



The Fukushima nuclear accident

Lessons learned and possible implications

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report is my personal observation based on the above reports and other publicly available information.

PREVENTION OF THE ACCIDENT: 'A MAN-MADE DISASTER'

How can we control nuclear weapons if we cannot control nuclear energy, asks Tatsujiro Suzuki of the Japan Atomic Energy Commission in his article. Highlighting the main points raised by the Japanese government investigation committee and the independent investigation committee, Suzuki provides an invaluable insight into the Fukushima accident in March 2011.

The Tohoku District-off the Pacific Ocean Earthquake and the resulting tsunamis struck the Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations of Tokyo Electric Power Co. (TEPCO) at 14:46¹ on 11 March 2011. A nuclear accident unprecedented in both scale and timeframe followed. Since then this has become an historic day to remember for all nuclear experts not only in Japan but also in the rest of the world.

More than 17 months have passed but the accident is not completely over. More than 100,000 residents in Fukushima are still living in temporary housing due to the evacuation that took place after the

accident and are still uncertain as to when they can return to their original hometowns. Although conditions at the Fukushima power stations have improved, it will take more than 30 years to remove melted fuel debris from the site. Still, we need to draw lessons based on the knowledge and information available so far to assure the safety of existing nuclear facilities and the possible implications this has for future nuclear energy policy.

Two important reports have been published, one by the government investigation committee (the Government committee)² and the other by the independent investigation commission (the Diet's commission)³ set up by the Diet – Japan's Parliament. The following

[1] All times herein are JST, which is nine hours ahead of UTC/GMT.

[2] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations, Final Report Recommendations, July 2012

[3] The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission (NAIIC), Final Report, July 2012.

This point was particularly emphasized by the Diet's commission. It concludes that the accident was a 'man-made disaster', i.e. the accident would have been preventable if the operators and regulators had acted properly based on the information available to them. In particular, the most important fact quoted in the report by the Diet's commission was that both the operator, TEPCO, and the regulator, the Nuclear and Industrial Safety Agency (NISA), had been aware since 2006 of the risk that a total outage of electricity at the Fukushima Dai-ichi plant might pose if a tsunami were to reach the level of the site. The report also concluded that there were many opportunities for taking preventive measures prior to 11 March. However, TEPCO did not take the necessary measures and NISA and the Nuclear Safety Commission (NSC) were aware of this. Meanwhile, the report by the Government committee concluded that the scale of the tsunami was 'beyond [the] imagination' of TEPCO and regulators, and also said that their preventive measures were insufficient against tsunami and severe accident.

