

Letters from Quake-hit Japan — Stories Unfolding amidst Tragedies —

Material prepared for
Disaster Management
in Asia Seminar Series
“Japan in Crisis:
Exploring the Consequences
of a Cascading Disaster”

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Minami-sanriku, Miyagi Prefecture (Source: Kyodo News, via AP)

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Note: The crisis in Japan is still ongoing. Therefore, it should be noted some of data in this presentation are tentative and subject to revision afterwards.

Slide No. 2

Letters from Quake-hit Japan — Stories Unfolding amidst Tragedies —

A Tentative Assessment of the Tohoku-Pacific Ocean Earthquake

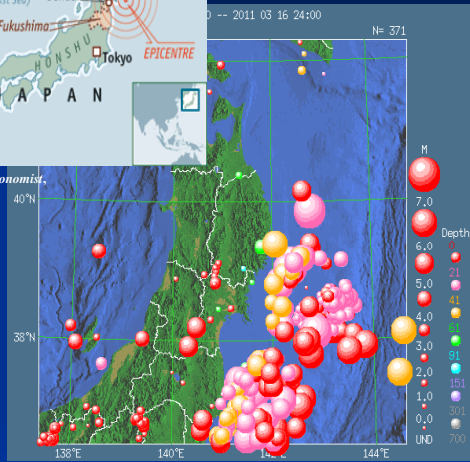
- 1. Disaster Diagnoses (Tentative)**
Series of huge earthquakes, tsunamis, and resultant blackouts . . .
- 2. Disaster Responses amidst Cascading Disasters**
Disaster responses during the first TWO hours after the earthquake
- 3. Nuclear Power Plant (NPP) Disaster Management**
Organizational structure of Japan and the case of Fukushima I NPP
- 4. Evaluations (Tentative)**
Preparedness, responses, recovery, communications and globalization

1.1. Trembling Earth

Quakes between
Mar. 10 and 16
Number of Quakes:
 $M \geq 7$: 4; $7 > M \geq 6$: 43



Source: *The Economist*,
March 11, 2011



Source: Japan Meteorological Agency (JMA)

Mar. 10	6:24	off Sanriku Coast	6.6
Mar. 11	14:46	off Sanriku Coast	9.0
	15:06	off Sanriku Coast	7.0
	15:15	off Ibaragi Coast	7.4
	15:26	off Sanriku Coast	7.2
	16:15	off Fukushima Coast	6.8
	16:29	off Sanriku Coast	6.6
	17:19	off Ibaragi Coast	6.7
	17:47	off Fukushima Coast	6.0
	20:37	off Iwate Coast	6.4
Mar. 12	0:13	off Ibaragi Coast	6.6
	3:59	Niigata-Chuetsu	6.6
	4:03	off Sanriku Coast	6.2
	4:47	off Akita Coast	6.4
	5:11	off Sanriku Coast	6.1
	10:46	off Fukushima Coast	6.4
	22:15	off Fukushima Coast	6.0
	23:43	off Iwate Coast	6.1
Mar. 13	7:13	off Fukushima Coast	6.0
	8:25	off Miyagi Coast	6.2
	8:25	off Miyagi Coast	6.2
	10:26	off Ibaragi Coast	6.4
	20:37	off Fukushima Coast	6.0
Mar. 14	14:02	off Ibaragi Coast	6.2
	15:13	off Fukushima Coast	6.3
Mar. 15	18:50	off Fukushima Coast	6.3
	22:31	Eastern Shizuoka	6.0
Mar. 16	0:24	off Sanriku Coast	6.0
	12:52	off East Coast of Chiba	6.0

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1.2. Lethal Danger Is NOT Quakes BUT Tsunamis

Slide No. 4

All Nuclear Power Plants
Withstood Quakes,
but



Sendai City, Miyagi Prefecture (Source: *Nihon Keizai Shinbun*)



JASDF Matsushima Air Base, Miyagi Prefecture (Source: *Kyodo*)



Kesennuma, Miyagi Prefecture (Source: *Kyodo*)

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1.3. Blackouts, and Lack of Fuels, Water, and . . .

