see https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/fukushima-bericht-oktober_2017_v2.pdf
20. Fukushima Minpo, “Route 114 stretch in Namie town seen open to traffic this fall”, 28 June 2017, see http://www.fukushimaminponews.com/news.html?id=843).
21. Ministry of Economy, Trade and Industry,“Results of radiation survey in difficult-to-return areas along National Routes 114, 399, 459, and Prefectural Routes 49, 34” 15th, September, 2017, http://www.meti.go.jp/earthquake/nuclear/release/infra/0605_001a.pdf
22. Namie Town plan, 22 December 2017 – see http://www.reconstruction.go.jp/topics/main-cat1/ sub-cat1-4/saiseikyoten/material/20171222_kouhyou_namie_tokuteifukkosaiseikyotenkuikifukkousaiseikeikaku.pdf (in Japanese).
23. Opcit. “Regarding Authorization of Namie town Specific Reconstruction and Recovery Base Area Plan”
24. Fukushima Prefecture Government, “Situation in Namie”, January 2018, see http:// www.pref.fukushima.lg.jp/site/portal/26-11.html (in Japanese).
25. Namie Town, 17 January 2018, see http://www.town.namie.fukushima.jp/ (in Japanese); also Sankei, “Fukushima - Namie Town, returning 2%”, 9 January 2018, see http://www.sankei.com/affairs/ news/180109/afr1801090016-n1.html (in Japanese)

26. Greenpeace Japan, “No Return to Normal: The Fukushima Daiichi Nuclear Disaster - House Case Studies of the Current Situation and Potential Lifetime Radiation Exposure in Iitate, Fukushima Prefecture”, February 2017, see https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/ 20170215_greenpeace_report_ fukushima_noreturntonormal.pdf
27. Fukushima Prefecture government, ‘Situation in Iitate”, see http://www.pref.fukushima.lg.jp/site/ portal/26-13.html
28. UNHRC, “Human Rights Council Working Group on the Universal Periodic Review” Twenty-eighth session 6-17 November 2017 Compilation on Japan Report of the Office of the United Nations High Commissioner for Human Rights”, November 2017, A/HRC/WG.6/28/JPN/2, see for documentation - http://www.ohchr.org/EN/HRBodies/ UPR/Pages/JPIndex.aspx and broadcast of event http://webtv.un.org/search/japan-review-28th-session-of-universal-periodic-review/5644308605001/ The Japanese government was challenged in 2012 by the UNHRC Special Rapporteur when he called on the government of Japan to protect citizens’ right to health and base its post-Fukushima policies upon the substantial body of evidence showing adverse health effects resulting from low-dose radiation exposures, including below 100 mSv. Rapporteur Anand Grover urged that “evacuees should be recommended to return only when the radiation dose has been reduced as far as possible and to levels below 1 mSv/year.” Human Rights Council, Twenty- third session Agenda item 3, Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development A/HRC/23/41/Add.3 Distr.: General 2 May 2013 Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, Anand Grover Addendum Mission to Japan (15 - 26 November 2012).
29. http://www.ohchr.org/EN/HRBodies/UPR/Pages/JPIndex.aspx and broadcast of event http://webtv.un.org/search/ japan-review-28th-session-of-universal-periodic-review/5644308605001/
30. Opcit. “Unequal Impact: Women’s & Children’s Human Rights Violations and the Fukushima Daiichi Nuclear Disaster”.
31. UNHRC, “Human Rights Council Working Group on the Universal Periodic Review” Twenty-eighth session 6-17 November 2017 Compilation on Japan Report of the Office of the United Nations High Commissioner for Human Rights”, November 2017, A/HRC/WG.6/28/JPN/2, see for documentation - http://www.ohchr.org/EN/HRBodies/ UPR/Pages/JPIndex.aspx and broadcast of event http://webtv.un.org/search/japan-review-28th-session-of-universal-periodic-review/5644308605001/
32. Opcit. “No Return to Normal: The Fukushima Daiichi Nuclear Disaster - House Case Studies of the Current Situation and Potential Lifetime Radiation Exposure in Iitate, Fukushima Prefecture”.
33. Mainichi Shimbun, “Airborne radiation near Fukushima nuke plant still far higher than gov’t max”, 18 January 2018, see https://mainichi.jp/english/articles/20180118/p2a/00m/0na/020000
34. Decontamination work already began in the “difficult to return to” exclusion zone of Futaba in December 2017, one of the districts targeted for a reconstruction hub, with the aim of lifting evacuation orders in the 550 hectare area (10% of Futaba) in 2022, see Kyodo, “Town of Futaba kicks off radiation cleanup with eye on 2022 revival”, Japan Times, 25 December 2017, see https://www.japantimes.co.jp/ news/2017/12/25/national/town-futaba-kicks-off-radiation-cleanup-eye-2022-revival/#.Wmjy7pOFhE4
35. Opcit. European Union Emergency.
36. Fukushima Prefecture Government, ‘Situation in Iitate”, 21 December 2017, see http:// www.pref.fukushima.lg.jp/ site/portal/26-13.html (in Japanese) and Fukushima Prefecture Government, “Situation in Namie”, 26 December 2017, see http://www.pref.fukushima.lg.jp/site/portal/26-11.html (in Japanese)
37. Fukushima Prefectural government, “On extension of the duration of emergency temporary housing relating to the Great East Japan Earthquake, 27 August 2017, see http:// www.pref.fukushima.lg.jp/sec/11050b/kyouyo.html (in Japanese); see also http://www.pref.fukushima.lg.jp/ uploaded/attachment/231332.pdf (in Japanese). In addition to Iitate, the extension to March 2019 is applied to evacuees from Kawamata town, Kawauchi village, Minami-soma city, Katsurao village. In addition to Namie town, a decision is to be made for evacuees from Tomioka town, Ohkuma town, Futaba town.
38. The IRSN assessment recommended the evacuation of the population in territories contaminated at 600,000 Bq/m2 or higher for radioactive caesium, which corresponds to an external dose of 10 mSv for the first year, see “Synthèse actualisée des connaissances relatives à l’impact sur le milieu marin des rejets radioactifs du site nucléaire accidenté de Fukushima Dai-ichi 26 Octobre 2011, see http:// www.irsn.fr/FR/Actualites_presse/ Actualites/Documents/IRSN-NI- Impact_accident_Fukushima_sur_milieu_marin_26102011.pdf; as cited in “Fukushima five years later: back to normal?” David Boilley (ACRO) commissioned by Greenpeace Belgium. February 2016, see http://fukushima.eu.org/wp-content/uploads/2016/02/Fukushima_back_to_normal_ ACRO_2016.pdf