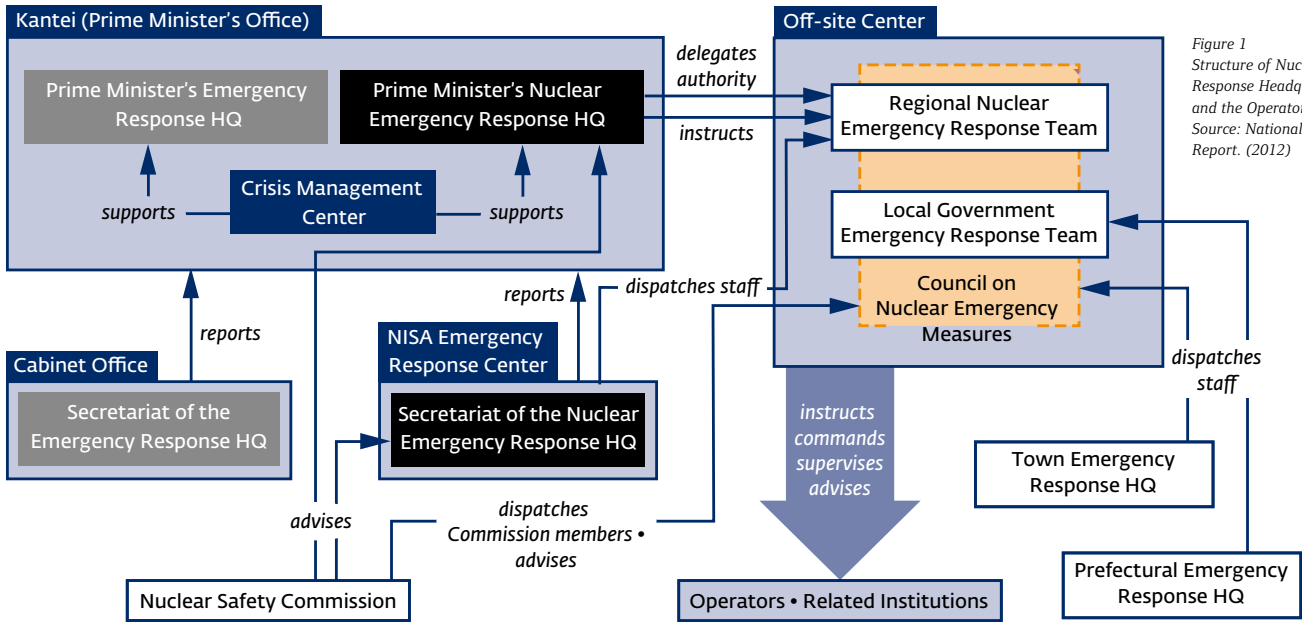


Figure 1
Structure of Nuclear Emergency Response Headquarters, Regulators, and the Operators
Source: National Diet Commission Report. (2012)

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EMERGENCY RESPONSE: 'UNPREPARED'

Both the Government committee and the Diet's commission concluded that both TEPCO and the regulators were unprepared for a tsunami and a severe accident, as well as for a so-called 'multiple disaster' (i.e. a natural disaster such as a big earthquake and tsunami and a severe nuclear accident that happened subsequently, which could cause much worse consequences than a single disaster). For example, the off-site emergency centre, which

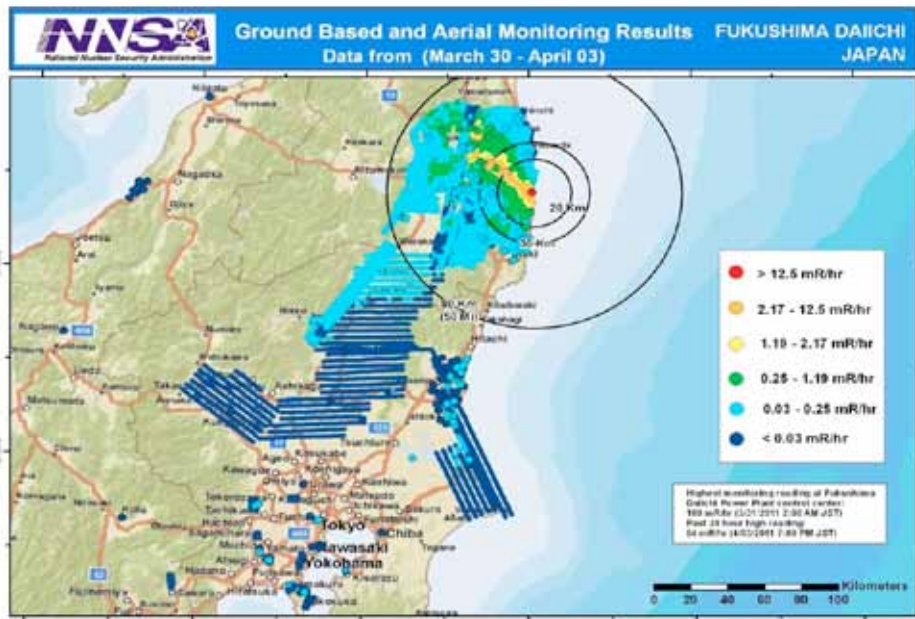
was supposed to play a central role in sharing information and coordinating an emergency response, did not function due to a loss of power caused by the earthquake. All staff needed to evacuate the centre later due to high radiation levels. As a result, information sharing and coordination among key players did not work well. (Figure 1)

The Government committee stated in its interim report published in December 2011³:

"The Investigation Committee is convinced of the need of a paradigm shift in the basic principles of disaster prevention programs for such a huge system, whose failure may cause enormous damage."

Both the Government committee and the Diet's commission concluded that, not only TEPCO and the regulators, but the central government,

*Combined results of 211 flight hours of aerial monitoring operations and ground measurements made by DOE, DoE and Japanese monitoring teams.
Source: National Nuclear Security Administration (NNSA) US Department of Energy*



[3] Investigation Committee on the Accident at the Fukushima Nuclear Power Stations, Interim Report, December 26, 2011

