Lessons from Fukushima

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Executive Summary

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Catalysing an energy revolution

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image A mother holds her baby at Yonezawa gymnasium, which is providing shelter for 504 people who either lost their homes to the tsunami, or live near the Fukushima nuclear power station.

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“For a successful technology, reality must take precedence over public relations, for nature cannot be fooled.”

Richard Feynman

image litate village, 40km northwest of the Fukushima Daiichi nuclear plant. Radiation levels found by the Greenpeace monitoring team are far above internationally recommended limits.

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It has been almost 12 months since the Fukushima nuclear disaster began. Although the Great East Japan earthquake and the following tsunami triggered it, **the key causes of the nuclear accident lie in the institutional failures of political influence and industry-led regulation**. It was a failure of human institutions to acknowledge real reactor risks, a failure to establish and enforce appropriate nuclear safety standards and a failure to ultimately protect the public and the environment.

Greenpeace International commissioned a report that addresses what lessons can be taken away from this catastrophe. The one-year memorial of the Fukushima accident offers a unique opportunity to ask ourselves what the tragedy – which is far from being over for hundreds of thousands of Japanese people – has taught us. And it also raises the question, are we prepared to learn?

There are broader issues and essential questions that still deserve our attention:

- How it is possible that – despite all assurances – a major nuclear accident on the scale of the Chernobyl disaster of 1986 happened again, in one of the world's most industrially advanced countries?
- Why did emergency and evacuation plans not work to protect people from excessive exposure to the radioactive fallout and resulting contamination? Why is the government still failing to better protect its citizens from radiation one year later?
- Why are the over 100,000 people who suffer the most from the impacts of the nuclear accident still not receiving adequate financial and social support to help them rebuild their homes, lives and communities?

These are the fundamental questions that we need to ask to be able to learn from the Fukushima nuclear disaster. This report looks into them and draws some important conclusions:

1. The Fukushima nuclear accident marks the **end of the 'nuclear safety' paradigm**.
2. The Fukushima nuclear accident exposes the **deep and systemic failure** of the very institutions that are supposed to control nuclear power and protect people from its accidents.

The end of the nuclear safety paradigm

Why do we talk about the end of a paradigm? After what we have seen of the failures in Fukushima, we can conclude that 'nuclear safety' does not exist in reality. There are only nuclear risks, inherent to every reactor, and these risks are unpredictable. At any time, an unforeseen combination of technological failures, human errors or natural disasters at any one of the world's reactors could lead to a reactor quickly getting out of control.

In Fukushima, the multiple barriers that were engineered to keep radiation away from the environment and people failed rapidly. In less than 24 hours following the loss of cooling at the first Fukushima reactor, a major hydrogen explosion blew apart the last remaining barrier between massive amounts of radiation and the open air.

The nuclear industry kept saying that the probability of a major accident like Fukushima was very low. With more than 400 reactors operating worldwide, the probability of a reactor core meltdown would be in the order of one in 250 years.

This assumption proves to be wrong. In fact, an observed frequency based on experience is higher: **a significant nuclear accident has occurred approximately once every decade**.

One of the principles of modern science is that when observations do not match the calculated predictions, the model and theory need to be revised. This is clearly the case for probabilistic risk assessments used in nuclear safety regulations. However, **the nuclear industry continues to rely on the same risk models** and supposedly extremely low probabilities of disasters, justifying the continued operation of reactors in Japan and worldwide.

This report exposes the systemic failures in the nuclear sector, specifically looking into three issues:

- emergency and evacuation planning;
- liability and compensation for damages; and
- nuclear regulators.

Human rights

In the **introduction,** Tessa-Morris Suzuki, Professor of Japanese History in the College of Asia and the Pacific at the Australian National University – who is also a member of the International Council on Human Rights Policy (ICHRP) – concentrates on the human rights angle of the Fukushima tragedy. She details how **disasters tend to reveal a whole range of cracks or weak points in social, economic and political institutions**, not only in the Japanese but also in an international context.

What becomes clear in her text is that the weaknesses in the regulation and management of Japan´s nuclear power industry have not been 'hidden' faults in the system. To the contrary, people had been aware of, written and warned about them for decades.

Emergency planning failed

In the **first chapter**, Professor David Boilley, chairman of the French Association ACRO, documents how even Japan, one of the most experienced and equipped countries when it comes to handling large-scale disasters, found that its **emergency planning for a nuclear accident was not functional**, and its evacuation process became chaotic, which lead to **many people being unnecessarily exposed to radiation**.

During the height of the crisis, the Japanese government frequently denied there were dangers from radiation releases. For example, on 12 March, the Chief Cabinet Secretary told a news conference that the reactor would not leak a large quantity of radiation, and that people outside a 20km radius would not be affected. Within two weeks of the statement, the government asked people living between a 20 and 30km radius of the disaster to voluntarily evacuate. Then, in late April, the government extended the evacuation zone to specific areas up to 50km. Again in June, July and August, the government asked more people outside the 20km evacuation zone to evacuate.