39. Fukushima Prefectural government, “About comprehensive support measures for return and living reconstruction”, 22 February 2017, see http://www.pref.fukushima.lg.jp/site/portal/ps-shiensaku.html (in Japanese).
40. Ibid
41. Sankei, “Voluntary evacuees wanted to leave for evacuation Supreme law, defendants’ state and TEPCO should continue compensation to 8 households in Yamagata, 25 October 2017, see http:// www.sankei.com/affairs/news/171025/afr1710250022-n1.html (in Japanese).
42. Kyodo, “Fukushima Prefecture has filed suit against five voluntary evacuees”, 10 November 2017, see https://this.kiji.is/301665133821183073 (in Japanese).
43. ICRP “Application of the Commission’s Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency”, The International Commission on Radiological Protection, ICRP Publication 111 Approved by the Commission in October 2008, see http://www.icrp.org/docs/P111(Special%20Free%20Release).pdf
44. David Richardson et al, Ionizing Radiation and Leukemia Mortality among Japanese Atomic Bomb Survivors, 1950-2000, Radiation Research (September 2009), vol.172, no.3, pp.368-82. as cited in Human Rights Council, Twenty-third session Agenda item 3, Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development A/HRC/23/41/Add.3 Distr.: General 2 May 2013 Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, Anand Grover Addendum Mission to Japan (15 - 26 November 2012).
45. National Research Council, Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2 (Washington DC, The National Academies Press, 2006), p.30; Kotaro Ozasa et al, Studies on the Mortality of Atomic Bomb Survivors, Report 14, 1950-2003: An Overview of Cancer and Non-cancer Diseases, Radiation Research (March 2012), vol.177, no.3, pp.229-243,pp. 229,236.; David J. Brenner et al, Cancer Risks Attributable to Low Doses of Ionizing Radiation: Assessing what we really know, PNAS (November 2003), vol.100, no.24, pp.13761-13766; Pierce and Preston, Radiation-Related Cancer Risks at Low Doses among Atomic Bomb Survivors, Radiation Research (2000),vol.154,pp. 178-186,p.185. As cited in Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, Anand Grover Addendum Mission to Japan (15 - 26 November 2012).
46. Opcit. The Lancet.
47. Greenpeace, “Joint submission to UNHRC: IADL and Greenpeace International on the Fukushima Nuclear Crisis and Human Rights”, Human Rights Council Thirty-seventh session 26 February-23 March 2018 Agenda item 3 A/HRC/37/NGO/X, General XX, February 2018, Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development, 2 February 2018, see https://documents-dds-ny.un.org/doc/UNDOC/GEN/G18/039/65/PDF/G1803965.pdf?OpenElement

APPENDIX 1

Chart 1: Dose rate average by Scanning (systematic measurements) 2017 – Mrs. Kanno's house

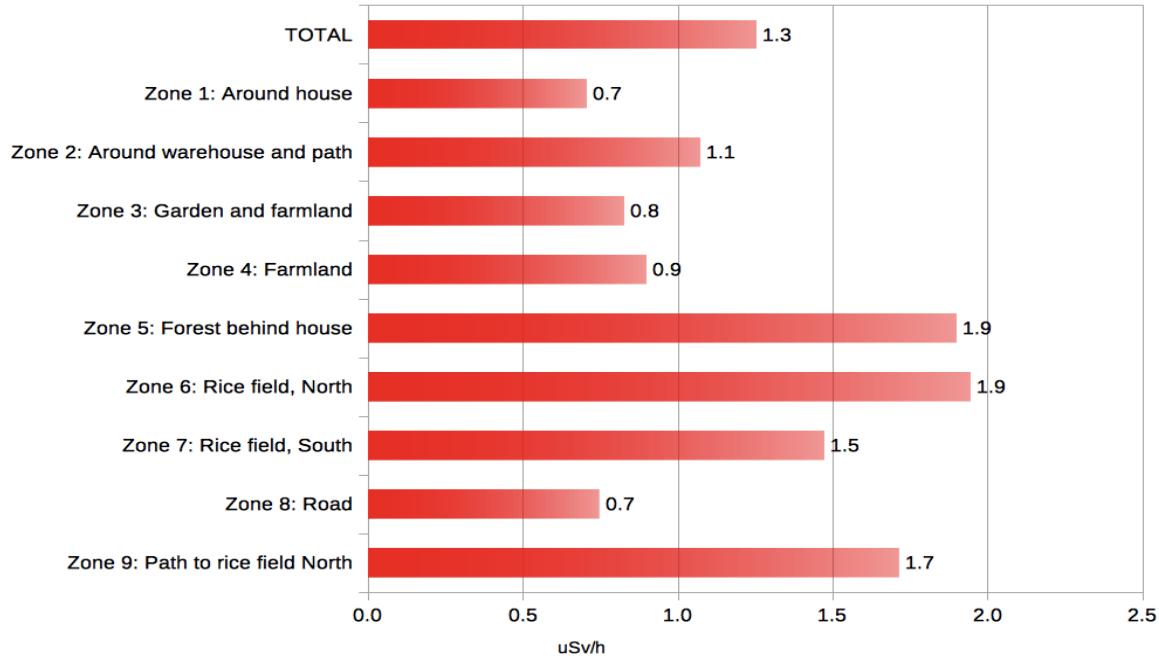
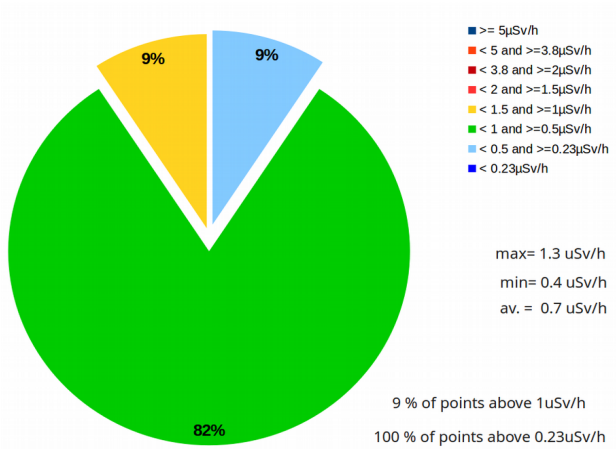
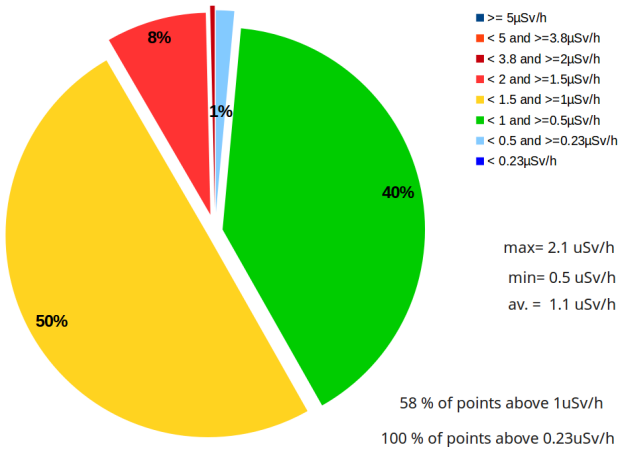


