

Nuclear Safety: Learning from Past Accidents- A Japanese View

**Nuclear Safety and Security After Chernobyl and
Fukushima: Lessons Learned and Forgotten**

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Personal Reflections on the Fukushima accident

- **Fundamental shift in thinking about risk of nuclear energy.**
 - Risk is as large as risks of nuclear proliferation and nuclear security (I thought nuclear safety risk is smaller)
 - **Social/political/economic risks** are tremendously larger than I thought. It has become an **issue of human security**.
 - Protection of human lives is not good enough. **Release of radioactive materials which would cause long term impacts on society and environment should not be allowed.**
 - **About 13,000 people are still not living in their own homes** and are concerned about their health, future life and future of their homeland. It is heartbreaking to listen to their story, with anger, frustration and anxiety.
- **Assuring and restoring life and welfare of people affected by the accident is the top priority.**

Most Important Lessons Learned from Fukushima: “Thinking Unthinkable” and “Resilience”

- “*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.*” - from the Interim Report by the Gov’t investigation committee (Dec. 2011)
- “**Thinking unthinkable**” is essential in preparing for the emergency and for energy security.
- “**Resilience**” beyond “defense in depth” is needed for preparing “unexpected crisis”.
 - Resilience means a capability to **respond to “unexpected crisis” as well as to restore safe and secure status** of the social system.

Big Shifts in energy structure and public opinion

• Nuclear Power:

- Operating: **54 units [48.9GWe]**(2011/3) → **9 units [9.1GWe]** (2021/1) (7 units license approved but not operated yet, 11 units are under license process)
- Share of nuclear power: **25.9%** (2010) → **6.2%** (2018)
 - Coal (29%→38%). Natural Gas (28% →32%). Renewable (9% →17%)

• Public Opinion:

- “Nuclear power is necessary”: **87.4%** (2010/9) → **24.9%** (2013/12)
- “Nuclear power should be maintained: **9.3%** or expanded: **3.0%** (2019/10)= **12.3%**
- “Nuclear energy should be phased out: **49.4%** or shutdown immediately:**11.2%** (2019/10)= **60.6%**

Source : Japan Atomic Energy Relations Organization (JAERO), “Public Opinion on Nuclear Power: 2019 edition”, February 2020. <https://www.jaero.or.jp/data/01jigyuu/tyousakenkyu2019.html> ,

Japanese gov't and nuclear industry: unlearning the accident?

- **Strategic Energy Plan (2018)**

- “GOJ and nuclear operators must continue to reflect on the fact that they fell into the trap of the so-called “myth of safety”, resulting in the failure to adequately deal with the severe accident and prevent a disaster like this.
- Japan, which has experienced the accident at TEPCO’s Fukushima Daiichi Nuclear Power Station, is giving the top priority to safety regarding nuclear power when realizing the 2030 energy mix and making its energy choices for 2050 and is reducing its dependency on nuclear power as much as possible as it aims to expand renewable energy.”

https://www.enecho.meti.go.jp/en/category/others/basic_plan/5th/pdf/strategic_energy_plan.pdf

- **Still GOJ wants to maintain nuclear power** as a base-load electricity source and promote it as a “growth sector” in its “Green Growth Strategy towards 2050 Carbon Neutrality”.

METI, “Green Growth Strategy towards 2050 Carbon Neutrality”, December 25, 2020,

https://www.meti.go.jp/english/press/2020/1225_001.html

REMEMBER: Accident is NOT over-Risks and People's life of Fukushima (1)

- **Decommissioning of Fukushima-Daiichi**
 - **Contaminated Water: 2.1 Peta Bq** of Tritium (annual discharge at Fukushima before the accident was **0.002 Peta Bq/year**)
 - Public opposition to the current plan to release the tritium water to the sea (**only 13% is in favor**)
 - **Risks remain:** Earthquake on Feb. 13 may have caused damages to containment vessels of Unit 1 and 3. It is found that water level is decreasing
 - **No consensus on the end-state:** Undecided what to do with fuel debris and all other wastes including low-level contaminated soil from decontamination
 - Investigation on the accident still continues...
- **Total accident costs: 35 ~ 80 Trillion yen (\$300~700 Billion)** estimated by Japan Center for Economic Research (2019) vs METI's estimate (**22 Trillion yen**)

Accident is NOT over: Risks and People's life of Fukushima (2)

Difficult-to-return-zone (> 50 mSv/y)