Slide No. 5

No. of Houses Suffering Blackouts, Unit: Million

	Time	Tokyo Electric	Tohoku Electric	Notes
Mar. 11	15:30	4.05	4.40	
	20:00	3.94	4.38	
	22:00	3.44	4.40	
Mar. 12	0:00	2.58		
	4:00	1.62		Tokyo: 0
	5:00	1.44	4.40	Kanagawa and Shizuoka: 0
	6:00	1.24	4.40	Saitama and Yamanashi: 0
	7:00	1.77	4.40	Gunma: 0
	10:00	1.00	4.11	
	21:00	0.45	2.30	
Mar. 13	15:00	0.26	1.58	
Mar. 14	16:00	0.07	0.97	Chiba and Tochigi: 0
Mar. 15	14:00	0.05	0.76	(Ibaragi: 5,100)
Mar. 16	22:00	0.03	0.48	(Ibaragi: 2,561)
Mar. 17	19:00		0.36	

Note: The size of the largest blackout in the Tokyo metropolitan area in recent years is the case of August 14, 2006, when 1.26 million houses suffered the blackout.

Source: Tokyo Electric Power Company (TEPCO) and Tohoku Electric Power Company

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1.4. Unfolding Tragedies and Spreading Fears of Nuclear Disasters

Rising Death Toll					Radiation, as of Mar. 22 19:00; Unit: μ Sv.	
Death	Miss- ing	In- jured	Isolat- ed in inac- cessible areas	Evacu- ees	Map Labels	
3/14	4,227	8,194	2,282	16,150	429,180	Sapporo, Hokkaido: 0.028
3/17	5,692	9,508	2,409	16,160	389,870	Akita: 0.035
3/19	7,348	10,847	2,603	22	366,858	Aomori: 0.022
3/20	8,133	12,272	2,612	4,140	362,887	Yamataga: 0.095
3/21	8,649	13,261	2,644	-	337,300	Niigata: 0.046
3/22	9,080	13,565	2,675	-	268,510	Morioka, Iwate: 0.033
						Fukushima I NPP 367.90 (Peak: 11,930 (3/15))
						Utsunomiya, Tochigi: 0.148
						Mito, Ibaragi: 0.378
						Saitama: 0.114
						Tokyo: 0.054
						Narita Airport
						Chigasaki, Kanagawa: 0.138
						Ichihara, Chiba: 0.106

Radiation Level, Unit: μ Sv.
 Chest X-Ray Test: 50
 Tokyo-New York round trip: 200
 Abdominal X-Ray Test: 600
 Chest CT Scan: 6,900
 Maximum Acceptable Level per year: 80,000
 Higher Risk of Cancer: 100,000

Source: Author's compilation based on statistics published by various organizations

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2.1. Emergency Responses: (1) Timeline: First 50 Minutes Slide No. 7

14:46 Quake off Sanriku Coast M9.0

- 14:46 **Nuclear and Industrial Safety Agency (NISA)**, the Japanese counterpart of the U.S. Nuclear Regulatory Commission (NRC), establishes an emergency headquarters
- 14:49 **Fire and Disaster Mgmt Agency (FDMA)**, through J-Alert, a satellite warning system, warns 37 local governments against huge tsunamis
- 14:50 **Prime Minister's Official Residence** sets up an emergency team, aiming at (1) damage assessment, (2) ensuring the safety of people, (3) recovery of infrastructure, and (4) providing of accurate information
- 15:06 Quake off Sanriku Coast M7.0
- 15:14 **Central Disaster Mgmt Council** is established
- 15:15 Quake off Sanriku Coast M7.4
- 15:15 Tsunami 3.2m Ofunato, Iwate
- 15:21 Tsunami 4.1m Kamaishi, Iwate
- 15:21 Tsunami 4.0m Miyako, Iwate
- 15:21 **Bank of Japan (BOJ)** sets up a disaster mgmt team
- 15:26 Quake off Sanriku Coast M7.2
- 15:27 Prime Minister orders the **Japan Self-Defense Forces (JSDF)** to make a maximum effort for disaster response
- 15:30 **Tokyo Electric Power Company (TEPCO)** makes its first announcement: All reactors of nuclear power plants (NPPs), found automatically shut down; it also reports blackout of 4.05 million houses

Source: Author's compilation from various materials

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2.2. Emergency Responses: (2) Timeline: Next 70 Minutes Slide No. 8

