

Fukushima Today: “I’m Glad that I Realized My Mistake before I Died.”

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After the nuclear disaster at Fukushima, evacuees were put in what was supposed to be temporary housing built in parking lots and fields on the outskirts of inland towns. These metal structures were measured by the size of Japan’s traditional tatami sleeping mats, typically about 36 by 71 inches.

Takenori and Tomoko Kobayashi lived in an eight-tatami-mat house for the next five years—nuclear refugees inhabiting 132 square feet of living space.

In 2016, Mr. and Mrs. Kobayashi were allowed to return to their former home in Odaka, a village on the edge of Fukushima’s 20-kilometer exclusion zone, where Tomoko is a third-generation innkeeper. Owner of a small *ryokan*—a traditional Japanese hotel with common baths and a dining room holding a long table for family and guests—she invited volunteers to help her scrub down the inn, plant flowers along the roadside, open a gift shop, and rescue some of the area’s famous “samurai horses,” which are now branded with the white mark that labels radioactive livestock.



A hostler at Mrs. Kobayashi's stable shows the brand put on radioactive livestock in Fukushima prefecture. Image courtesy of Thomas A. Bass

This past September, the inn was full again with visitors such as my research assistant, **Ms. Yuki Abe**. (Due to COVID, non-citizens, even long-term visa holders, are not allowed into Japan.) They had come for the yearly festival that marks the fall planting of rape seed, a member of the mustard family that has the dual benefit of leeching cesium from the soil while producing uncontaminated canola oil, because cesium is not soluble in oil. The idea of replacing the area's traditional rice-growing with rape seed was borrowed from Chernobyl—a place which the Kobayashis and many of their friends have visited, in an effort to learn how to live in a nuclear exclusion zone.

The Kobayashi family brought another important lesson back from Chernobyl. While his wife Tomoko had been bustling around her inn, Takenori opened a radiation testing lab in the nearby town of Minamisoma. With money raised on a TV telethon and donated labor and equipment, his laboratory welcomes anyone who comes in with soil samples or foraged mushrooms or even potentially contaminated food from the grocery store. “What we learned from Chernobyl is that you have to measure everything and keep measuring,” Takenori says. Chernobyl got a 25-year head start on Fukushima, but living with nuclear disasters and their long-term effects is still a work in progress. Despite the official government spin that everything is back to normal—indeed, Japan is touting the upcoming Olympic games as the so-called “Recovery Olympics”—life in Fukushima is far from normal.

The torch for the 2020 Olympics—delayed for a year by the [coronavirus pandemic](#) but still called the “2020 Olympics”—is scheduled to be lit on March 25, 2021, at what is known as J-Village, the Japan Football Association Academy for training soccer players.

J-Village lies 12 miles south of Fukushima Daiichi, where this March also marks something else: the 10th anniversary of the meltdown of three of the six nuclear reactors at the generating complex known as Fukushima Number 1, or F1. The reactors started melting down and exploding on March 11, 2011, after the [9.0 magnitude Tohoku earthquake](#) sent a

130-foot wave racing at [500 miles per hour](#)—the speed of a jet plane—toward Japan’s eastern coast, killing more than 18,000 people, according to the [International Journal of Disaster Risk Reduction](#).

Already damaged by the earthquake and emitting high levels of radiation before the tsunami arrived, F1 was finished off by flood waters that destroyed its backup generators and cooling systems. As the reactors began exploding, authorities made F1 the center of a nuclear exclusion zone that stretched up to 60 miles inland—depending on where the winds and rains deposited the damaged plant’s emissions of cesium, plutonium, strontium, iodine 131, and other radioactive elements. One hundred and sixty thousand people were evacuated from Fukushima’s nuclear exclusion zone; 10 years later, most of them—unlike the Koybayashi family—are [still displaced, their former homes forming part of an eerie landscape of abandoned villages](#) filled with palm civets, monkeys, and other animals nesting in the urban ruins.