Chart 2: Proportions of dose rate in 12 zones measured by Scanning (systematic measurements) 2017 – Mrs. Kanno's house

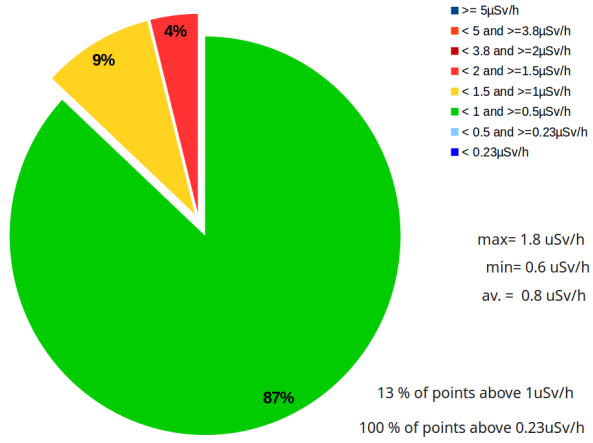
Zone 1 Around house



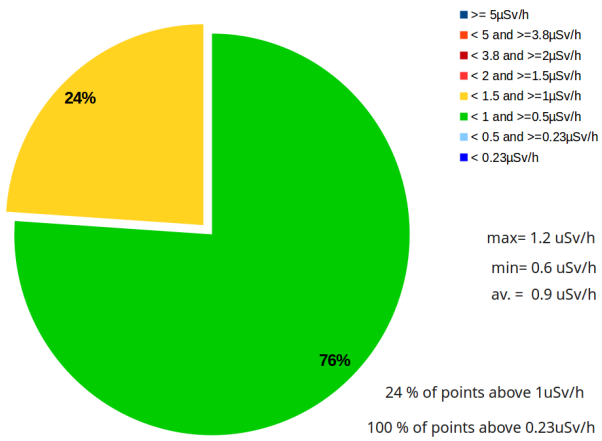
Zone 2 Around warehouse and path



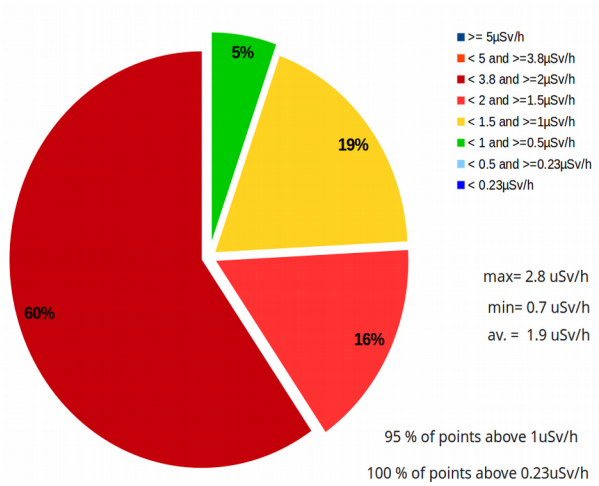
Zone 3 Garden and farmland



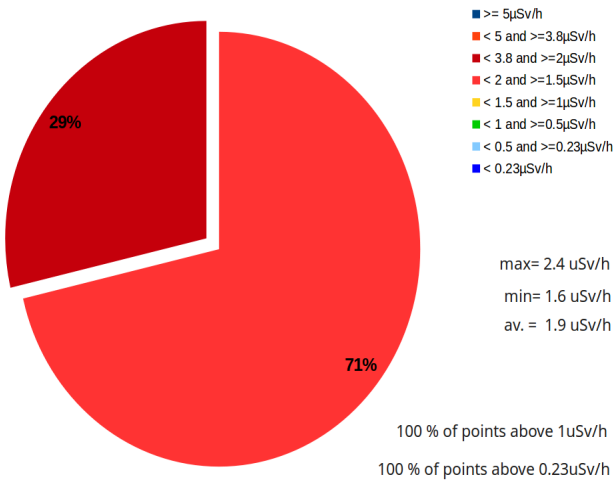
Zone 4 Farmland



