

Post-Fukushima Nuclear Safety Scheme

— In Search of a Confluence of Nature and Science —

Material prepared for
the 5th Annual
Institute for Security
and Development Policy
(ISDP)-

Academy of Military
Science (AMS)/
军事科学研究院
Joint Conference:
'Crisis Management'

October 19~21, 2012
Rival Hotel
Stockholm, Sweden



Tsunamis Attacking Fukushima Daiichi Nuclear Power Plant (Source: TEPCO)

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Disclaimer: The views expressed in this presentation are those of the author and do not necessarily reflect those of CIGS or NAIIC.

Post-Fukushima Nuclear Safety Scheme

—In Search of a Confluence of Nature and Science—

Here in Stockholm, the Author Wishes to Share the Lessons Learned from the Bitter but Valuable Experience at the Fukushima Tragedy:

*Toward A More Robust, Effective and Efficient,
Versatile and Resilient, and Collaborative Scheme*

1. Personal Memories: Japan and Sweden

As a Japanese who cherishes enduring memories connecting the two countries in difficult times, especially a memorable friendship between Swedish Generals (Helge Victor Jung and Carl August Ehrenswärd) and an Imperial Japanese Army General (Makoto Onodera).

2. Personal Memories: Japan and China

As a Japanese whose grandfather, a captain of Japan's ocean liner, had a lot of Chinese friends including Admiral Sà Zhènbing (萨镇冰) prior to the tragic wars between the two countries, and whose father, former chairman of the Japan Library Association, was frequently invited by the Chinese national and Shanghai municipal governments.

Post-Fukushima Nuclear Safety Scheme

—*In Search of a Confluence of Nature and Science*—

*Now is the Time for Making Lemonade from Fukushima Lemons
(Zhuǎn Huò ér Wéi Fú, Yīn Bài ér Chéng Gōng/轉禍而為福，因敗而成功)
To Share the Lessons Learned from the Bitter but Valuable Experience
at the Fukushima Tragedy*

Lessons Learned:

Not to Be Complacent and Study Strenuously!

1. Keep A Humble and Cautious Attitude toward Nuclear Technology and Accidents

As August Strindberg warns:

“What men call success serves always as a basis for their next failure
(*Det människan kallar framgång blir alltid anledningen till deras nästa motgång*).”

2. Maintain A Strenuous Effort toward a Confluence of Nature and Science

As Johann Wolfgang von Goethe teaches:

“Profoundly learned I would grow, . . . Nature and science I desire to know
(*Ich wünschte recht gelehrt zu werden, . . . Die Wissenschaft und die Natur*).”

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

Crises: A Typology

A Typology of Collective Stress Situations

	Global/National	Regional	Segmental	Local
Sudden	Nuclear war Enemy invasion Economic crash Rebellion	Earthquake Tsunami Typhoon/Hurricane Major flood Nuclear plant meltdown <i>(Severe Accident)</i>	Cyber/Mechanical malfunction <i>(Global Supply Chain)</i> Ethnic massacre Corporate layoff Expropriation of property of a class	Blackout <i>(in the Tokyo region)</i> Tornado Explosion Terrorism Ghetto riot Plant closing
Gradual	Global warming Environmental decay Depression Epidemic Government breakdown	Drought Famine Price collapse Land exhaustion	Aborigines dying off Obsolete occupation Group discrimination Addictions to harmful substances	Decline of main industry Environmental pollution Land sinking Coal seam fire
Chronic	Poverty Endemic disease Wartime bombing Colonialism	Backward regions Endemic disease Civil war	Enslavement Class discrimination Persecution Gender discrimination	Slum, ghetto High crime areas

Source: the author's modification and rearrangement of a table in Allen H. Barton's article, "Disaster and Collective Stress," in *What Is A Disaster? New Answers to Old Questions*, edited by Ronald W. Perry and E.L. Quarantelli, 2005.

0.2. Implications of the Globalization Age: 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)

Post-Fukushima Nuclear Safety Scheme

—In Search of a Confluence of Nature and Science—

Now is the Time for Transforming Disaster to Good Fortune, Failure to Success

(Zhuǎn Huò ér Wéi Fú, Yīn Bài ér Chéng Gōng/轉禍而為福，因敗而成功)

To Share the Lessons Learned from

the Bitter but Valuable Experience at the Fukushima Tragedy:

Toward A More Robust, Effective and Efficient,

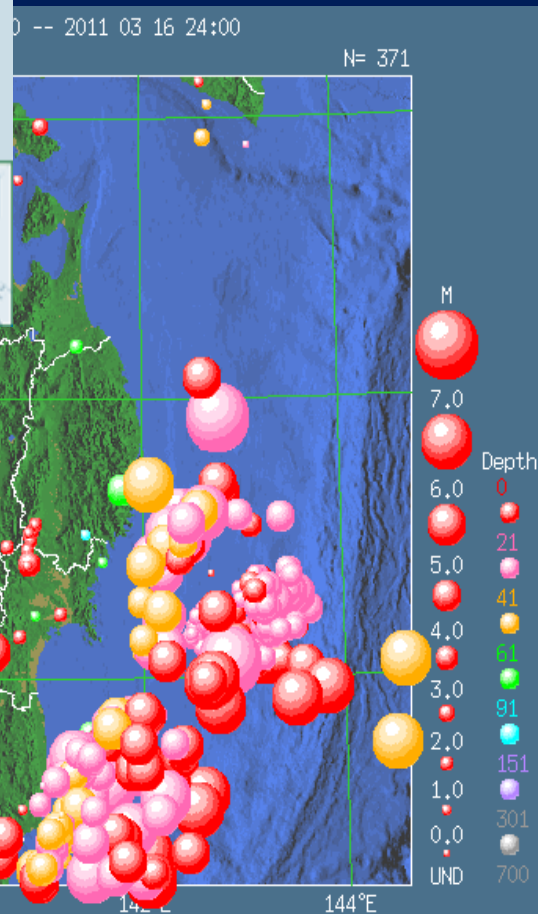
Versatile and Resilient, and Collaborative Scheme

- 1. The Fukushima Disaster: A Complex and Catastrophic Crisis**
Series of the 3/11 Earthquakes, tsunamis, and resultant blackouts . . .
- 2. Emergency Responses amidst Cascading Disasters**
Crisis management during the first critical hours of the 3/11 Crisis
- 3. Disruptions of Communication and Organizational Cacophony**
Sporadic disruptions of communication and organizational disharmony within crisis management team exacerbated the crisis situation
- 4. Evaluations: Problems re: Communication and Collaboration**
Preparedness, communication, Multi-sector collaboration in the globalization era.

1.1. Trembling Earth



**Quakes between
Mar. 10 and 16**
**Number of Quakes,
(Richter Magnitude Scale)**
M ≥ 7: 4; 7 > M ≥ 6: 43



Source: *The Economist*,
March 11, 2011

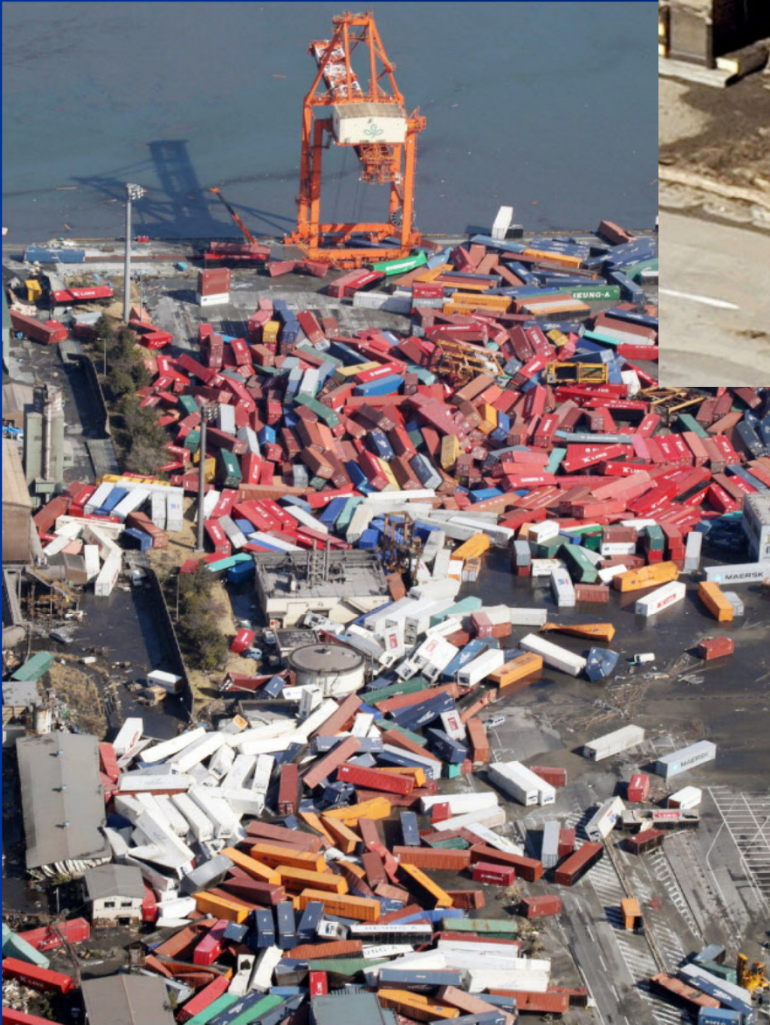
Source: Japan Meteorological Agency (JMA)