A wild boar on the streets of Namie, five miles north of Fukushima Daiichi, in 2015. Image courtesy of Yuki Iwanami

The operator of the plant, the Tokyo Electric Power Company, or TEPCO, evacuated its workers from F1 and ordered the site abandoned. The Japanese prime minister, in a dawn visit to TEPCO headquarters in Tokyo, effectively seized the company and demanded that they keep working. As a result, a suicide squad of older workers struggled to contain the disaster. Known as the “Fukushima Fifty” (which actually numbered 69) they tried to cool the reactors with fire trucks brought from Tokyo, 140 miles to the south. The command center for managing the disaster was moved to J-Village.

No one can say with 100-percent certainty the amount of radiation that came from Fukushima, since most of this radiation has been carried eastward into the ocean. At the high end, Fukushima [may be worse than Chernobyl](#) in terms of global contamination. At the low end, the Nuclear Energy Institute estimates that Fukushima’s [release is one-tenth](#) that

of the accident at Chernobyl—which is estimated to have [scattered between 50 and 200 million curies of radiation](#) over Russia and Central Europe says Kate Brown, the MIT historian who published a book on Chernobyl in 2019. (One curie equals 37 billion becquerels, the standard unit of measurement for radioactive decays per second.) To give a sense of scale, this amount of radiation is the equivalent of what would have been emitted by at least 400 Hiroshima bombs, according to the [International Atomic Energy Agency](#). As Nobel laureate **Kenzaburō Ōe** says of the Fukushima disaster, unlike Hiroshima and Nagasaki, this time Japan bombed itself.

Compounding the problem, most of Fukushima’s dosimeters were swept away in the flood or knocked offline. Readings from US military planes flying overhead and ships sailing offshore differed dramatically from those reported by TEPCO. The same is true for spot readings of air and soil samples around the plant.

What we know about nuclear disasters at Chernobyl, Fukushima, and elsewhere comes primarily from modelling what is known as the “[source term](#)”—the types and amounts of radioactive material that were in a reactor’s core and then released to the environment by an accident. These models are revised as we learn more about the prevailing winds and other factors but are still only models; ideally, one wants to examine the reactors’ cores themselves. Unfortunately, even 10 years later, no one can get close to Fukushima’s reactor cores, and we do not even know precisely where they are located. As recently as December 2020, Japan’s Nuclear Regulatory Authority (NRA) announced “extremely serious” developments at Fukushima that were far worse than previously thought, the [Asahi Shimbun newspaper](#) reported. TEPCO had discovered that the massive shield plugs covering the reactors were emitting 10 Sieverts of radiation per hour—a lethal dose for humans (though it should be noted that reactor cores are normally examined by robots, unless these, too, are destroyed by radiation). Because Fukushima now has more contaminated material at higher doses than previously estimated, “this will have a huge impact on the whole process of decommissioning work,” said NRA chairman Toyoshi Fuketa.

The effective dose of radiation required to sicken or kill you is measured in Sieverts, a unit named after Rolf Sievert, the Swedish physicist who first calibrated the lethal effects of radioactive energy. A dose of 0.75 Sieverts will produce nausea and a weakened immune system. (Sieverts are used to measure the relative biological damage done to the human body, while becquerels and curies are units that describe the amount of radiation emitted by radioactive material.)

A dose of 10 Sieverts will kill you, if absorbed all at once.

A dose somewhere in-between 0.75 and 10 Sieverts gives you a fifty-fifty chance of dying within 30 days.

Guidelines for workers in the nuclear industry limit the maximum yearly dose to 0.05 Sieverts, or 50 milliSieverts—the equivalent of [five CT scans](#), says *Harvard Health Publishing*. (This is a high figure compared to the 1 milliSievert per year that is considered acceptable for the general public; a physicist familiar with the industry explained that the thinking is that workers in the nuclear energy industry are implicitly being paid to take on the risk.)

So how many Sieverts are currently being produced by Fukushima’s melted reactors? The latest reading from reactor No. 2 is 530 Sieverts per hour. This means that every hour the

heart of the reactor is emitting more than 10,000 times the yearly allowable dose for radiation workers.

