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Who should have been in charge of decision-making in the extreme situation at Fukushima Daiichi?

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1. Introduction

■ ***The primary responsibility for nuclear safety is with the operator.*** [1]

■ ***The regulator must provide assurance that NPS are operated in a safe manner and in accordance with regulation.*** [1]

■ **Who should have been in charge of decision-making under the extreme situation at Fukushima Daiichi?**

[1]Diane JACKSON, Continuous shared learning and improvement of nuclear safety and regulatory organisations through the OECD/NEA, International Workshop on Nuclear Safety Regulation, Tokyo Japan, 18 January 2012

2. Role and responsibility for emergency

(1) U.S. NRC FRERP[2];

■ ***For a radiological emergency at a facility or site not under the control of a Federal agency, State and local governments have primary responsibility for determining and implementing measures to protect life, property and the environment outside the facility boundary. The owner or operator of a nuclear facility has primary responsibility for actions within the boundaries of that facility; for providing notification and advice to off-site officials and for minimizing the radiological hazard to the public.***

■ ***For radiological emergencies involving an area under Federal control the responsibility for onsite actions belongs to the Federal agency, while off-site actions are the responsibility of the State or local government.***

[2] NRC: Federal Radiological Emergency Response Plan (FRERP)-Operational Plan-, Federal Register, Vol. 61, No. 90, May 8, 1996

2. Role and responsibility for emergency

(2)A proposal from STUK's previous Director General Jukka Laaksonen[3]:

■Case A

In order to ensure optimized and well founded decisions during the acute phase of an emergency, it is important that the decisions are made by persons who have best understanding of the potential consequences of their decisions and who have trained decision making in similar situations.

■Case B

The decisions on plant site, aiming to ensure safety of the plant personnel and to minimize the total radioactive releases during the entire course of accident have to made by the responsible plant manager, based on the possible advice asked from operating staff and nuclear safety experts.

■Case C

The decisions concerning evacuations and other measures aimed to protect the general public during the acute phase have to be made by the head of the public rescue authority who is well aware of the local conditions and the resources available for protective measures.

[3] Jukka Laaksonen, Social and Institutional Management leading to Risk Mitigation of Nuclear Power, JAIF Symposium, Tokyo, 26 February, 2013

3. Good practices: acceptable voluntary decision-making

Case A of Laaksonen's proposal:

(1)***A total of five members*** ***wore full-face masks and headed for the Reactor Building (of Unit 1). With the help of flashlights, the members reached the Reactor Building where they manually opened five motor valves and at around 20:30 (on March 11), completed the formation of an alternative line of water injection into the reactor (before the radiation level of containment become critically high)*** **.(TEPCO report, p.36)** [4]

The decision to perform this action was made by the operators of Unit 1 voluntarily without the top-down directions from emergency management room. [5]

(2)***Prior to the earthquake, an oil tanker at the harbor refueled heavy oil into a tank on land. After the earthquake, however, the oil tanker suspended the fueling due to the evacuation and moved offshore to guard against the anticipated tsunami.*** **(TEPCO report, p.2)** [4]

This action prevented the oil tanker from crashing into the nuclear power plant.

[4] TEPCO report (APPENDIX Measures Taken at Fukushima Daiichi Nuclear Power Station and Fukushima Daini Nuclear Power Station), December 22, 2011

[5] Makoto Takahashi, Actions Less Known but Contributed to Mitigate Outcome of Fukushima Accident, Proceedings of Second International Seminar /Symposium on Natural Science and Technology -Resilience Engineering-, Tokyo, March 4, 2013

3. Good practices: acceptable decision-making

Case B of Laaksonen's proposal:

(1)*At 17:12 on March 11 when the Site Superintendent ordered that an alternative means of water injection be studied as part of Accident Management (AM) measures and a method for injecting water into the reactor using fire engines (installed on a lesson from the "Chuetsu-oki Earthquake").* (TEPCO report, p.36) [4]
At around 7:00 on March 12, *two fire-fighting vehicles of the Self-Defense Forces (SDF) arrived, and* after Prime Minister Kan departed from Fukushima Daiichi twelve firefighters of SDF started to *set up a water-supply to the Unit No.1.*
(TEPCO Report on initial responses, p.39) [6]
***This decision should be appreciated considering the battlefield situation he faced then.*[5] Core cooling of all the units using fire engines failed, but 'satisficing' of cooling molten core succeeded.**