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 Cost of Chiba	6.0

1.2. Lethal Danger Is NOT Quakes BUT Tsunamis

Slide No. 8

All Nuclear Power Plants
Withstood Quakes,
but



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



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



Kesennuma, Miyagi Prefecture (Source: Kyodo)

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

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	

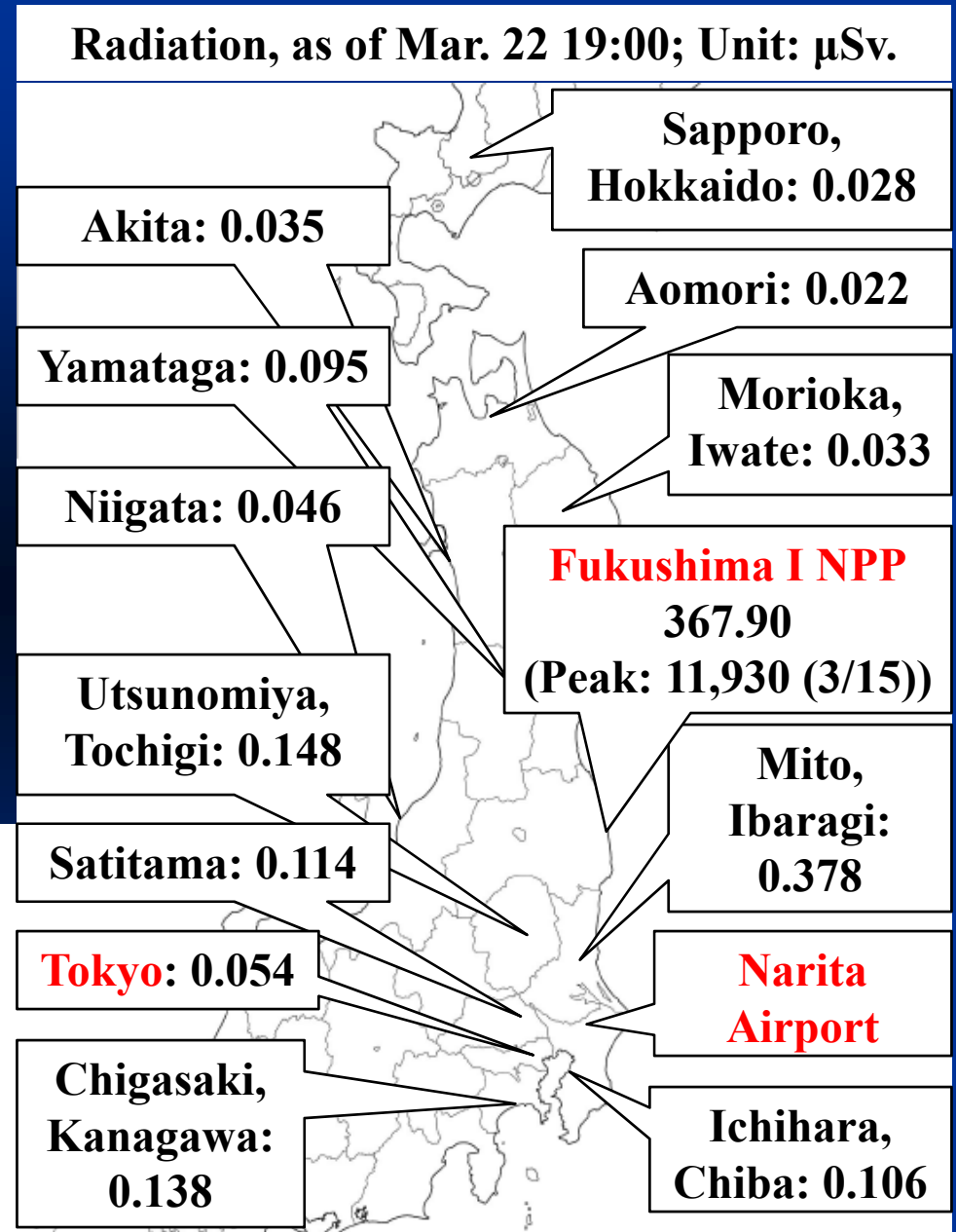
Note: The size of the largest blackout in the Tokyo metropolitan area in recent years is the case of August 14, 2006, when 1.26 million houses suffered the blackout.

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

1.4. Unfolding Tragedies and Spreading Fears of Nuclear Disasters

Rising Death Toll Primarily by Tsunamis

	Death	Missing	Injured	Isolated in inaccessible areas	Evacuees
3/14	4,227	8,194	2,282	16,150	429,180
3/17	5,692	9,508	2,409	16,160	389,870
3/19	7,348	10,847	2,603	22	366,858
3/20	8,133	12,272	2,612	4,140	362,887
3/21	8,649	13,261	2,644	-	337,300
3/22	9,080	13,565	2,675	-	268,510



Radiation Level, Unit: μSv .

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

1.5. Evaluation: Crisis Management at the Time of the Great East Japan Earthquake

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*

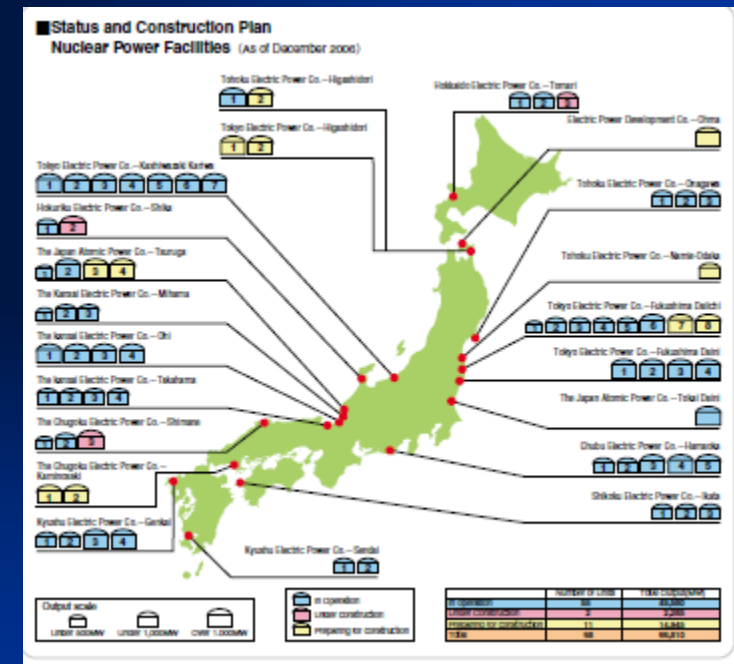
4. Evaluations: Time to Think Seriously

*Disaster preparedness: Institutional and Organizational Restructuring of Nuclear Policy
Implications of globalization:*

Information travels fast and forcefully like tsunami

Importance of communications (accountability & transparency):

Both domestic and global



Source: Nuclear Safety Commission (NSC)

2.1. Emergency Responses: Timeline (1): First 1 Hour Slide No. 12

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 tsumamis

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 **Tokyo Electric Power Company (TEPCO)** establishes an emergency headquarters

15:06 Quake off Sanriku Coast M7.0

15:14 **Central Disaster Management Council** is established

15:15 Quake off Sanriku Coast M7.4, Tsunami 3.2m Ofunato, Iwate

15:21 Tsunami 4.1m Kamaishi, Iwate, Tsunami 4.0 m Miyako, Iwate

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

15:27 **The first tsunami attacks TEPCO Fukushima Daiichi** Nuclear Power Plant (NPP)

15:30 **TEPCO makes its first announcement:** All reactors of NPPs, found automatically shut down; it also reports blackout of 4.05 million houses

15:35 **The second tsunami attacks TEPCO Fukushima Daiichi NPP**

15:37 **Fukushima Daiichi NPP: Station Black Out (SBO)**

15:37 **Gov't convenes the 1st Central Disaster Management Council**

15:42 **TEPCO reports to NISA about malfunctioning of Fukushima I NPP's** Reactor Nos. 1, 2, and 3

2.2. Two Tsunamis Paralyzed Fukushima Daiichi

Slide No. 13

All Nuclear Power Plants Withstood Quakes, but at Fukushima I NPP



Two Tsunamis Brought Station Black Out (SBO) to Fukushima Daiichi 49 Minutes after the Quake