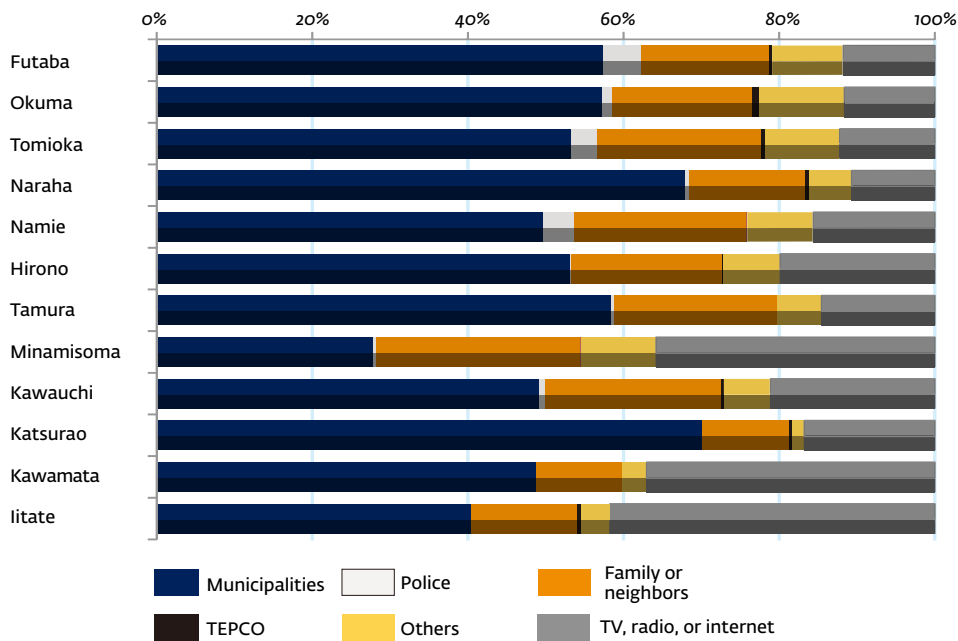


Figure 2
Sources of information about the evacuation instruction
Source: National Diet Commission Report. (2012)

in particular the Nuclear Emergency Response Headquarters (NERHQs) at the Prime Minister's office, was not prepared for a nuclear emergency. The Diet's commission concluded that the government, the regulators, TEPCO management and the Prime Minister's office lacked the preparation and the mindset to perform an emergency response. Miscommunication and mistrust among regulators, the Prime Minister's office and TEPCO were the result of poor crisis management by the government. The Government committee also recommended that the crisis management system for a nuclear disaster should be urgently reformed.

PROTECTING PUBLIC HEALTH: 'COMMUNICATION FAILURE'

Both the Government committee and the Diet's commission criticized the government for failing to communicate with the public in order to minimize the risk and concerns of the local population. In particular, both reports concluded that the government did not use the System for Prediction of Environmental Emergency Dose Information (SPEEDI) effectively. SPEEDI was intended to be utilized to inform the policy makers and the public which direction and how far the risk

of radiation hazards might spread. The government noted that the SPEEDI data were not disclosed initially because they were not reliable and thus were not helpful for evacuation purposes. Unfortunately, however, communication failure on the radioactive release hindered the effective evacuation of the local public. (Figure 2) The Diet's commission concluded that the government and the regulator are not fully committed to protecting public health and safety. On this point, the Government committee recommended that nuclear operators and the regulators should establish a systematic activity to identify all risk potentials from the "disaster victims' standpoint".

REGULATORY FRAMEWORK: 'CAPTURED BY THE UTILITY INDUSTRY'

One of the most important conclusions of both reports was the deficiency of a regulatory framework. In particular, the Diet's commission stated that the regulator was 'captured' by the utility industry, i.e. the utility industry, through its Federation of Electric Power Companies (FEPC), guided and controlled the regulatory process to serve their interests. According to the Diet's commission:

"..they [operators and regulators] repeatedly avoided, compromised or postponed any course of action...The FEPC has been the main organization through which this intransigent position was maintained...In fact, it was a typical example of 'regulatory capture,' in which the oversight of the industry by regulators effectively ceases."

As a result, the Japanese nuclear industry has fallen behind international standards in meeting the challenges of a tsunami and a severe accident. In short, they failed to keep up the global standard of the so-called five layers of 'defense in depth' strategy.

In order to reform this regulatory structure, both reports emphasized the importance of the "independence" and "transparency" for the newly established regulatory organization.

INTERNATIONAL DIMENSION: IMPORTANCE OF INFORMATION DISCLOSURE AND SHARING

Finally, the international dimension of the accident needs to be emphasized. In particular, information disclosure and sharing was considered insufficient, in particular with neighbouring countries. A

lack of adequate and timely information from Japan after the accident was cited as one of the reasons for increased concern about the risk of radiation. In this context, international monitoring of radioactive materials in the air and water can be very effective in providing an accurate picture of the consequences of the accident. In fact, the global network of radioactive monitoring stations established by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) was instrumental in reporting traces of radioactivity from the accident and sharing this information globally. Although the purpose of this network is to detect nuclear tests, monitoring radioactive materials (gases) in the air could be used to estimate the impact of serious nuclear accidents like Fukushima.