(2)In order to remotely open the AO valve located under the high radiation dose for Wetwell vent, *the recovery team installed the compressor outside the Reactor Building. At around 14:00* (on March 12), *the recovery team started up the temporary compressor.(*TEPCO report, p.56) [4] *Plant Manager Yoshida exercised strong leadership with his dedicated staff. Although they sometimes made mistakes in judgment, they finally succeeded in overcoming the critical situation* beyond *emergency preparedness.*[7]

[6] Report on initial responses to the accident at Tokyo Electric Power Co.'s Fukushima Daiichi Nuclear Power Plant, December 22, 2011 TEPCO

[7] Masahiko Aoki and Geoffrey Rothwell, A Comparative Institutional Analysis of the Fukushima Nuclear Disaster: Lessons and Policy Implications, Energy Policy, June 26, 2012

3. Good practices: acceptable sole discretion

Case C of Laaksonen's proposal:

(1)*Fukushima Prefecture, acting on its own accord, issued an evacuation order for residents within 2km of the nuclear power plant at 20:50 on March 11, approximately 30 minutes before the national government's decision to set the evacuation area to a 3km radius around the Fukushima Daiichi Nuclear Power Plant.(National Diet report,Ch.3, p.77)*[8]

(2)*The fact that the governor of the Fukushima prefecture did not exercise this authority is one reason why iodine tablets were not distributed. (Diet report,Ch.4, p.84)* [8]

Miharu Town (located 50km west of Fukushima Dai-ichi NPP) *was aware of the potentially adverse side effects of iodine tablets. Yet, the town decided in an evening meeting on March 14 that everyone should take iodine tablets. The decision was made based on the information that prevailing winds from the nuclear power plant would bring the radioactive plume to the town on March 15. (National Diet report,Ch.4, p.81)* [8]

[8]The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission [NAIIC] report, July 2012

4. What is acceptable intervention by government?

■ *When President Carter visited TMI on April 1, 1979* (four days later from the occurrence of accident), *he was there to raise hope for an anxious nation. He was not there to intervene, but as an ex-nuclear submarine officer, he wanted to show the public that there was nothing to fear. President Carter did not involve himself with the decision-making at TMI, or in the investigation of its causes or consequences.* [7]

■ *At the Chernobyl accident which caused uncontrolled radioactive release into the environment Mikhail Gorbachev, the last General Secretary of the Soviet Union, determined to send 600,000 workers called "liquidators," meaning those who eliminated the consequence of the accident.*[9]

[9]Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine , The Chernobyl Forum: 2003–2005 Second revised version

5. Too many micro-interventions by the Kantei

■*The fact that the direct intervention by the Kantei, including the site visit to the Fukushima Daiichi NPP by the Prime Minister, led to disruption in the chain of command and gave rise to confusion at the scene of the accident. (National Diet report,Ch.3, p.64)*[8]

■*Intervening in the site of the disaster as a commander (of PM Kan) may create confusion on-site, and lead to a loss in the opportunity of making important decisions or lead to making wrong judgment.(Government final report, p.498)* [10]

■**The government's safety inspectors were largely absent from Fukushima Daiichi NPS from March 14 to when they returned on March 22, and a site was not under the control of a nuclear regulator.**

■**There were too many micro-interventions by the Kantei as the personal performance, but not macro-interventions as the Prime Minister. This excessive interventions by the Kantei including Prime Minister Kan, NSC Chairman Madarame, etc. impeded efforts such as injecting water by firefighters of SDF to mitigate the crisis at the Fukushima.**

Kantei : Office of the Prime Minister Kan, NSC Chairman Madarame , etc. NSC: Nuclear Safety Commission

[10]Government Investigation Committee [ICANPS] final report, July 23, 2012

6. Socially unacceptable decision-making

■**An issue on responsibility for emergency in U.S. NRC FRERP**[2] :

Is it acceptable that the licensee has primary responsibility for the following actions?;

-wetwell vent,

This ventilation presumed the availability of power supply and operation from the central control room. (Government final report, *p.38)*[10]

-drywell vent and

In the Fukushima accident where a meltdown occurred around 20:00 on March 14 and *the molten core had already exited the RPV, any discharge from drywell venting would not be expected to be scrubbed by the suppression pool.* [11]

-discharge of low-level contaminated water into the sea

The discharge of low-level contaminated water into the sea does not violate Article 62 of Reactor Regulation Act corresponding to a ban on dumping radioactive waste at sea (London Convention, 1996) which prohibits dumping from ships because the discharge at Fukushima is dumping from land-based sources.