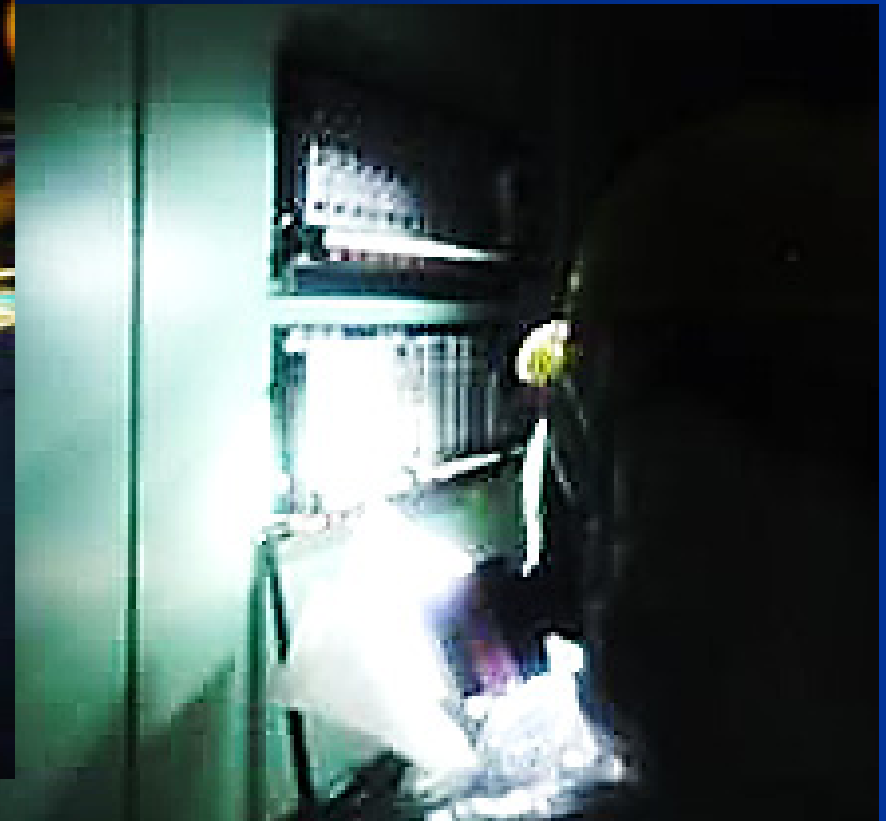
2.3. Fighting against the Clock in the Cold, Dark and Contaminated Rooms

Slide No. 14

A Herculean Effort Spearheaded by the “Fukushima Fifty” at the NPP



Reading Gauges amidst
Seismic Aftershocks and
Relentless Tsunami Warnings



2.4. Emergency Responses: Timeline (2): Next 3.5 hours Slide No. 15

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 all 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

16:36 Fukushima I NPP prepares a vent operation of Reactor No. 1 (Implemented 22 hrs. later)

16:45 TEPCO reports to NISA about malfunctioning of **Fukushima I NPP's** Reactor No. 2

17:35 Ministry of Economy, Trade and Industry (METI) Minister endorses an emergency announcement

17:42 METI Minister arrives at Prime Minister's Official Residence for the emergency

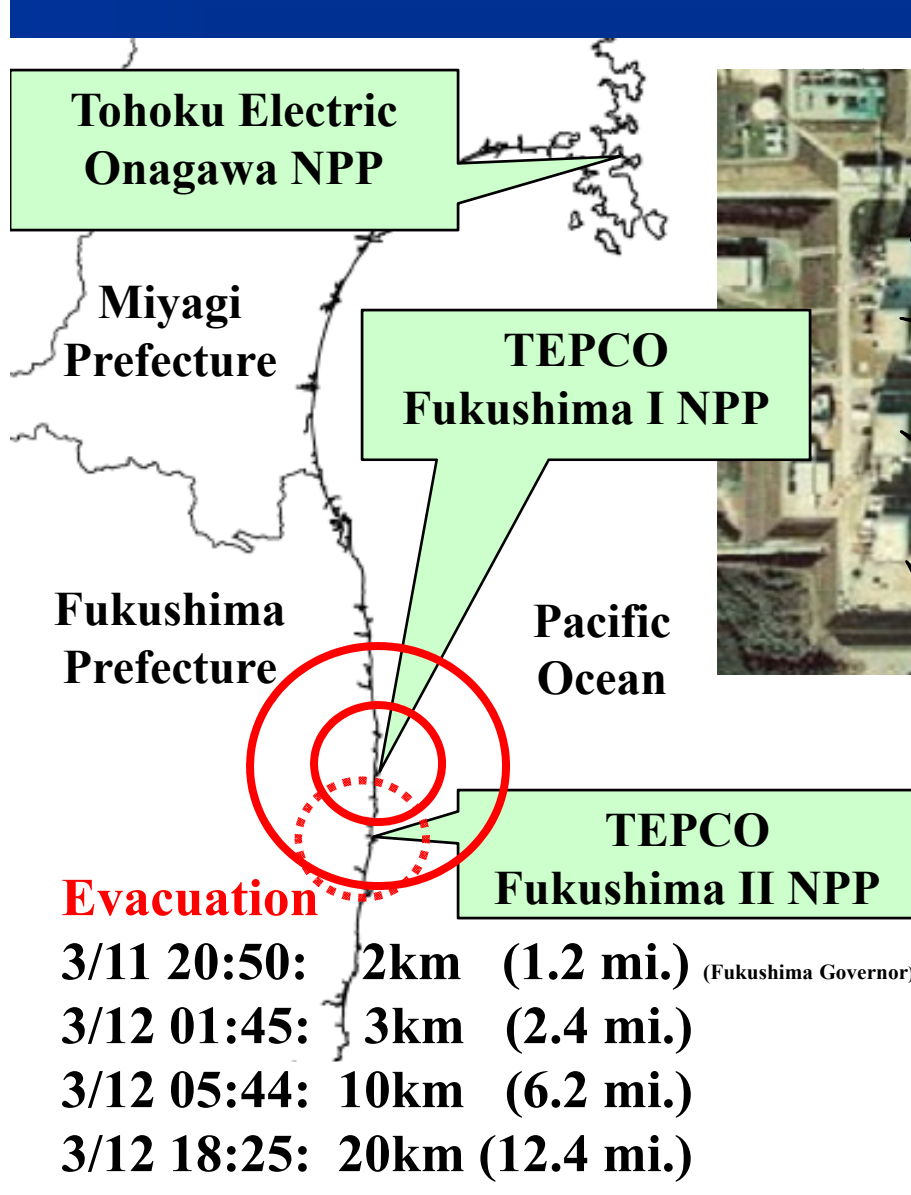
18:12 Prime Minister meets with opposition party leaders until 18:50

.... (Lapse of Time without Any Concrete Actions) . . .

19:03 Prime Minister declares a nuclear emergency

2.5. Emergency Responses at Fukushima I NPP

Slide No. 16



amidst Continuing Quakes and Tsunamis

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

2.6. Imperative Scientific Approaches to Rehabilitate Contaminated Nature

The Contaminated Area Is Extremely Limited Compared with the 1986 Chernobyl Disaster ⁽¹⁾. . . .

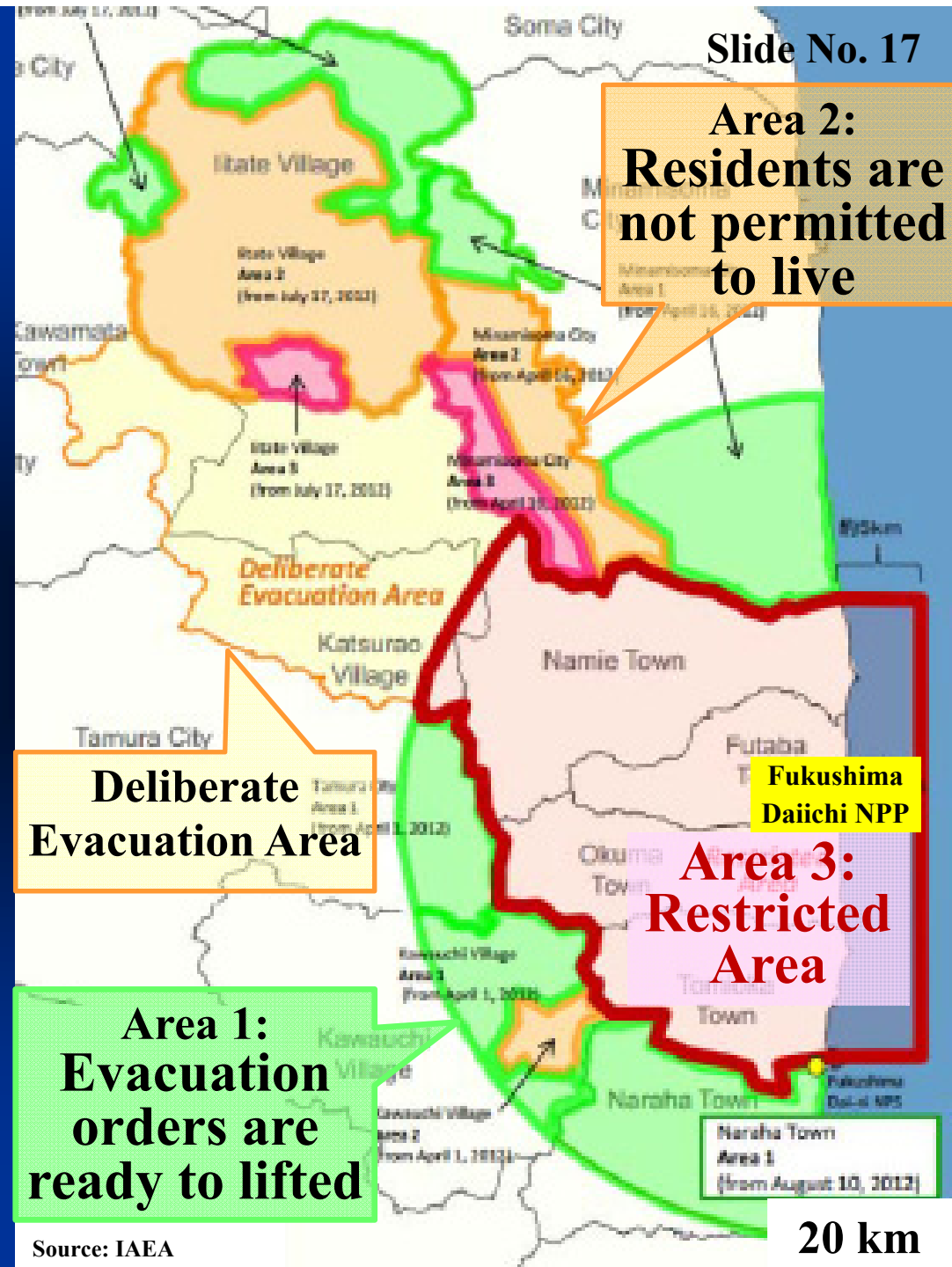
(1) Estimated iodine-131 equivalent radioactive material released in the air at the Fukushima accident was 17 million curies, while 378.4 million curies at the Chernobyl case.