F1's reactors are still radioactively hot. They are lethal to humans who approach them and even the robots sent to explore the melting cores are quickly fried; in 2017, TEPCO [lost two robots in two weeks](#). But some of the nuclear exclusion zone has been re-opened—at least officially—to resettlement, and the Japanese government is paying two million yen (about \$20,000) to people who move into the area.

Outside the core but still in the zone. An army of about 100,000 workers has spent a decade scraping up and bagging radioactively contaminated soil. Consequently, what were once the emerald green rice paddies of Fukushima's coastal plain are now filled with black plastic garbage bags holding mountains of radioactive dirt.



Drone photo giving an aerial view of some of the black plastic garbage bags containing radioactive soil from the Fukushima nuclear disaster. Some of the piles of bags are about five or six layers high, and cover several acres—as can be seen by the relatively small size of the adjacent trucks and heavy equipment. Image courtesy of Andreasz Podnieszinski

After a lighting ceremony at J-Village, the Olympic torch will be run for three days through Fukushima's nuclear exclusion zone. The zone is now a checkerboard of remediated areas and other places that are closed off behind accordion fences. Japan hopes to focus our attention on the refurbished schools and town halls, re-opened train stations, and two new museums that have been built in Fukushima, while trying to keep the TV cameras away from the ruined houses and radioactive cars lying nearby. The torch will then be run to Fukushima City, 40 miles to the northwest, where the first six Olympic games in softball and baseball are scheduled to be played after the games officially open July 23.

But is it safe to promote Japan's so-called "[recovery](#)" by sending athletes into a nuclear exclusion zone? The area has been tidied up and dotted with LED monitors showing the latest cesium releases from F1, comparable to the devices that measure airborne radiation

levels found in other parts of the world. But these airborne releases are only part of the story—and not the most worrisome part. In 2013, [scientists discovered](#) that Fukushima’s exploding reactors had showered Japan with microparticles, or little glassy beads, of radioactive cesium and uranium. Hot spots from these microparticles can be found in vacuum cleaner bags and automobile air filters as far away as Tokyo. Fukushima prefecture is full of radioactive hot spots, and these hot spots keep moving as microparticles are washed down from the forested mountains that make up 70 percent of the prefecture, researchers said in [Nature Scientific Reports](#).

In 2019, a [survey conducted for Greenpeace](#) found hot spots in the J-Village parking lot, where children participating in a youth soccer match were eating their lunch. Greenpeace measured radiation levels at over 71 microSieverts per hour (one microSievert is one-millionth of a Sievert, or one-thousandth of a milliSievert)—1,775 times higher than the normal reading in this area before the Fukushima disaster of about 0.04 microSieverts per hour. The elevated reading, which translates to roughly about 0.62 Sieverts over the course of a year, meant that anyone breathing dust from the J-Village playing fields could be ingesting radioactive particles—little death stars lighting the way to cancer and genetic mutation. Since then, researchers have found radioactive hot spots at the Azuma baseball stadium in Fukushima City and all along the route to be run by the Olympic torch bearers.



[File photo](#) of workers stacking bags of soil collected during Fukushima’s so-called decontamination and cleanup operations, a few months after the accident. Image courtesy of Ricardo Herrgott/Global 2000.

This casual attitude toward radiation is widespread. “We found a [disregard for global trends and a disregard for public safety](#),” said the parliamentary report on the Fukushima disaster, known as [The Official Report of The Fukushima Nuclear Accident Independent Investigation Commission](#). “Across the board, the commission found ignorance and arrogance unforgivable for anyone or any organization that deals with nuclear power,” the report’s authors concluded.

They went on to note: “What must be admitted—very painfully—is this was a disaster ‘Made

in Japan.’ ”

If Japan covered up the risks involved in building 54 nuclear reactors on its geologically unstable shores, it is now covering up the consequences. A government-sponsored study of radiation exposure in Fukushima prefecture [undercounted](#) people’s exposure by two-thirds. Australian physician Tilman Ruff, co-founder of the International Campaign to Abolish Nuclear Weapons (which won the 2017 Nobel Peace Prize), wrote me to say that doctors have left the area because the [government refuses to reimburse them](#) when they list radiation sickness as the cause for nose bleeds, spontaneous abortions, and other ailments resulting from ionizing radiation. (The only acceptable diagnoses are so-called “radiophobia,” nervousness, and stress.) The spike in thyroid cancer among children in Fukushima is dismissed as a survey error, produced by examining too many children.