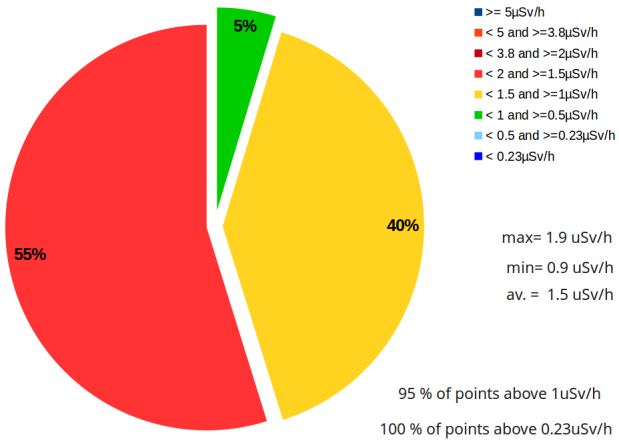
Zone 5 Forest behind house



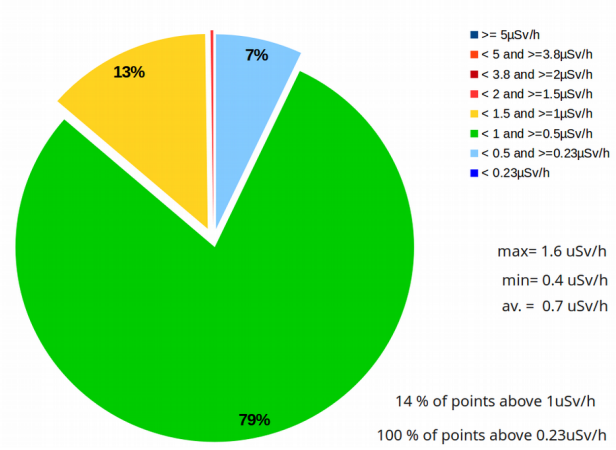
Zone 6 Rice field, North



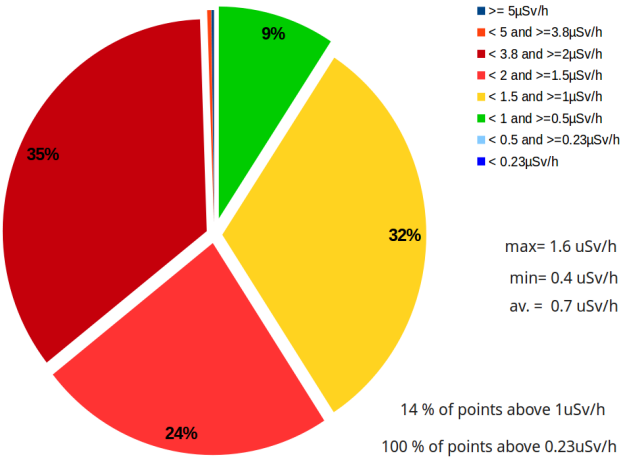
Zone 7 Rice field, South



Zone 8 Road

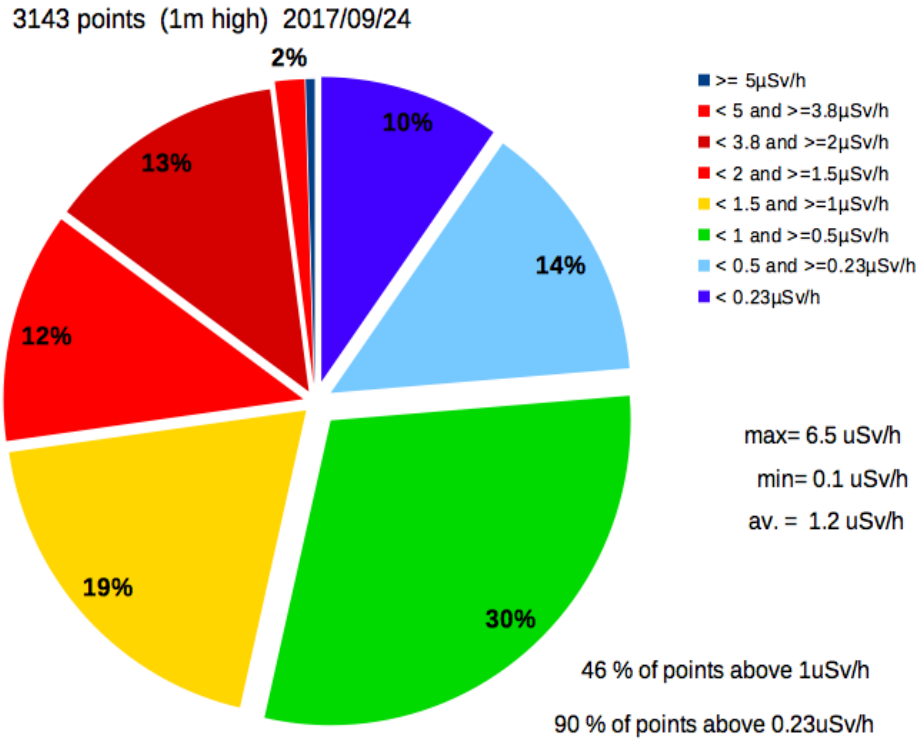


Zone 9 Path to rice field North



APPENDIX 2

Chart 1: Route 114
Proportions of dose rate from Route 114 (From outside vehicle at various speed)