But A Painful Process to Come

Japanese and Russian Wrecked NPPs (Fukushima and Chernobyl) presented at the same center on the same scale



Source: <http://matome.naver.jp/odai/2131468288290995401/2131481678194194803>



Slide No. 17

Area 2:
Residents are not permitted to live

Deliberate Evacuation Area

Area 1:
Evacuation orders are ready to be lifted

Area 3:
Restricted Area

Fukushima Daiichi NPP

Naraha Town Area 1
(from August 10, 2012)

20 km

Source: IAEA

3.1. Post-Fukushima Nuclear Security Scheme

Slide No. 18

Time to Examine the “Myth” about Nuclear Power Safety

*Not A Feeble, Ineffective and Inefficient, Limited and Brittle, and Separate Scheme
But A More Robust, Effective and Efficient, Versatile and Resilient, and Collaborative Scheme*

1. Disaster Preparedness

Difficulty of predicting tsunami impacts on NPPs

Ill-designed Crisis Management : Underestimation of Sever Accidents

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 NPP

Difficulty of restoring activities in radiation contaminated areas

4. Evaluations

Redesigning disaster preparedness: NPP Security System, Redesigning contingency plans

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

Importance of Multi-sector collaboration: Integrated incident Command System

*Not A Feeble, Ineffective and Inefficient, Limited and Brittle, and Separate Scheme
But A More Robust, Effective and Efficient, Versatile and Resilient, and Collaborative Scheme*

1. Disaster Preparedness: More Robust, Not Feeble

*Building of A Communication System to Elaborate A Crisis Management Plan
Building of A Communication System for a Well-informed Nation or Region*

2. Disaster Responses: More Effective and Efficient

*Building of A Communication System within the Crisis Management Team
Building of A Communication System for Intra-Agency Collaboration
Knowledge Communication for Crisis Assessment and Monitoring
Knowledge Communication for Crisis Response to Specific Needs
Risk Communication for Disaster Mitigation and Evacuation
Mass Communication for Prevention of Ungrounded Rumors*

3. Disaster Recovery: More Versatile, Resilient and Collaborative

*Postmortem Analyses to Share and Restore the Lessons Learned
Knowledge Retention/Prevention of Knowledge Loss
Knowledge Dissemination to Enhance a More Resilient Nation or Region*

3.3. Multi-Agency Collaboration Problems

Slide No. 20

Beyond Cultural and Physical Constraints

Types	Challenges
Organization	Clear and effective leadership: Competent Incident Commander Adequate multi-agency response procedure: Smart Incident Command System Clear and reasonable role and responsibility of each agency Clear coordination principle of conflicting goals
Communication	Clear common communication structure Communication of accurate, consistent, and complete information Communication with an appropriate interval
Information/Knowledge Management	Adequate knowledge/information management Clear common operational picture
Situation Awareness	Entire membership of coordinating agency Adequate common situation awareness Adequate understanding of each agency's role, capability, and resources
Equipment	Adequate and compatible communications technology Common level of sophisticated equipment
Cultural Issues	Compatible procedures Adequate understanding of each agency's organizational culture
Training	Sufficient multi-agency training exercise Each agency's working experience with other agencies

Source: the author's modification and rearrangement of a table in the article of Paul Salmon *et al.*, "Coordination during Multi-agency Emergency Response: Issues and Solutions," *Disaster Prevention and Management*, Vol. 20, No. 2 (April 2011).

4.1.1. Postmortem Analysis: First Responders

Slide No. 21

Amidst the Catastrophe, the Planned Scheme Was Evaporating

—Disaster response is merely the continuation of war by other means—

TEPCO: Absence of Key Incident Commanders (ICs)

*Chairman (in China, returned to TEPCO HQ on 12th at 16:00),
and President (in Nara, on 12th at 09:00);*

Obscure incident command system (ICS)

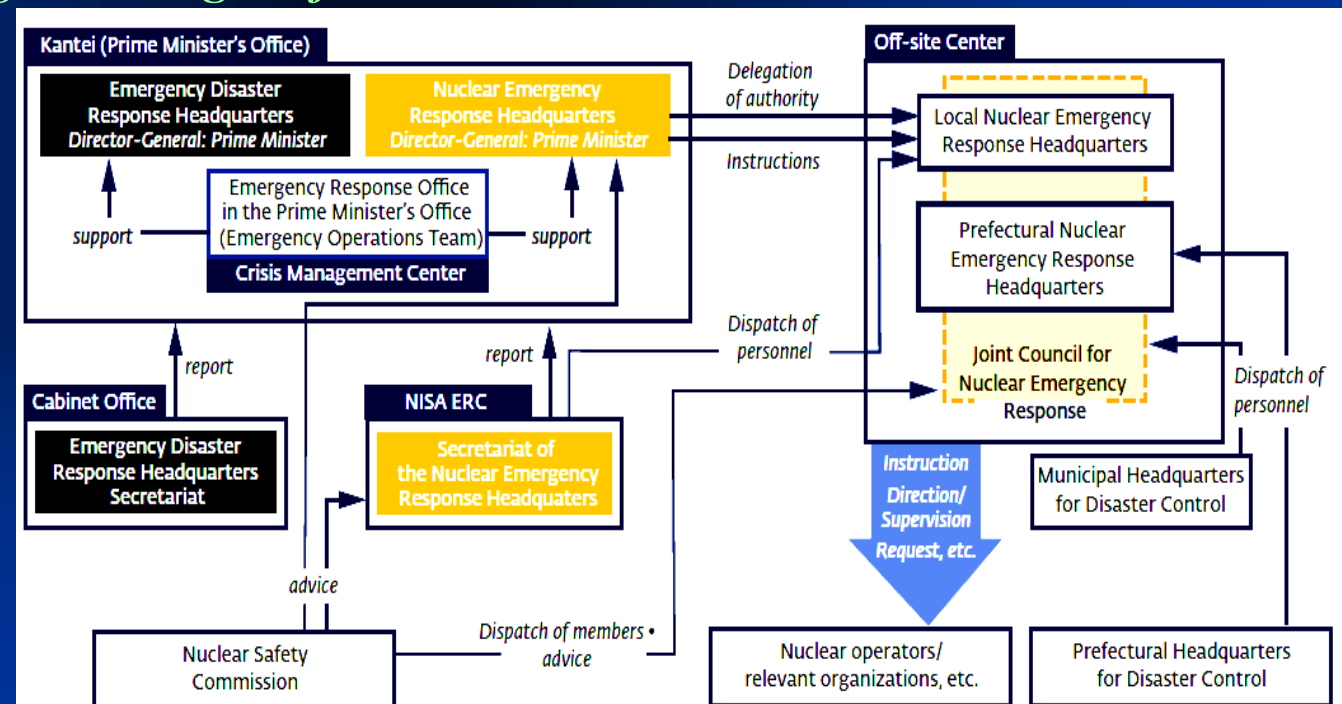
Governments: Serious Damage to the Off-site Center and Key Infrastructure

Ill-trained ICs (NISA) and Incompetent Advisors (NSC),

Obscure ICS and Prime Minister's Direct Intervention

Neglecting the Danger of Mobile Phone and Radio Communications

At the time of the 3/11 Crisis, the government's pre-crisis plan proved to be based on a **sandy foundation (obscure ICS)** with optimistic scenarios, leading to the establishment of *ad hoc* crisis management scheme



Source: NAIC, Final Report, Figure 3.2.1-1

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4.1.2. Postmortem Analysis: *ad hoc* Scheme