The Diet's committee recommended that "active and polite responses should be in place for prompt and accurate provision of relevant information with due consideration to language barriers." It also emphasized

Japan's role as a provider of disaster-related information to Japan and the world. It further recommended that "the new regulatory organization must establish an organizational framework that enables it to provide information in a timely and appropriate manner during an emergency."

CONCLUSION: FROM FUKUSHIMA TO THE WORLD

I would like to conclude with the following personal remarks.

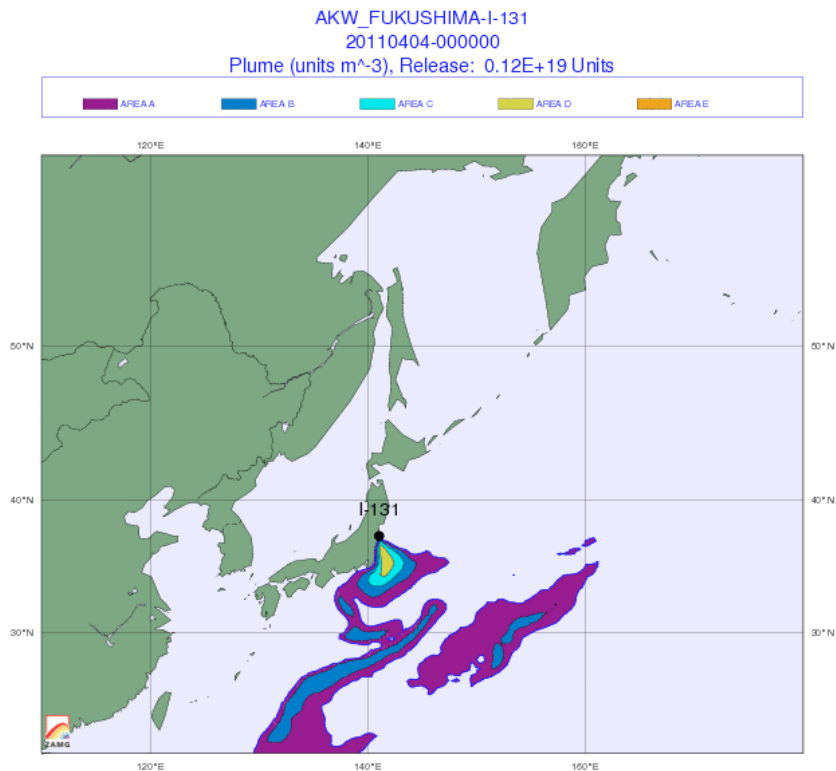
First, we should be able to overcome this tragic accident with our wisdom. Yes, this is an unprecedented crisis, but a crisis can be an opportunity. We will draw lessons and come up with innovative ideas to improve the safety of nuclear power plants and to clean up the site. If we cannot control nuclear energy, how can we control nuclear weapons? We should overcome this man-made disaster with a humble attitude towards nature, science and technologies. I truly appreciate in

this context that the international community can work together with Japan to overcome this crisis.

Second, let's make Fukushima a symbol of 'recovery'. Fukushima is now the victim of one of the most serious nuclear accidents in human history. But I sincerely believe Fukushima can become a symbol of 'recovery'. And this should be the goal of the Japanese Government and I will personally do my best to achieve this goal as a government official and as an individual.

Finally, in order to achieve the above two goals, I believe that the role of scientists can be extremely important. One of the important lessons we learned from the Fukushima accident is that closer collaboration between nuclear engineers/scientists and other fields of scientists, especially social scientists, is definitely needed to further improve the 'safety culture' of the nuclear community.

I sincerely hope that the lessons learned from the Fukushima accident can be shared by the global community and can be useful for improved safety and a better understanding of nuclear technology.



A regional dispersion simulation made by the Austrian Meteorological Service ZAMG

BIOGRAPHICAL NOTE

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has been a Vice Chairman of the Japan Atomic Energy Commission since January 2010. Before that, he was an Associate Vice President of the Central Research Institute of Electric Power Industry in Japan and Visiting Professor at the Graduate School of Public Policy, University of Tokyo. From 1988 to 1993, he was an Associate Director of the Massachusetts Institute of Technology's International Program on Enhanced Nuclear Power Safety. Dr Suzuki is also a former member of the Pugwash Council.

The opinions expressed in this paper are the author's and do not necessarily reflect those of the Japan Atomic Energy Commission or the Japanese government.