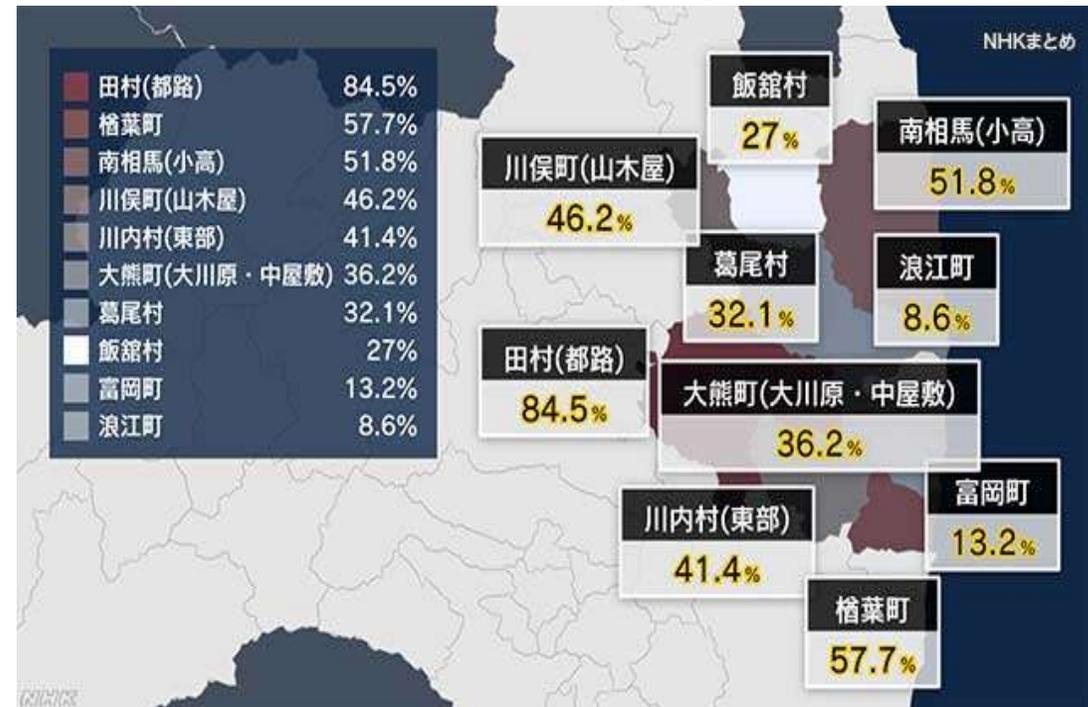


Now allowed to return (<20mSv/y)

<https://www.pref.fukushima.lg.jp/site/portal/cat01-more.html>

Ratio of people returned to home (2020/3)

~8.6% to 84.5%: ~13,000 people are still away from home



<https://www3.nhk.or.jp/news/html/20200311/k10012320891000.html>

Total compensation paid (2021/02/26): 9.7 Trillion Yen(\$92 billion)

https://www.tepco.co.jp/fukushima_hq/compensation/results/index-j.html

29 legal cases brought by the Fukushima residents/evacuated citizens

Safety/Security Culture Needs to be Enhanced (still)

- **Illegal entry by an employee** to Kashiwazaki Kariwa Nuclear Power plant (reported on Feb. 2021)
 - It was revealed that in September 2020, **an employee was illegally entering into a strictly controlled control room using another person's ID card**
 - *"It shows that the staff are not educated and the high awareness of security is not widespread. TEPCO is severely questioned. It can't be helped,"-Dr. Fuketa, Chairperson of Nuclear Regulation Authority (Feb. 3, 2021)*
(<https://www3.nhk.or.jp/news/html/20210203/k10012848211000.html>)
- **Japan Atomic Power Co. erased data** from the documents submitted to NRA (Feb. 2020) – **Data was omitted as they undermined the argument** that there was no “active geological fault underneath the Tsuruga Unit 2”.
(<https://mainichi.jp/articles/20200212/k00/00m/040/161000c>)

New, Independent, Tough, Nuclear Regulation Authority(NRA): Still not trusted?

- **Public opinion**
 - Is it possible to secure safety of nuclear power plants (after tougher new regulatory standards are set)?
 - Yes (7.1%), Probably (14.5%)=**21.6%**, Probably Not (15.1%), No (17.2%)=**32.3%**
- **Evacuation Plan is not included as a licensing process**
 - **Not clear who is responsible for approving the plan**
- **Not enough risk communication with the public**
 - **Need a communication platform among stakeholders on the risk of nuclear power plans**

Enhanced self regulation and Move towards Risk-informed regulation

- Japanese utilities established a **Japan Nuclear Safety Institute (JANSI)**, a Japanese version of INPO (Institute of Nuclear Power Operators), and other institutes to enhance self-regulation. But not enough.
 - Still it lacks “oversight” power (only “peer review”)
 - **Nuclear Risk Research Center(NRR)** ; Promote PRA and Risk-Informed-Decision Making
 - **ATENA(Atomic Energy Association)** : Improving communication with NRA
- ***“Core Damage Frequency(CDF) or Large Early Release Frequency (LERF) are great communication tools within the industry, between the industry and regulators, and between the nuclear establishment and the public. Yet, with few exceptions, they cannot be used with the public in Japan”***
 - George Apostolakis, Director of NRRC, “The Utilization of Risk Information in Japan”, Nihon Genshiryoku Gakkai-shi (Journal of Atomic Energy Society of Japan), Vol. 63, No. 2, 2021, pp.90-91.

Polarized debate inhibits constructive dialogue

- **Policy debate is often characterized by “pro-” or “anti-” nuclear power.**
- **As a result, it is difficult to discuss urgent and critically important issues with open-minded spirit.**
- Issues need to be resolved regardless of future of nuclear power include;
 - **Decommissioning of Fukushima Dai-ichi and Reconstruction of Fukushima**
 - **Nuclear Waste (Spent Fuel) management and Waste Disposal** (including plutonium stockpile)
 - **Assuring nuclear safety/security of existing nuclear facilities**
 - **Evacuation plan and citizens’ safety near the site**
- **Lack of independent oversight and reliable information source are undermining the credibility of policy debate**

Recommendations: Restoring public trust overcoming “polarized” debate

- Public trust has not been restored, and the **GOJ and nuclear industry must remember the lessons** of the Fukushima accident. **Accident is NOT over yet.**
- **Should focus on issues that need to be resolved regardless of future of nuclear energy to overcome “polarized debate”.**
- **Three measures are necessary to restore public trust.**
 - **Improved transparency and complete information disclosure**
 - **Public participation** in decision making process
 - **Independent oversight** organization for policy/technology assessment