[11] NRC,SECY-12-0157, ENCLOSURE 4 BWR Mark I and Mark II Containment Performance during Severe Accidents, Nov. 2011

7. Is government concurrence desired?

■ ***The TEPCO EOPs and SAMGs specify that the site superintendent shall determine if (injecting seawater and) containment venting should be performed. Although government permission is not specifically required before containment is vented, the site superintendent informed the government of his intention and received concurrence from government agencies to vent containment .*** **(INPO report, p. 10)[12]**

■ **METI Minister Kaieda ordered TEPCO to carry out the injecting seawater and venting based on Paragraph 3, Article 64 of Reactor Regulation Act because he was concerned that TEPCO hesitated about the implementation of injecting seawater and venting.**

EOP: Emergency Operating Procedure, SAMG: Severe Accident Guide Line

[12] INPO 11-005 Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, November 2011

8. The serious decision-making in the extreme situation

Case-1: Injecting seawater at 19:25 on March 12:

■ ***Plant Manager Yoshida's decision to defy his superiors who had instructed him to stop injecting seawater into the reactor prevented the disaster from becoming worse than it was. His decision is widely applauded by the public as having prevented a more serious accident.***

■ ***On the other hand, RJIF report cautions against praising his "runway" behavior, even if his judgment were right in retrospect, "the site manager cannot substitute for" what is the government's responsibility.*** [7] [13]

■ ***Plant Manager Yoshida said, "I thought that this was ultimately my judgment at a time when everything was so dispersed and nobody knew what the chain of command actually was." (National Diet report,Ch.3, p.66)***[8]

Can his rejection of senior decision be acceptable?

[13] NPO "Rebuild Japan Initiative Foundation" [RJIF] Report, pp. 118−9, March 11, 2012, (in Japanese)

8. The serious decision-making in the extreme situation

Case-2: Wetwell vent on March 12:

■ ***At 7:11 Prime Minister Kan met with Site Superintendent Yoshida at Fukushima Daiichi and demanded to know why the venting had not yet been implemented. Site Superintendent Yoshida reported that they were aiming for 9:00 for venting. After Prime Minister Kan departed from Fukushima Daiichi, information confirmed that part of the residents in Okuma town had not been evacuated yet. Based on a confirmation of the evacuation situation, a schedule to have venting around 9:00 was conveyed to Fukushima Prefecture. The Unit 1 scheduled venting could not be implemented around 9:00. The coordination with Fukushima Prefecture on evacuation of residents took priority over approval of Prime Minister. After confirmed that the evacuation of Okuma town residents had been completed, the vent of MO valve was implemented at approximately 9:15. TEPCO confirmed that the D/W pressure decreased at 14:30.*** (*Diet report,Ch.3,*p.8) [8](TEPCO report, p.33)[4]

■ ***The TEPCO procedures require management to be knowledgeable about the status of evacuations and to coordinate venting with local authorities.*** (INPO report, p.11)[12]

Can this priority be acceptable?

8. The serious decision-making in the extreme situation

Case-3: Drywell vent on March 15:

■***Neither the Fukushima plant nor the TEPCO head office appeared to be hesitant about the implementation of D/W venting. (National Diet report,Ch.3, p.23)*** [8]

■***Two minutes after midnight on March 15, the operators opened the small air-operated drywell vent valve (AO-208). The vent line lineup was complete, except for the rupture disk that remained closed. The operators rechecked their lineup and found that the small air-operated drywell vent valve had already failed closed. (INPO report, p.27)***[12]

■***After repetitious attempts to vent failed at Unit 2, a burst is presumed to have occurred at 6:00 on March 15. (National Diet report,Ch.2, p.30)*** [8]

■***At 10:30 on March 15 METI Minister Banri Kaieda ordered TEPCO to perform D/W venting as needed. (TEPCO report, p.219)*** [4] **This order became ex-post-facto approval of D/W venting.**

■**TEPCO decision may become socially unacceptable.**

After a burst, the background dose rate near the main gate at Fukushima Dai-ich increased from 3μSv/h to 300μSv/h. After that, it has continuously decreased to less than 20μSv/h. If TEPCO had succeeded D/W venting, the background dose rate would have decreased in a short period.