The government has mounted no epidemiological study in Fukushima. It has established no baseline for comparing public health before and after the disaster. Instead, it has greenlighted the use of radioactive ash and soil from Fukushima in construction projects throughout the country, the [Japan Times](#) reported.

The generally accepted safety standard for radiation exposure is one milliSievert, or one-thousandth of a Sievert, per year. Different countries have different standards, but in the United States, the [Nuclear Regulatory Commission requires](#) that the operators of nuclear power plants limit the amount of their incidental radiation exposure to individual members of the public to 1 milliSievert (1,000 microSieverts) per year above the average annual background radiation, and this figure has become a sort of rough international average benchmark. (For comparison’s sake, the natural level of background radiation usually averages in the range of up to as much as 3 milliSieverts annually.)

But in its haste to deal with the Fukushima emergency in the months after the accident, the Japanese government simply raised the limit of what was considered an acceptable amount of incidental radiation coming from the now-defunct nuclear power plant. The Japanese government now allows individuals in Fukushima prefecture to be exposed to 20 milliSieverts per year of incidental radiation, above and beyond what was emitted naturally, reported [Scientific American](#). Figures like these are a far cry from that international average benchmark of 1 milliSievert annually.

To give a sense of scale, a figure in the 20 milliSieverts range means that a schoolchild in Fukushima can be exposed to the same amount of radiation as the average adult working *full-time* in a nuclear power plant.

The limit in the rest of Japan, outside of Fukushima’s environs, remains 1 milliSievert per year.

21st-century versions of *hibakusha*, or “bomb-affected people”? Anyone objecting to Fukushima’s 20-fold increase in allowable radiation exposure is criticized for promoting “harmful rumors.” After China and 50 other countries banned the importation of food from Fukushima on the grounds that it might be radioactive, the Japanese authorities reacted vehemently, and critics of the Japanese government’s response to the handling of anything related to Fukushima were treated like [economic saboteurs](#). Similarly, refugees from Fukushima are scorned in other parts of Japan, and the *Asahi Shimbun* reported “widespread bullying and stigmatization of evacuees.” This finding was echoed by the UK newspaper [The Independent](#), which said that “discrimination suffered by evacuee pupils [is] likened to that

faced by those who lived through the atom bomb blasts of the Second World War.”

Women from Fukushima are shunned as marriage partners, and a new kind of Fukushima divorce has emerged, with men returning to the area in greater numbers than their wives, who want to keep their children as far away as possible.

“Japan has clamped down on scientific efforts to study the nuclear catastrophe,” [said Alex Rosen](#), a pediatrician who co-chairs the German affiliate of International Physicians for the Prevention of Nuclear War. “There is hardly any literature, any publicized research, on the health effects on humans, and those that are published come from a small group of researchers at Fukushima Medical University, which are centered around the scientist Shunichi Yamashita, who in Japan is called ‘Mr. 100 milliSieverts.’ ” (Yamashita was the spokesman for the Japanese government in the early months of the catastrophe and led the Fukushima health survey for two years, before being forced to resign in 2013. Contradicting his earlier research and instructions to his own staff, Yamashita told the public that 100 milliSieverts of radiation was harmless. He recommended against administering iodine pills to prevent thyroid cancer, and told people that their best protection against radiation poisoning was literally to [smile and be happy](#).)



Image courtesy of Pixabay

Four thousand people continue to labor daily to contain the ongoing disaster at F1. They pump cooling water into reactor cores and fuel pools, while struggling to keep the damaged buildings from collapsing. More than a billion liters of contaminated water—the equivalent of 480 Olympic-sized swimming pools—are stored on-site in rusting tanks. Claiming that it has run out of storage room, TEPCO is [planning to release this water directly into the ocean](#). For years, TEPCO maintained that the water stored at F1 had been scrubbed of radioactivity, save for tritium, a water-soluble isotope that is said to be relatively safe. In 2014, TEPCO was forced to admit that its cleaning process had failed, and Fukushima’s cooling water is actually contaminated with high levels of strontium-90 and other radioactive elements.