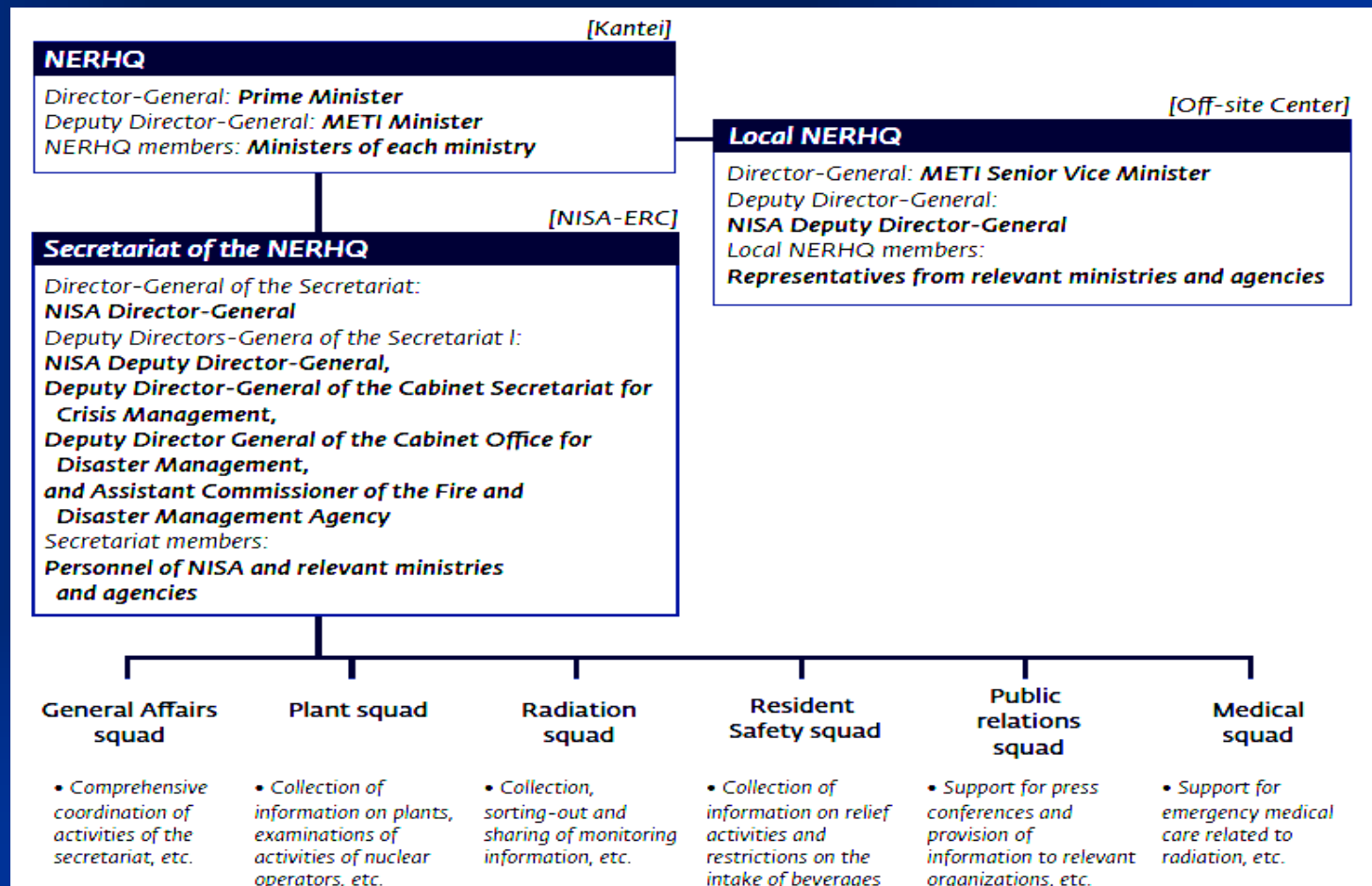
Slide No. 22

‘Improvised’ Crisis Management Emerged

*Government: Serious Damage to the Off-site Center and Key Infrastructure
 Ill-trained ICs (NISA) and Obscure ICS and Govn’t Silo Structure
 Prime Minister’s Direct Intervention*

*Local Governments: Serious Damages amidst Multiple Disasters
 Neglecting the Danger of Mobile Phone and Radio Communications*

Amidst the complex and catastrophic crisis, the prime minister was preoccupied with the nuclear crisis, passing other parts of crisis management to the hands of his subordinates.



Source: NAHC, Final Report, Table 3.2.2.-1

Jun KURIHARA, Canon Institute for Global Studies (CIGS)

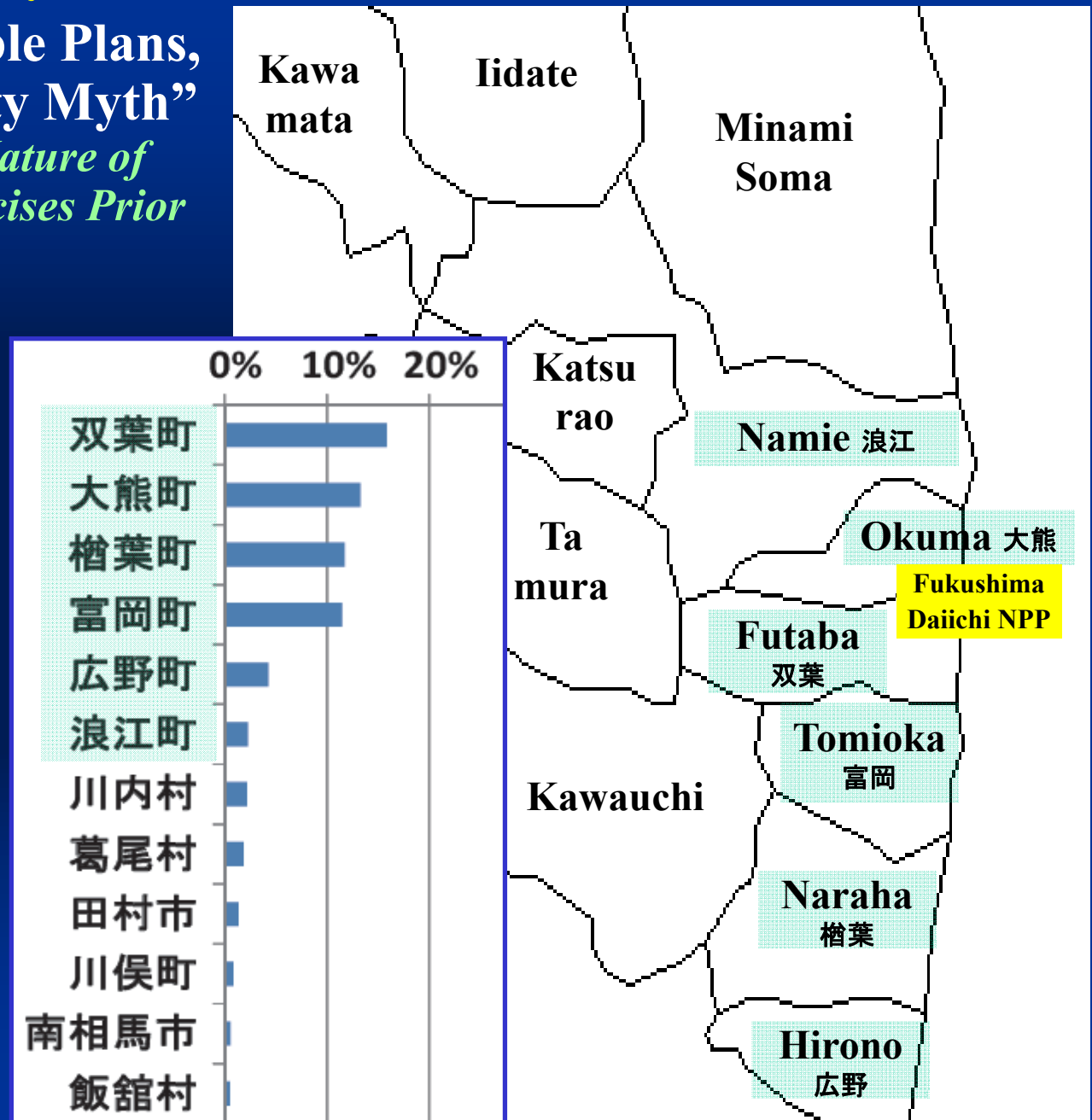
4.1.3. Postmortem Analysis: Lack of Evacuation Drills

Slide No. 23

History of Impracticable Plans,
Shrouded in the “Safety Myth”

*Government: Perfunctory Nature of
Evacuation Plans and Exercises Prior
to the 3/11 Crisis*

According to a questionnaire survey, prior to the 3/11 Crisis, most of the residents in the nuclear crisis areas **did not experience any evacuation drills**. Even in the towns of Futaba and Okuma, less than 20% of people had experience of such drills (See the Right Chart).



4.2.1. Postmortem Analysis: Disruption of Communications

Slide No. 24

Culprit of the Execrated Situation Is Insufficient and Disrupted Communication?

A Feeble Communication System within the Crisis Management Team

TEPCO (Tokyo HQ, Fukushima I NPP & II NPPs, Thermal Power Stations, . . .)

Central Gov't (Prime Minister's Office, NISA, NSC, FDMA, MOD/SDF, MEXT, . . .)

Local Governments (Prefecture, Town)

A Feeble Communication System for Intra-Agency Collaboration

Prime Minister's Office-NISA-NSC-TEPCO

Central and Local Governments

Embassies and Consulates in Japan

Knowledge Communication for Crisis Assessment and Monitoring

Prime Minister's Office-NISA-NSC-TEPCO

MEXT (SPEEDI, Monitoring Posts)

Knowledge Communication for Crisis Response to Specific Needs

Local Governments, MOD/SDF-U.S. Forces, IAEA, U.S. NRC

Risk Communication for Disaster Mitigation and Evacuation

Local Governments, Residents incl. Vulnerable People during the Disaster

Mass Communication to Prevent the Explosion of Ungrounded Rumors

Media both Domestic and Foreign

“Exchange information.” . . . This is of great importance in achieving a common language.