Governmental data released only later revealed that in a worst-case – but possible – scenario, evacuation would have included the megapolis of Tokyo and other settlements up to 250km away. Clearly, **evacuation planning based on circles with diameters of several kilometres is too rigid and hopelessly inadequate in the case of nuclear power plants**.

Special software for predicting fallout patterns was not used correctly. In some cases, people were evacuated to areas with more, not less, radiation. For example, the software predicted that a school would be in the path of a radioactive plume, yet the school was used as a temporary evacuation centre. Thousands stayed for days in an area that was very highly contaminated. In addition, radiation fallout scenarios developed in the early days of the crisis were never sent to the office of the Prime Minister, where decisions on managing the disaster were being made.

Evacuation procedures of vulnerable people failed. Patients from one hospital and a nearby home for the elderly were sent to shelters: 45 of 440 patients died after staff fled. In another incident, more than 90 elderly people were left without caregivers. Hospitals in Fukushima Prefecture have had to suspend services because hundreds of doctors and nurses in the area resigned to avoid radiation.

The Fukushima crisis also exposed that one of the key principles of nuclear emergency plans – confinement (recommending people to stay in their homes to avoid radiation exposure) – simply does not work in practice. Confinement is only possible for a short period of time, but not for 10 days, which turned out to be the necessary period of time as massive releases of radiation from the Fukushima disaster carried on this long. (Also in the case of Chernobyl disaster, the vast radiation release continued for nearly two weeks).

Communities where people were confined ran out of food, as well as fuel needed for eventual evacuation. In addition, specialised workers – such as drivers, nurses, doctors, social workers and firemen, who were needed to help those confined – were not prepared to stay in an area receiving large amounts of radiation.

The post-emergency situation is also riddled with problems. Pragmatic radiation standards introduced by the government are higher than internationally recommended limits. Japanese authorities keep failing to foresee the scale of problems with contaminated food and crops, and are repeatedly being caught by surprise. The government has insufficient programmes for monitoring and screening radiation levels, leading to scandals that further undermined the confidence of the public and caused unnecessary additional economic damages to farmers and fishermen and to their livelihoods. **Decontamination programmes to clean up highly contaminated areas pose big questions in terms of their effectiveness, costs and negative side effects**.

Lack of accountability

The **second chapter**, based on interviews by Dr David McNeill, the Japan correspondent for *The Chronicle of Higher Education* and journalist for *The Independent* and *Irish Times* newspapers, investigates probably the most dreadful face of the Fukushima accident – the human consequences. Over 150,000 people evacuated; they lost nearly everything and are denied sufficient support and compensation to allow them to rebuild their lives.

Most countries limit the liability of reactor operators to only a small fraction of real damages, which allows the nuclear industry to basically escape paying for the consequences of an accident. The Japanese legislation on liability and compensation stipulates that there is no cap on liability for a nuclear reactor operator – in this case TEPCO – for damages caused to third parties. However, it **does not include any detailed rules and procedures about how and when the compensation will be paid**. Nor does it define who is eligible and who is not. This leaves lots of space for interpretation.

TEPCO has so far **managed to escape full liability and fails to properly compensate people and businesses that have been dramatically impacted** by the nuclear accident. The larger compensation scheme excludes dozens of thousands of people who decided to evacuate voluntarily to reduce their risks of radiation exposure. Some have been offered only $1,043 US dollars as a one-off payment. TEPCO lawyers have also been trying to avoid their duty to pay for decontamination costs by claiming that the radiation, as well as the burden of dealing with it, now belongs to the landowners, not to the company.

Families have been split apart, and have lost their homes and their communities. People have lost their jobs and have had their living costs doubled in some cases – yet the first package of one-time financial support was limited to a rather symbolic $13,045 and arrived from TEPCO only after people were relocated for several months. What was supposed to be the first package of larger compensations began six months later when TEPCO provided people with a 60-page application form, accompanied by another 150 pages of instructions. Many people struggled to understand it, and many others simply gave up, choosing to forget and move on.

Importantly, Japanese law requires that TEPCO has compulsory insurance to cover $1.6bn, meaning that anything over this amount may not be available if the company faces inevitable financial difficulties or a bankruptcy. So far, the company has paid out compensation to citizens in the amount of roughly $3.81bn. The estimates of the real cost of damages are however in the order of $75 to $260bn. Overall costs of the Fukushima accident including compensation and decommissioning the Daiichi plant's six reactors have been projected to reach $500 to $650bn. It is clear already that the government will be stepping in, one way or the other, to bail out TEPCO. Most of the costs of the damage, if ever compensated, will be shouldered by taxpayers.