- 15:37 Gov't convenes the 1st Central Disaster Mgmt Council
- 15:42 TEPCO reports to NISA about malfunctioning of **Fukushima I NPP's** Reactor Nos. 1, 2, and 3
- 15:50 Tsunami 7.3m at Soma, Miyagi
- 15:57 Quake off Ibaragi Coast M6.1
- 16:00 Gov't convenes the 2nd Central Disaster Mgmt Council
- 16:00 NISA initiates an emergency headquarters to collect information on 55 nuclear reactors in Japan
- 16:15 Quake off Fukushima M6.7
- 16:29 Quake off Sanriku M6.6
- 16:30 TEPCO makes its second announcement: All NPPs are under control but **7 thermal power plants** have been closed
- 16:36 TEPCO reports NISA about malfunctioning of the emergency cooling systems of **Fukushima I NPP's** Reactor Nos. 1 and 2
- 16:36 Prime Minister's Official Residence sets up an emergency headquarters
- 16:45 TEPCO reports to NISA about malfunctioning of **Fukushima I NPP's** Reactor No. 2

Source: Author's compilation from various materials

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3.1. Nuclear Emergency Responses at Fukushima I NPP

amidst Continuing Quakes and Tsunamis

Tohoku Electric Onagawa NPP

Miyagi Prefecture

Fukushima Prefecture

TEPCO Fukushima I NPP

Pacific Ocean

TEPCO Fukushima II NPP

Evacuation

3/11 20:50: 2km (1.2 mi.)
 3/12 01:45: 3km (2.4 mi.)
 3/12 05:44: 10km (6.2 mi.)
 3/12 18:25: 20km (12.4 mi.)

No. 1: 3/11 15:42

No. 2: 3/11 15:42

No. 3: 3/11 15:42

No. 4: 3/15 09:38

19:03: Nuclear Emergency

Hydrogen Explosions
 3/12 15:36: No. 1
 3/14 11:01: No. 3

Explosion and Fire
 3/15 06:10: No. 2
 3/15 09:38: No. 4

Cooling reactors with seawater and boron
 3/12 20:20: No. 1
 3/13 13:12: No. 3
 3/14 16:34: No. 2

3/12 07:45: Nuclear Emergency

Evacuation (Fukushima II NPP)
 3/12 07:45: 3km; 17:39: 10km

Source: Author's compilation based on materials published by Prime Minister's Official Residence
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3.2. Nuclear Emergency Responses Situation at Fukushima I Nuclear Power Plant (NPP)

Slide No. 10

Time to Examine the "Myth" about Nuclear Power Safety

1. Disaster Preparedness

Difficulty of predicting tsunami impacts on NPPs

Cooling system: Brittleness of the triple safety system—Power lines and generators

2. Disaster Responses

Recovery operations amidst earthquakes and tsunami warnings

Inevitable human errors

Disruption of communications and evacuation

Difficulty of handling simultaneously occurring crises (Fukushima I and II)

3. Disaster Recovery

Long way to restore "trust" and to scrap "safely" Fukushima I

Difficulty of restoring activities in radiation contaminated areas

4. Evaluations (Tentative)

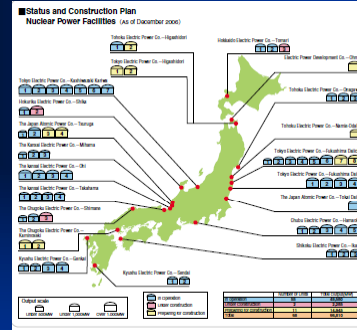
Disaster preparedness: Structural strength of NPPs, Redesigning contingency plans

Importance of communications: Intra- and inter-organizational, and public

4.1. Evaluations (Tentative)

Slide No. 11

- 1. Disaster Preparedness:** Effectiveness and Efficiency Are of Great Essence
Redesigning contingency plans regarding, e.g., rolling blackouts, metropolitan commuters, hospitals, and elderly people
- 2. Disaster Responses:** Resources Are Limited and Speed is of Great Essence
Assessment and prioritization of simultaneously occurring crises
Sophistication of organizational structure for optimum division of labor
- 3. Disaster Recovery:** A Pile of Uncertainties
Fiscal strength of Japan's economy
Restoration of global supply chain networks
Legal consideration of the reconstruction of tsunami-hit areas
Resuscitation of quake-hit communities and social capital
- 4. Evaluations:** Time to Think Seriously
Disaster preparedness:
Structural strength of NPPs
Implications of globalization:
Information travels fast and forcefully like tsunami
Importance of communications (accountability & transparency):
domestic and global



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4.2. Implications of Globalization: Photos and Fears Travel Fast on the Globe



Disaster Management Center, Minami Sanriku, Miyagi, (Source: Kyodo)



Fukushima I NPP (Source: New York Times/AFP)



Tokyo (Source: Nihon Keizai Shimbun)



Fukushima Prefecture (Source: New York Times/Asahi Shimbun/European Pressphoto Agency)

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