“互通情报”。 . . 这对于取得共同的语言是很重要的。

(Máo Zédōng/毛泽东)

4.2.2a. Postmortem Analysis: Risk Communication (1)

Slide No. 25

Risk Communication: For Those Who Need Vital Information

Government: Ill-trained PIO/Team at NISA

Evacuation Guidance issued by Local Governments with varying success rates

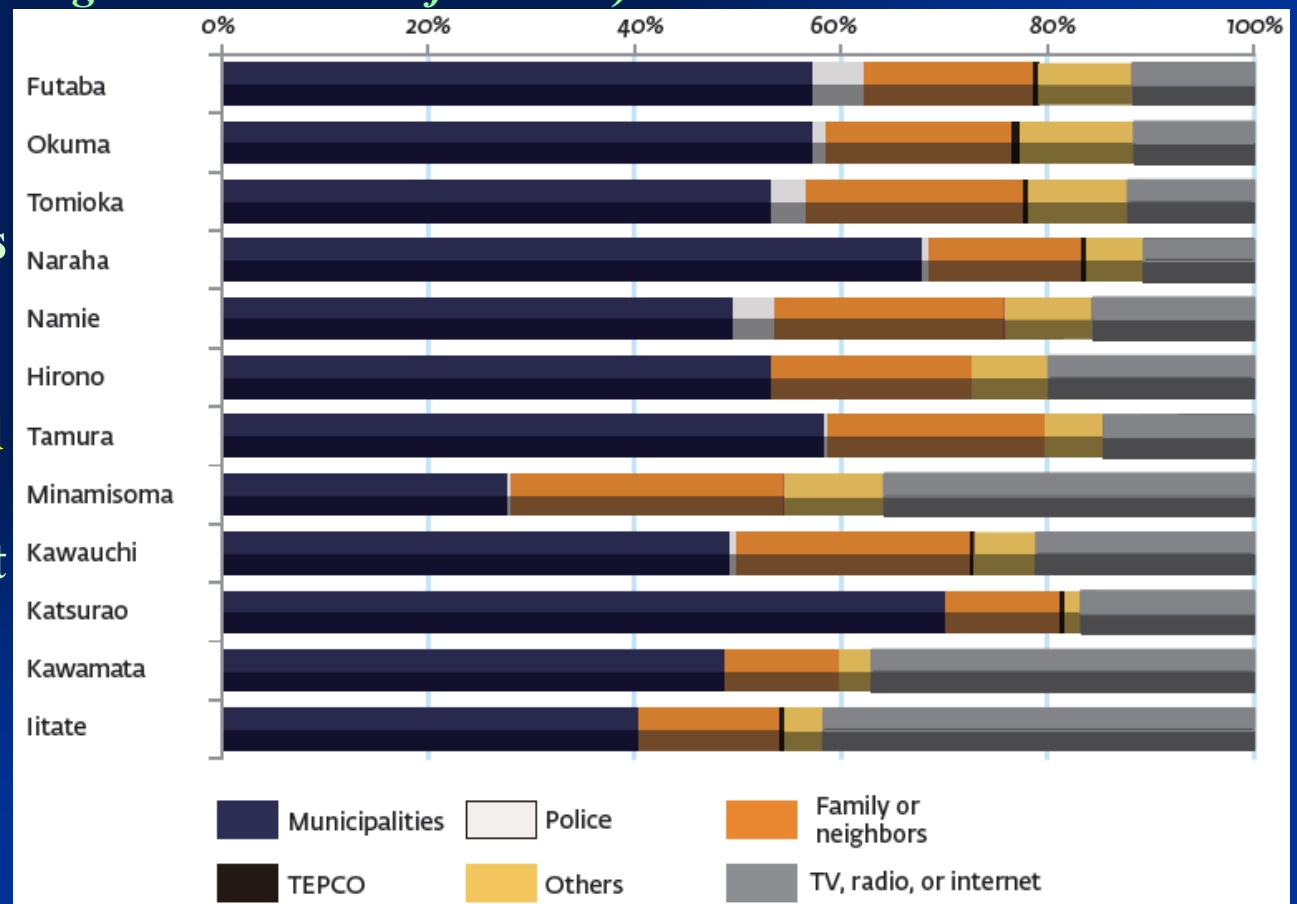
Certainly Connected (Leaving No People Left)?

Well-Timed (Leaving Ample Time and Means to Evacuate)?

Well-Coordinated (Avoiding Traffic Jams)

Sufficient (Leaving No Problems Left Behind)?

According to a questionnaire survey, a majority of the residents in the nuclear crisis areas was helped via **risk communication organized by local governments** (See the Right Chart); but the evacuees were instructed to leave their houses **expecting that evacuation would be very brief.**



Source: NAIIC, Final Report, Table 4.2.2-2

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Risk Communication vs. Mass Communication

Government: Ill-trained PIO/Team at NISA

Crisis information provided by Local Governments Proved to Be Ineffective

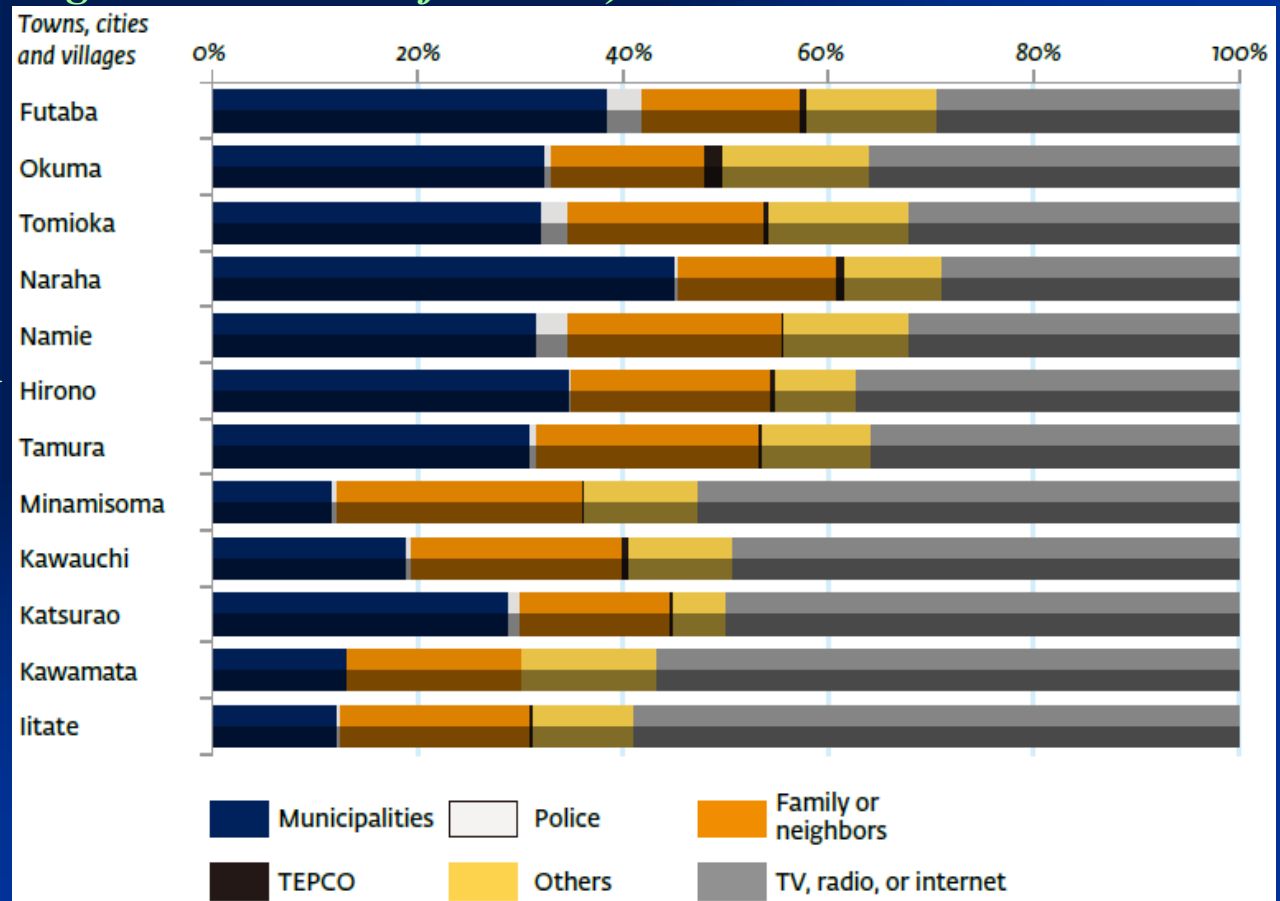
Certainly Connected (Leaving No People Left)?

Well-Timed (Leaving Ample Time and Means to Evacuate)?

Well-Coordinated (Avoiding Traffic Jams)

Sufficient (Leaving No Problems Left Behind)?