From the day it opened, Fukushima Daiichi struggled to contain the groundwater that rushed down from the nearby mountains and flowed through the plant. Fukushima today is a swamp of groundwater and cooling water contaminated with strontium, tritium, cesium, and other radioactive particles. Engineers have laced the site with ditches, dams, sump pumps, and drains. In 2014, TEPCO was given \$292 million in public funds to ring Fukushima with an underground [ice wall](#)—a supposedly impermeable barrier of frozen soil. This, too, has failed, having “limited, if any effect,” Japan’s Nuclear Regulation Authority said.

In 2019, the Japan Institute for Economic Research estimated that the cost of cleaning up the Fukushima disaster could reach \$747 billion. But there is actually no such thing as saying that a nuclear disaster has been cleaned up. Lumps of radioactive fuel, concrete, and cladding remain lethal for tens of thousands of years. At Chernobyl, this lava-like mass, called the “[Elephant’s Foot](#),” has been buried under a mountain of concrete and covered again by a second, [\\$1.5 billion shield financed by the European Union](#), which some have dubbed the “sarcophagus.” Sensitive about looking like a failed nuclear power, Japan has vetoed the building of a similar concrete sarcophagus over Fukushima. Instead, relying upon technology yet to be invented, TEPCO plans to scoop up the fuel in its failed reactors and store the waste in some undisclosed location. In the meantime, Fukushima sits like an open wound on Japan’s eastern shore.

The takeaway? Among the new buildings meant to lure settlers back to Fukushima are two museums. In Tamioka, directly to the south of the power plant, a former energy museum has been converted into something called the Decommissioning Archive Center. Films depict actors replaying scenes from the disaster on one floor of the museum and demonstrate TEPCO’s “Progress of the Work” on another floor.

In the village of Futaba, directly to the north of the reactors, the government has erected a three-story building called The Great East Japan Earthquake and Nuclear Disaster Memorial Museum. A former boomtown filled with workers from the plant, Futaba used to have an archway over its main street, declaring, in bold letters, “Atomic Power: Energy for a bright future.” Yuji Onuma created this slogan for a ninth-grade homework assignment. He received a prize from the mayor.

Now living far from Fukushima and running a business installing solar panels, Onuma returned to Futaba one day a few years after the disaster. A photo from that visit shows him wearing a white Tyvek suit, booties, hat, and facemask. Behind him is Futaba’s main street, filled with crumbling buildings and overgrown with weeds. Above him is the archway that TEPCO financed. Over his head, Onuma holds a placard with red-letter writing on it, so the sign instead reads, “Atomic Power: Energy for a *destructive* future.”

The archway has since been removed and stored in Futaba’s new museum. Onuma wants it reinstalled, where the irony of having his slogan floating over the ruins of a dead city will remind everyone of their original mistake. At the least, he wants the sign put on display in the museum. “I made the wrong slogan,” he recently told an American interviewer. “But I’m glad that I realized my mistake before I died.”



Yuji Onuma and his wife, Serina, wearing traditional mourning suits and holding the ashes of his aunt, outside the entrance to the village of Futaba. Evacuated after the Fukushima disaster in 2011, she died alone in a refugee camp in October 2013; it was two weeks before her body was discovered. The Onumas are carrying her urn to the family grave in Futaba; because it lies in the nuclear exclusion zone, the cemetery can be visited only by special permission. Visitors must wear Tyvek suits and dosimeters, like the one that Mrs. Onuma is wearing around her neck. Photo courtesy of Yuji Onuma.

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Featured image: Yuji Onuma had come up with the slogan for the gate that originally hung above the entrance to his home village of Futaba, north of the reactors at Fukushima. It said, "Atomic Power: Energy for a bright future." After the disaster, he went back, with a new, handwritten correction in red, "Atomic Power: Energy for a DESTRUCTIVE future." Image courtesy of Yuji Onuma

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