Can D/W venting be acceptable?

8. The serious decision-making in the extreme situation

Case-4: Discharge of low-level contaminated water into the sea on April 4:

■ **On April 1** ***the Kantei did not approve of the discharge of contaminated water into the ocean. (National Diet report, Ch3, p29)[8]***

■ ***TEPCO and NISA explained to Prime Minister Kan, Chief Cabinet Secretary Edano and METI Minister Banri Kaieda, while preparing the documents and got their consent by 15:00 on April 2. (Government interim report, p.397)[14]***

■ ***Minister Kaieda gave his basic approval in regards to a policy that ocean release was judged as inevitable. At this time, Special Adviser Hosono, who was present, said that he would obtain approval from the Official Residence. (TEPCO report, p.381) [4]***

■ ***If TEPCO had taken countermeasures to dispose of contaminated water immediately after the accident, it is highly likely that it could have avoided the situation in which it was necessary to discharge the contaminated water into the ocean. Furthermore, as TEPCO released its announcement on the discharge of the contaminated water to the press on short notice—just before the actual discharge—it carried out the action without obtaining the full understanding of parties concerned. (Diet ,Ch3, p28) [8]***

[14]Interim Government Investigation Committee [ICANPS], interim report, Dec 2011

9.Who should have been in charge of decision-making in the extreme situation?

■**Who should have been in charge of decision-making shown in the following table under the extreme situation at Fukushima Daiichi?**

■**What decisions made by site superintendent shall you endorse if the delegation of authority changed from TEPCO top management or Minister of regulatory authority to site superintendent?**

Decision-making	Consequence	Fukushima accident		Ultimate approval authority
		Decision-maker	Approval authority	
Seawater injection to RPV	Core Cooling	Site superintendent	None (Site superintendent)	Site superintendent
W/W vent (Filterd vent)	Regional low-level radioactive fallout	Site superintendent	Prime Minister (But coordination with Fukushima Prefecture took priority over approval of PM)	Who should have been in charge of decision-making?
D/W vent (Direct release)	Regional high-level radioactive fallout (Failure of vent)	Site superintendent	TEPCO top management (ex-post-facto approval by Minister of regulatory authority)	Who should have been in charge of decision-making?
Discharge of low-level contaminated water into the sea	Global marine pollution (Before notification to IAEA, relevant domestic organizations and foreign governments)	Site superintendent, TEPCO top management and NISA	Minister of regulatory authority and Prime Minister	Who should have been in charge of decision-making?

10. Worst practices on regulator concurrence

■*An explosion did not occur in the reactor building of Fukushima Daiichi Unit 2. This is considered to be because the blow-out panel on the top floor of the reactor building was opened due to the explosion at Unit 1, and this accelerated ventilation of the Unit 2 reactor building.*(TEPCO final report, p.427) *[15]*

■The blow-out panels of Fukushima Daiichi Units 1, 3 and 4 were not opened even by the the Great East Japan Earthquake, and the leaked hydrogen accumulated at the reactor building and caused an explosion.

■According to regulator requirement, TEPCO strengthened so that *the blow-out panels* (which was non-safety system to protect the physical integrity of secondary containment) *at the Fukushima Dai-ichi NPS were securely installed to avoid easy removal on a lesson from the "Chuetsu-oki Earthquake" that the blow-out panels of the R/Bs at the Kashiwazaki-Kariwa NPS had moved easily. (Government interim report, p.248)*[14]
This is thought to be because the worst measure for the blow-out panel was implemented due to a lack of mutual trust between regulator and licensee. Who should have been in charge of this decision-making ?

[15] TEPCO final report, Fukushima Nuclear Accident Analysis Report, June 20, 2012

11. Conclusion -SAMG lessons raised by Fukushima

■ The EOPs and SAMGs specify that the site superintendent shall determine. Although government and regulator permissions are not specifically required, their concurrences are desired.

■ By facilitating mutual trust between regulator and licensee as 'independence' does not imply 'isolation', it should be clarified in the SAMGs or Nuclear Emergency Preparedness who is in charge of making the best possible decisions as the prerequisite that the unexpected event will inevitably happen in the future.

Thank you for your attention