According to a questionnaire survey, a larger number of the residents in the nuclear crisis areas were depended on **mass communication through TV, Radio, and Internet** (See the Right Chart); accordingly evacuees were **not effectively instructed where to evacuate.**



Evacuation from the Invisible Danger

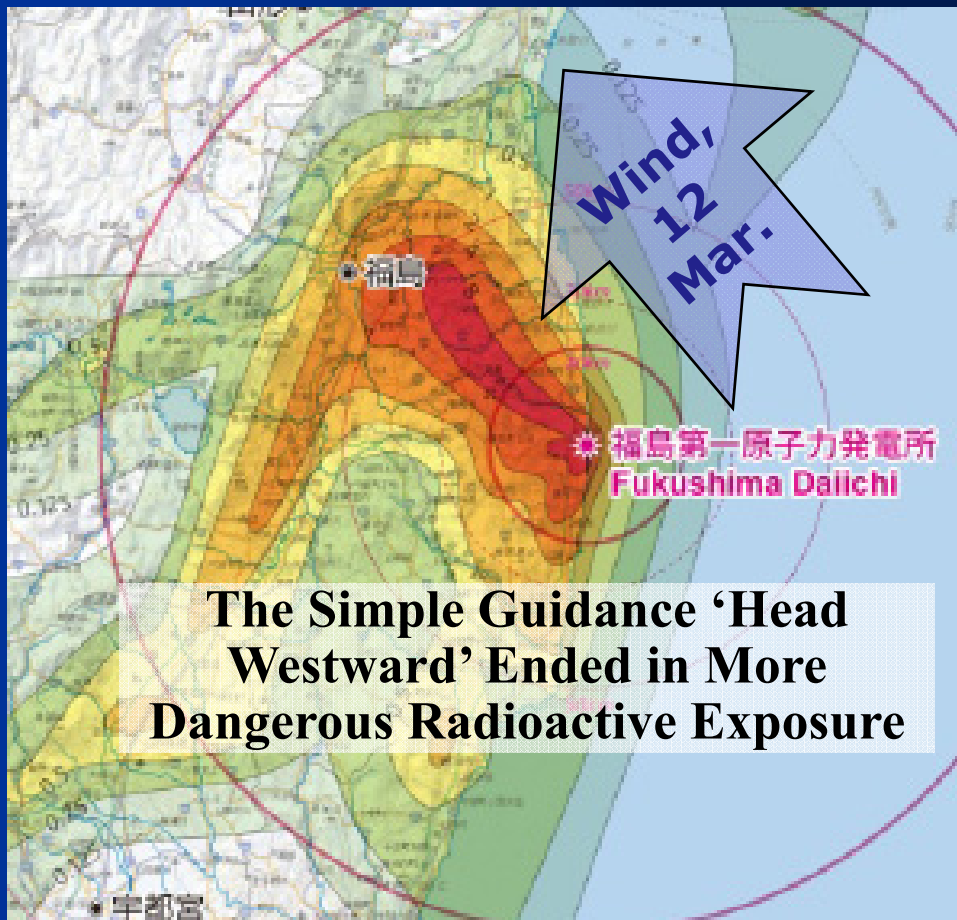
Misguided Evacuation Guidance

MEXT (Ministry of Education) Was Criticized

for keeping the SPEEDI (System for Prediction of

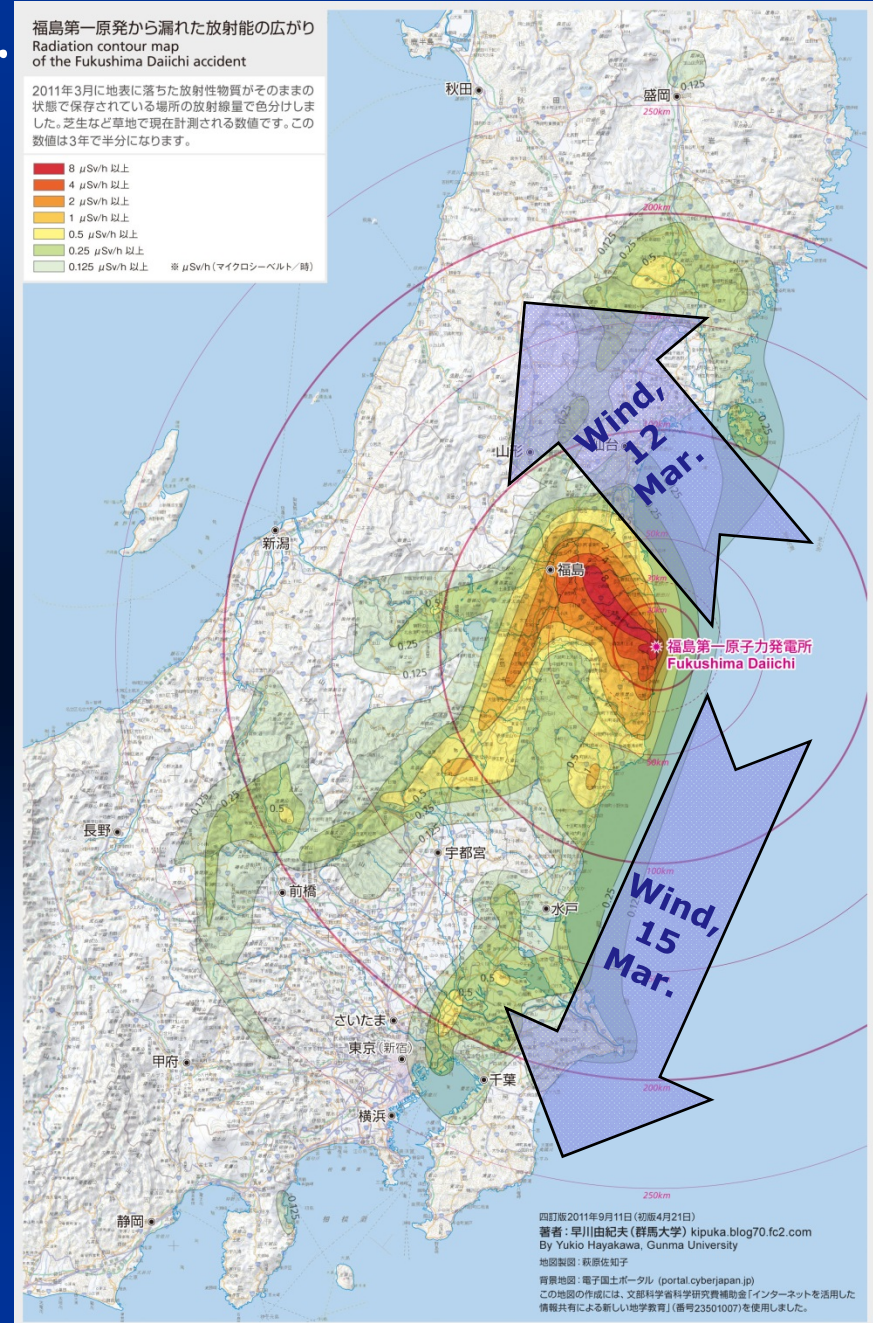
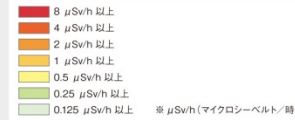
Environment Emergency Dose Information) AS A

“White Elephant.”



福島第一原発から漏れた放射能の広がり
Radiation contour map
of the Fukushima Daiichi accident

2011年3月に地表に落ちた放射性物質がそのままの状態
で保存されている場所の放射線量で色分けしまし
た。芝生など草地で現在計測される数値です。この
数値は3年で半分にになります。