APPENDIX 3

Chart 1: Dose rate average by Scanning (systematic measurements) and a comparison from 2015 to 2017 – Mr. Anzai's house

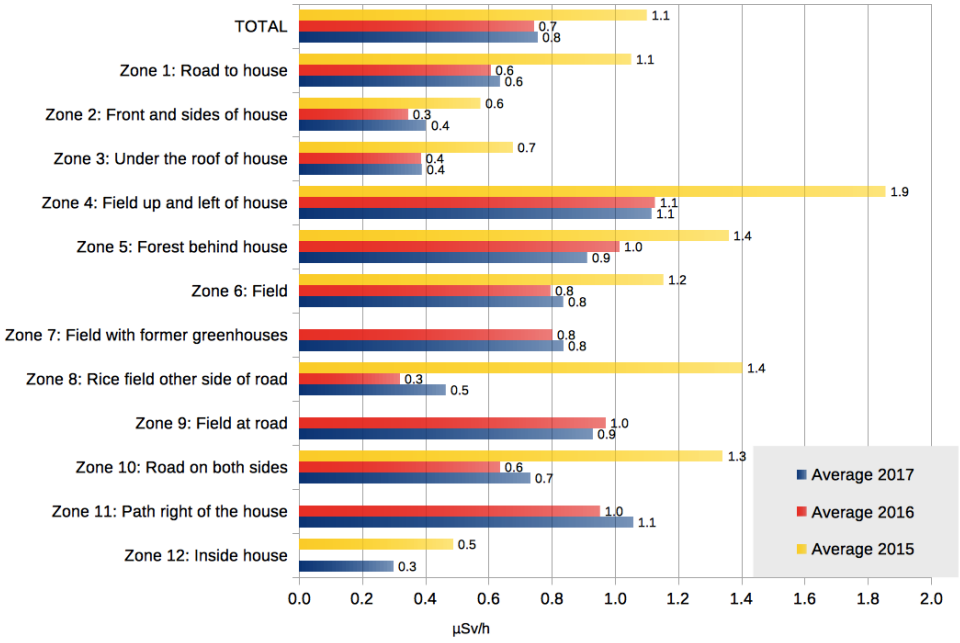
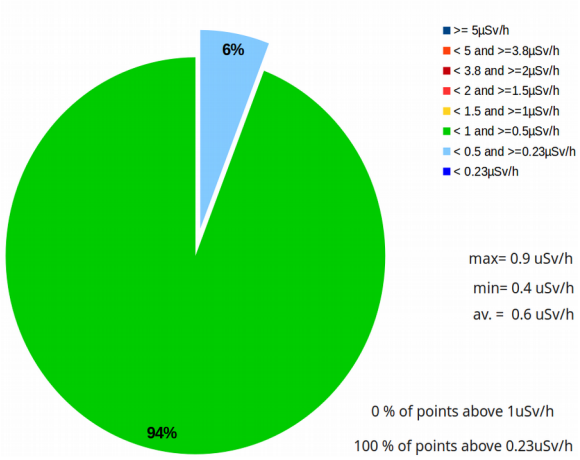


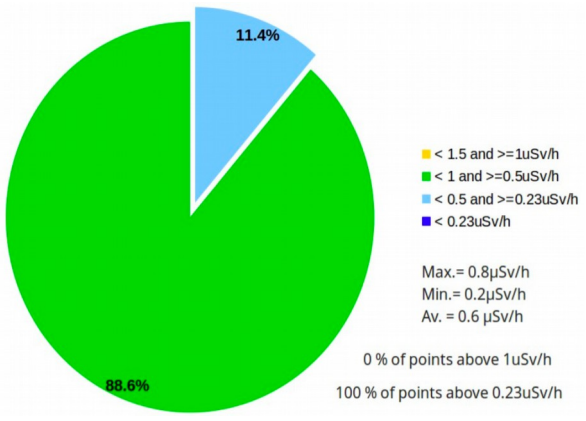
Chart 2: Proportions of dose rate in 12 zones measured by Scanning (systematic measurements) and a comparison between 2017 and 2016 – Mr. Anzai's house