It is staggering to witness how the nuclear industry managed to build up a system whereby polluters harvest large profits, while the moment things go wrong, they throw the responsibility to deal with losses and damages to the impacted citizens.

Systemic failures

The **third chapter**, by Arnie Gundersen from Fairewinds Associates, looks into how it is possible that an accident like Fukushima happened at all. It finds that an 'attitude of allowed deception' existed between TEPCO and the state institutions in Japan that were supposed to ensure its citizens' safety. This deception characterises the institutional failures in Japan; failures that include **undue political influence on regulation of the nuclear industry**, allowing industry to lead the development of regulations and a dismissive attitude to the risks of nuclear accidents.

For example, even when the problems, weaknesses and scandals of TEPCO came to the surface, regulators never enforced sufficiently strong measures to avoid the same things from happening again and again and again. On occasions when regulators finally requested certain modifications, they allowed many years to go by before these were implemented. This is exactly what proved to be fatal in Japan in 2011.

Image A satellite image shows damage at the Fukushima nuclear power plant. The damage was triggered by the offshore earthquake that occurred on 11 March 2011.

In Japan, the **failure of the human institutions inevitably led to the Fukushima disaster**. The risks of earthquakes and tsunamis were well known years before the disaster. The industry and its regulators reassured the public about the safety of the reactors in the case of a natural disaster for so long that they started to believe it themselves. This is sometimes called the Echo Chamber effect: the tendency for beliefs to be amplified in an environment where a limited number of similarly interested actors fail to challenge each other's ideas. The tight links between the promotion and regulation of the nuclear sector created a 'self-regulatory' environment that is a key cause of the Fukushima Daiichi disaster.

It is symptomatic of this complacent attitude that the first concerns voiced by many of the decision makers and regulators after the accident were about how to restore public confidence in nuclear power – instead of how to protect people from the radiation risks. This has also been the case with the UN's International Atomic Energy Agency (IAEA), which **failed to prioritise protection of people over the political interests of the Japanese government, or over its own mission to promote nuclear power**. The IAEA has systematically praised Japan for its robust regulatory regime and for best practices in its preparedness for major accidents in its findings from missions to Japan as recently as 2007 and 2008.

Lessons to be learned

The institutional failures in Japan are a warning to the rest of the world. These failures are the **main cause of all past nuclear accidents**, including the accident at Three Mile Island in the US and the disaster at Chernobyl in Ukraine. There are a number of similarities between the Chernobyl and Fukushima nuclear disasters: the amounts of released radiation, the number of relocated people, and the long-term contamination of vast areas of land. Also the root causes of the accident are similar: concerned institutions systematically underestimated risks, other interests (political and economic) were prioritised over safety, and both industry and decision makers were not only fatally unprepared, but were allowed to establish an environment in which they existed and operated without any accountability.

Governments, regulators and the nuclear industry have stated they have learnt big lessons from the past. Yet, once again they failed to deliver. How confident can we be that the same will not happen again? But we have a choice. **Mature, robust and affordable renewable energy technologies are available and up to the task of replacing hazardous nuclear reactors**. During the last five years, 22 times more new power generating capacity based on wind and solar was built (230,000MW) compared to nuclear (10,600MW). Renewable power plants built in just the one single year of 2011 are capable of generating as much electricity as 16 large nuclear reactors.This is where the opportunity stands for a nuclear-hazard-free-future.

"For a successful technology, reality must take precedence over public relations, for nature cannot be fooled."

This statement is by one of the leading physicists of the past century, Nobel Prize winner Richard Feynman, written in 1987 in his minority report for a commission investigating the tragic disaster of the Challenger space shuttle. His analysis has astonishing parallels to the nuclear industry. He explains how the socio-economic influences of modern society led to a massive gap between official predictions and real-world risks of disastrous accidents of complex technologies. He notes the fact that, if things go well and accidents do not happen for a while, there is an inevitable watering down of regulation and precautionary principles. He also calls for the consideration of alternative technologies to do the job.

It took two lethal disasters to phase out the expensive and accident-prone space shuttles. Now, **we are living through the second major nuclear reactor disaster in history**. Let's not fool ourselves again: we have a responsibility to use this critically important moment to finally switch to a **safe and affordable supply of electricity — renewable energy**. All the worlds' reactors can be replaced within two decades.

In the meantime, we can learn from Fukushima that **nuclear power can never be safe**. If there is yet another major nuclear accident, the people who will suffer can be given better protection if we hold the nuclear industry and regulators fully accountable and liable. We must **put the nuclear regime under close public scrutiny** and require transparency. But again, while doing so, we have to **phase out dangerous nuclear power entirely**, and do so as soon as possible.

image Sampling soil to test for contamination, on the outskirts of Fukushima City, 60km from the sticken Fukushima Daiichi nuclear plant. Greenpeace is monitoring radioactive contamination of food and soil to estimate the health and safety risks for the local population.

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

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