Zone 1 Road to house

2017

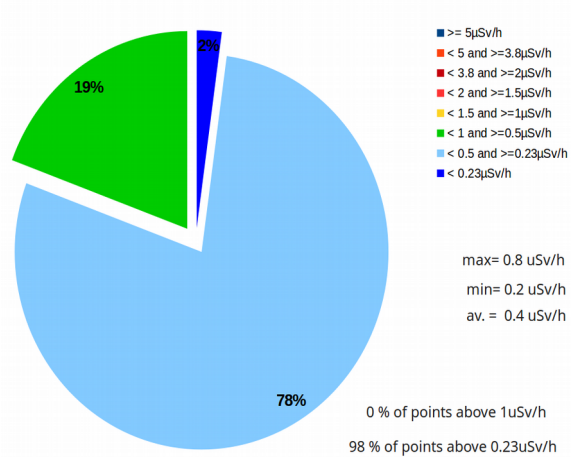


2016

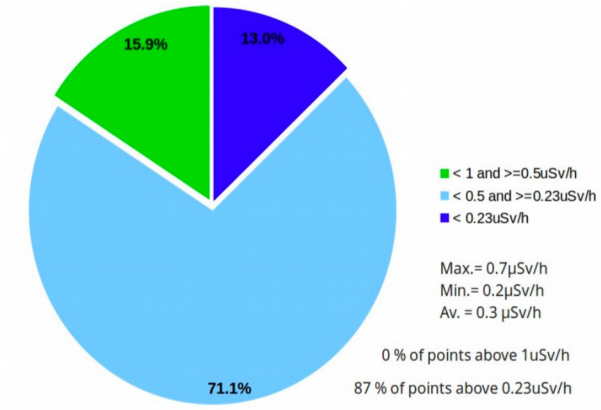


Zone 2 Front and sides of house

2017

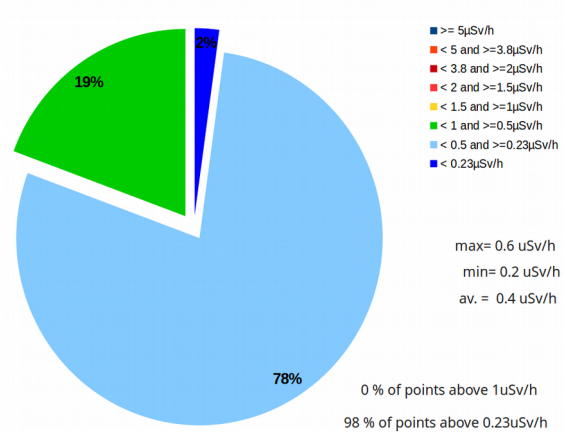


2016

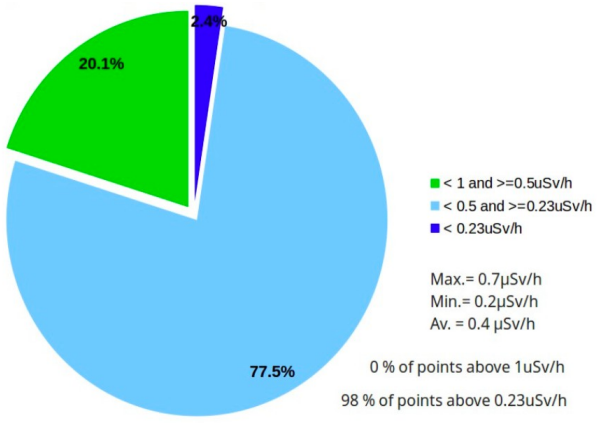


Zone 3 Under the roof of house

2017

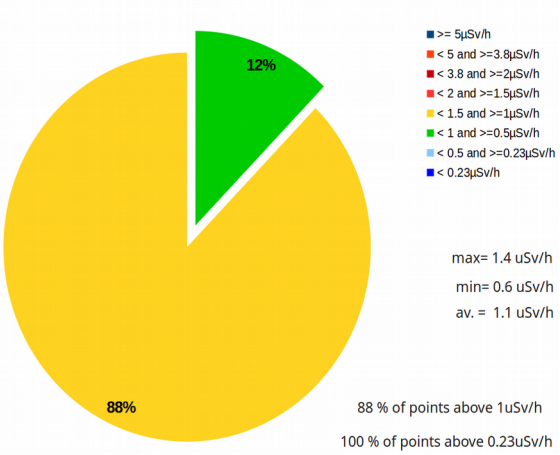


2016

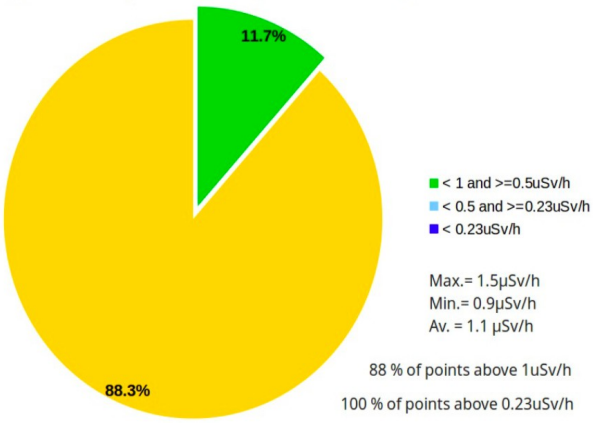


Zone 4 Field up and left of house

2017

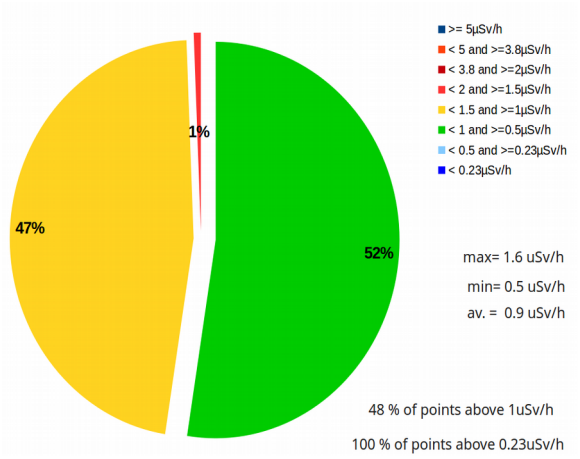


2016

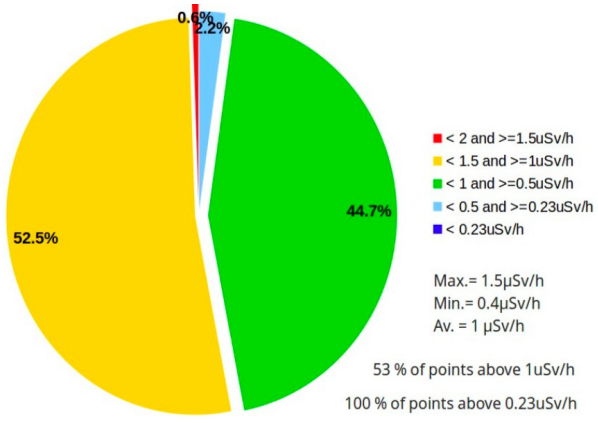


Zone 5 Forest behind house

2017

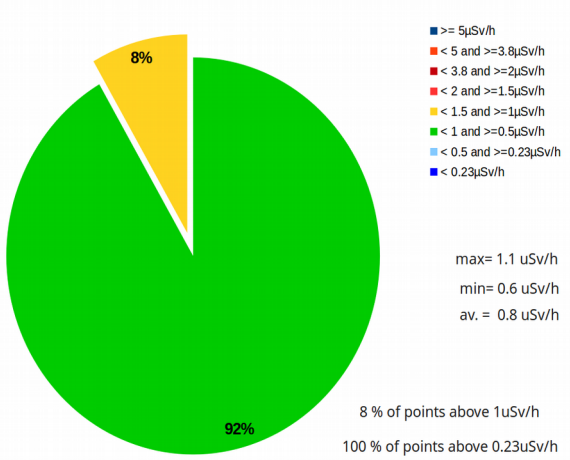


2016

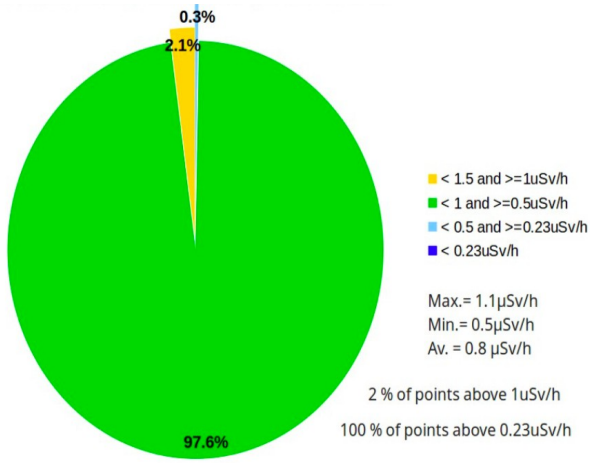


Zone 6 Field

2017

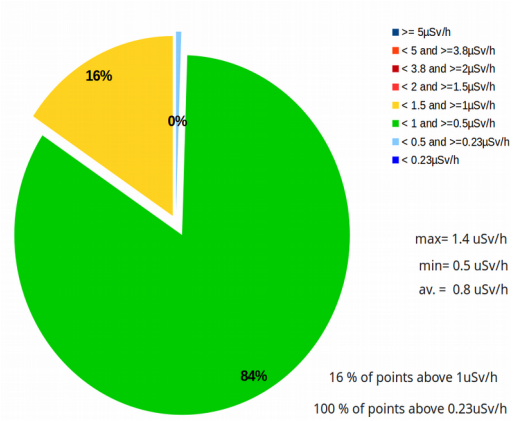


2016

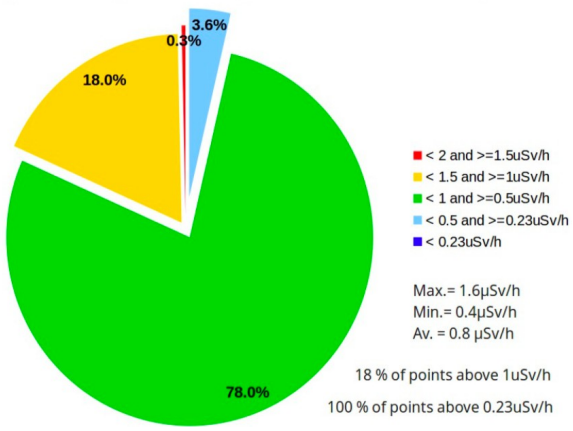


Zone 7 Field with former greenhouses

2017

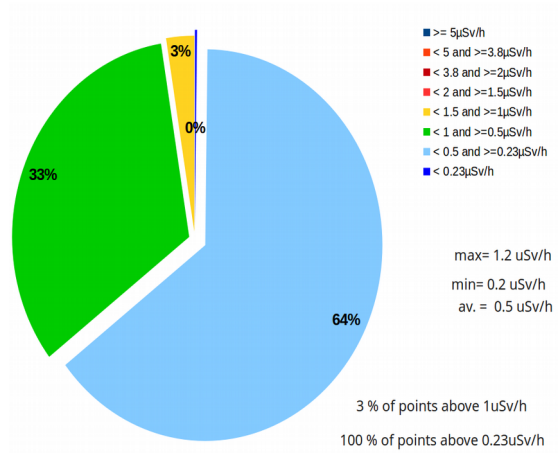


2016

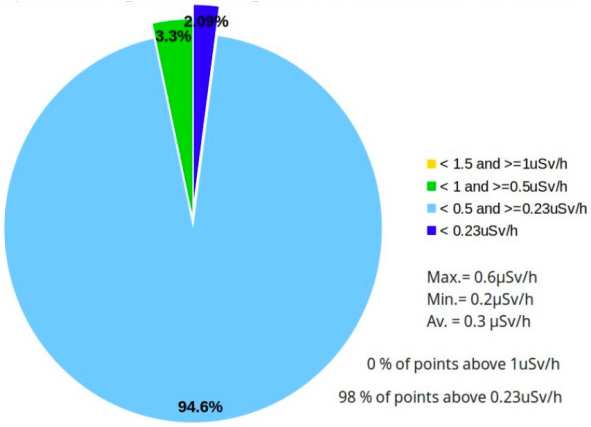


Zone 8 Rice field other side of road

2017

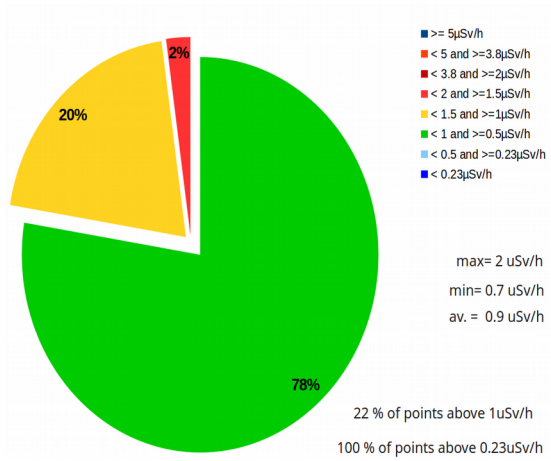


2016

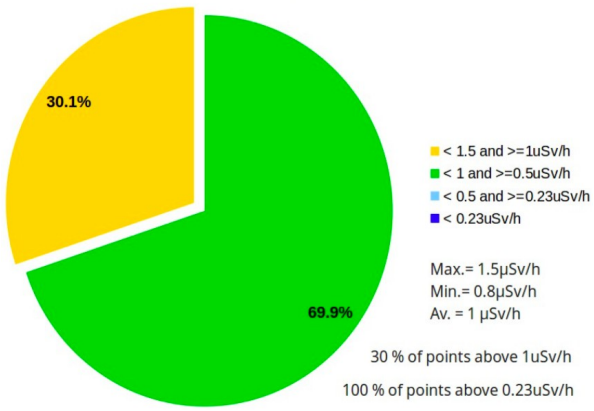


Zone 9 Field at road

2017

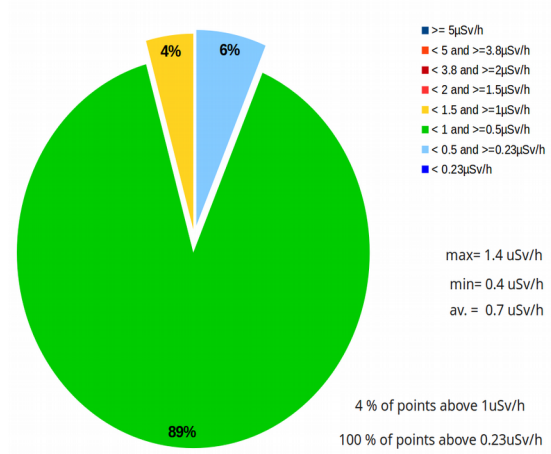


2016

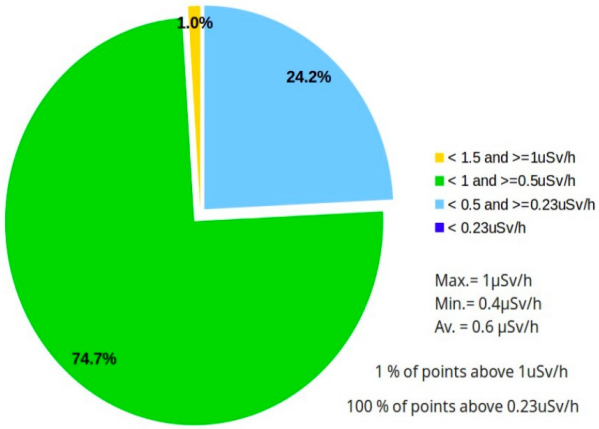


Zone 10 Road on both sides

2017

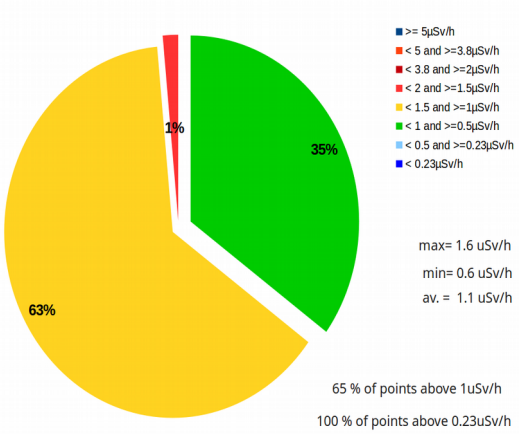


2016

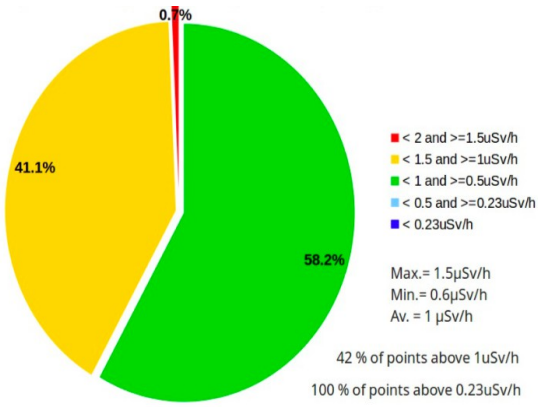


Zone 11 Path right of the house

2017

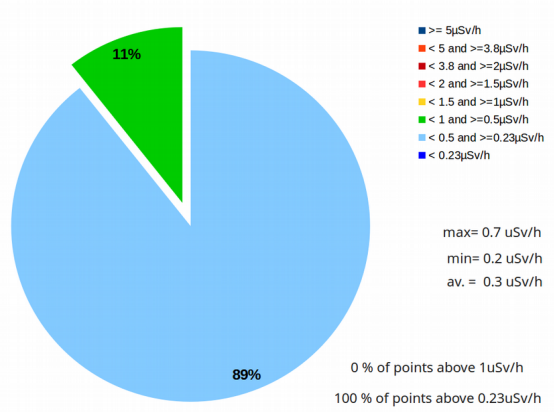


2016

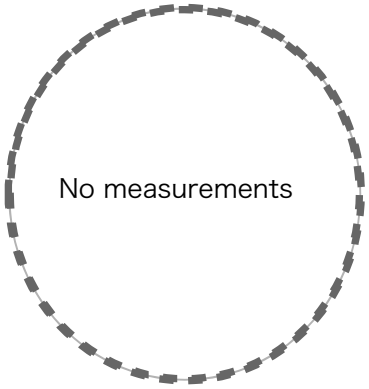


Zone 12 Inside house

2017



2016



Radiation specialist Heinz Smital in Obori, Futaba district, inside the highly contaminated exclusion zone in Namie, Fukushima prefecture, September 2017.

Greenpeace is an independent campaigning organisation that acts to change attitudes and behavior, to protect and conserve the environment, and promote peace.

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