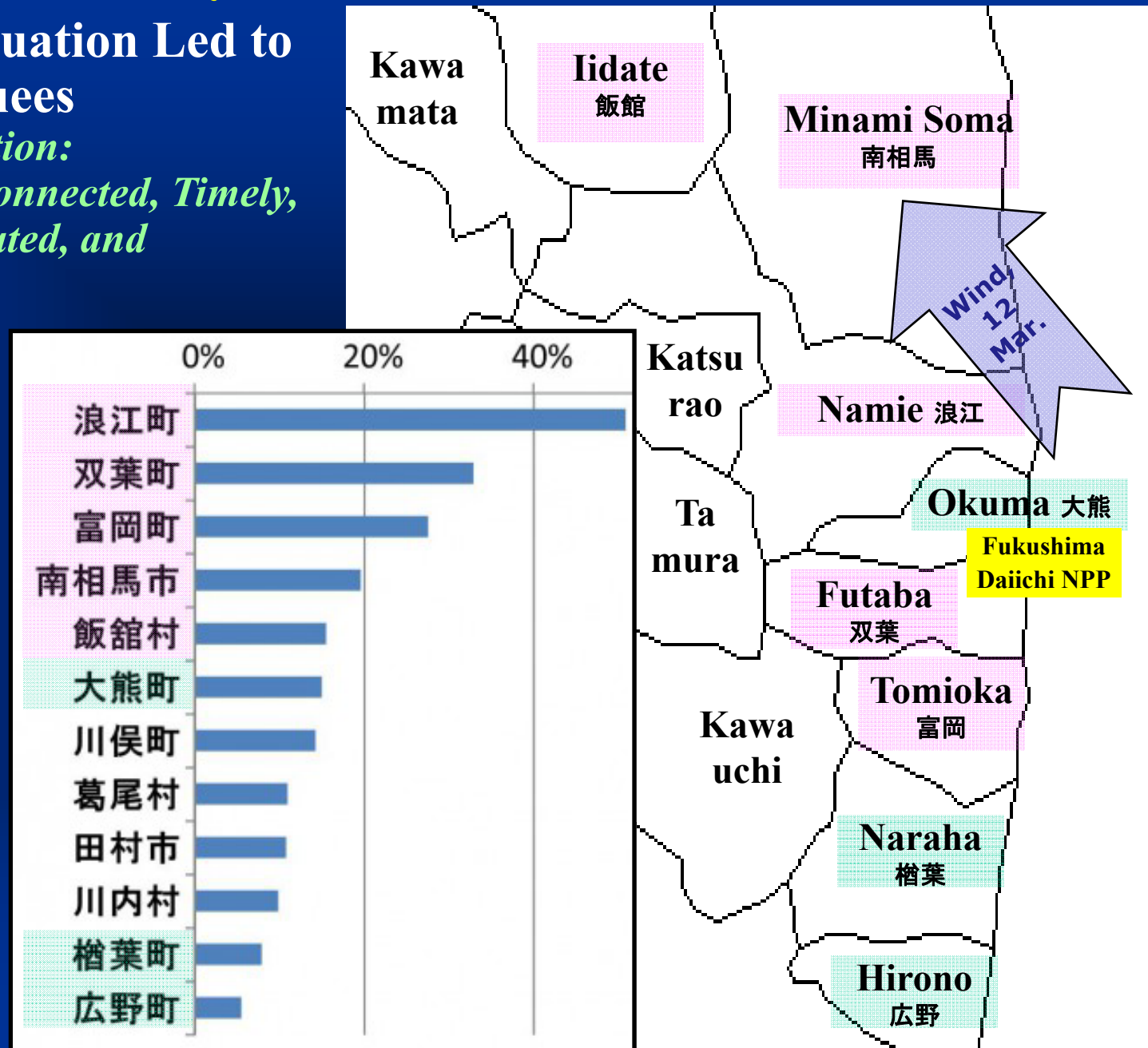


Inadequate Evacuation Led to Ordeals of Evacuees

Evacuation Information:

Was It Well-connected, Timely, Well-coordinated, and Sufficient?

According to a questionnaire survey, over 40% of Namie Town people experienced an emergency evacuation to radioactive contaminated areas (See the Right Chart).



Source: NAHC, Final Report Table 4.2.2-6 (Japanese version p. 408)

4.2.2e. Postmortem Analysis: Risk Communication (5)

Slide No. 29

Evacuation Process: Orderly? Timely? Correctly? or Adequately?

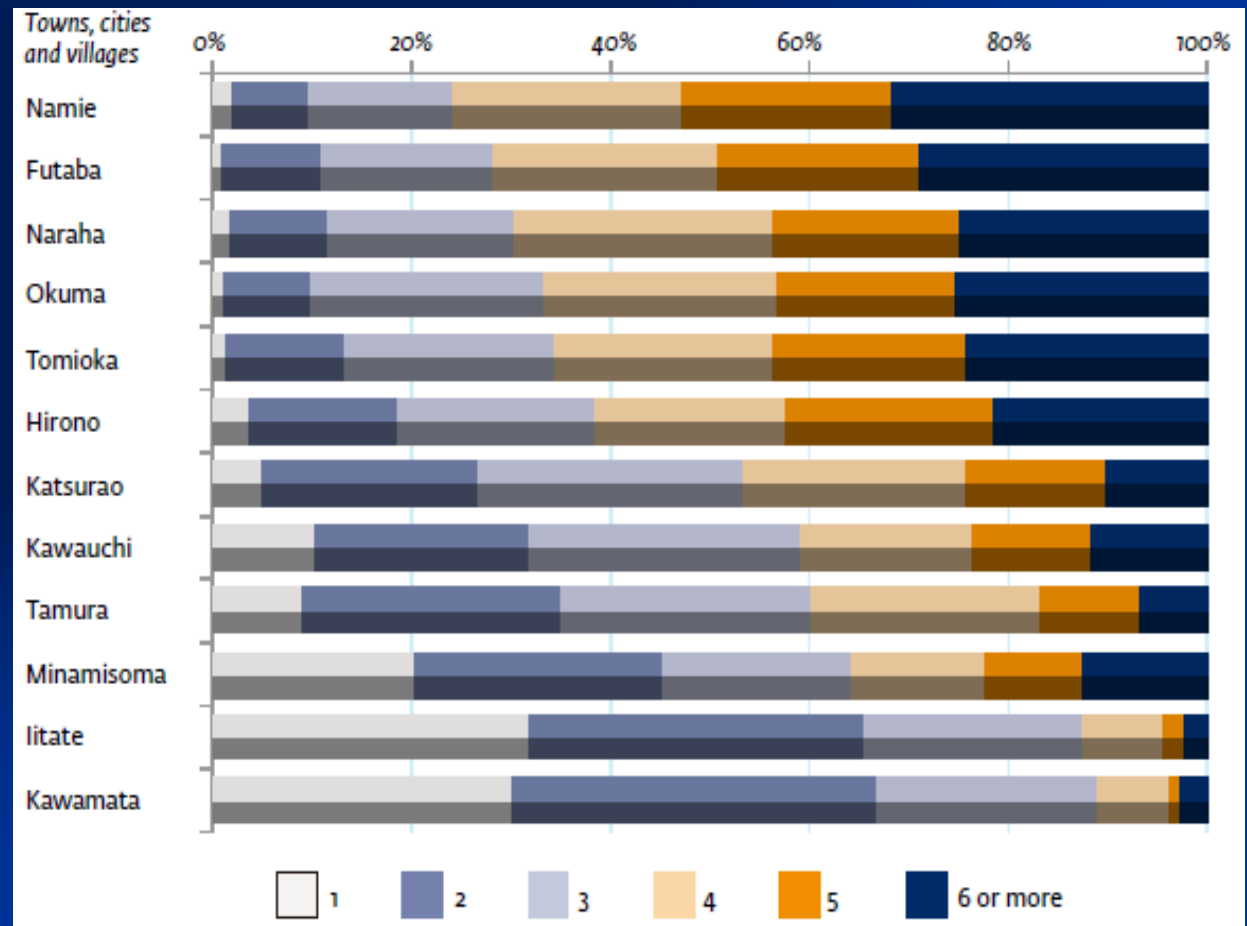
Correct and Updated Evacuation Information:

Was It Well-connected, Timely, Well-coordinated, and Sufficient?

Confusing Expression: “Nenno-tame (to make absolutely sure)”

Experience of Evacuation by the End of March, 2011

According to a questionnaire survey, Amidst the 3/11 Crisis, evacuees closer to the NPP left their houses earlier and were forced to **migrate from one shelter to another**; over 50% of Namie Town people experienced 5 or more evacuations (See the Right Chart).



4.2.2f. Postmortem Analysis: Risk Communication (6)

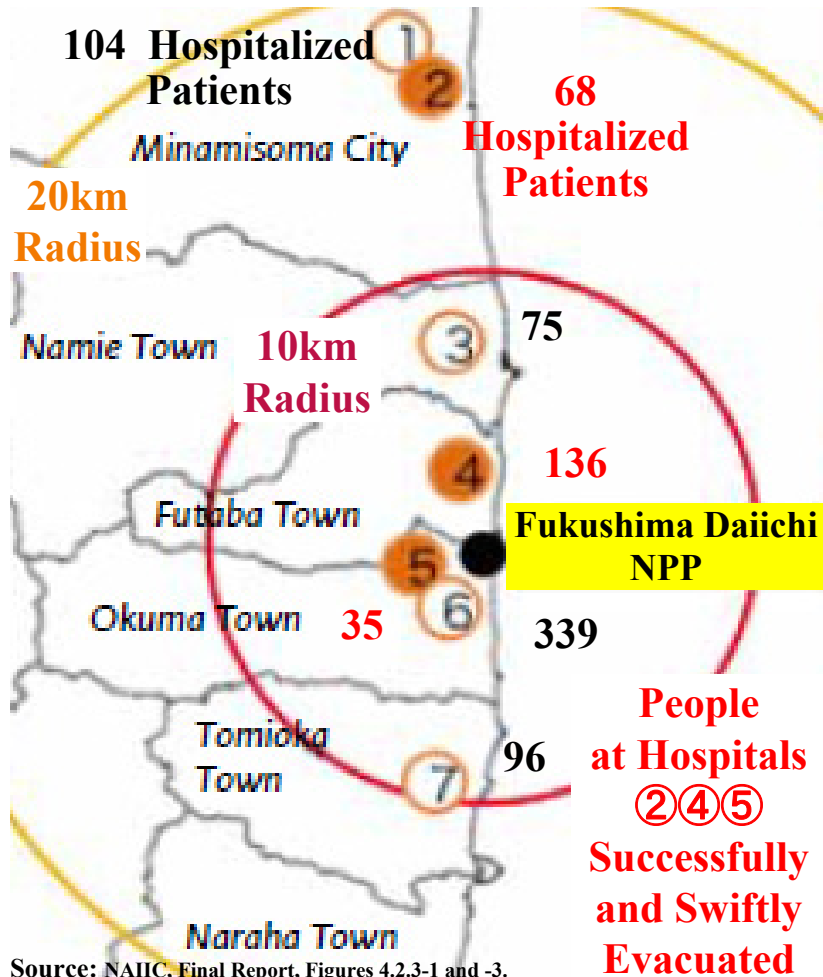
Slide No. 30

One-Size-Fits-All Information Is Not Enough

Evacuation Information: Was It Sufficient?

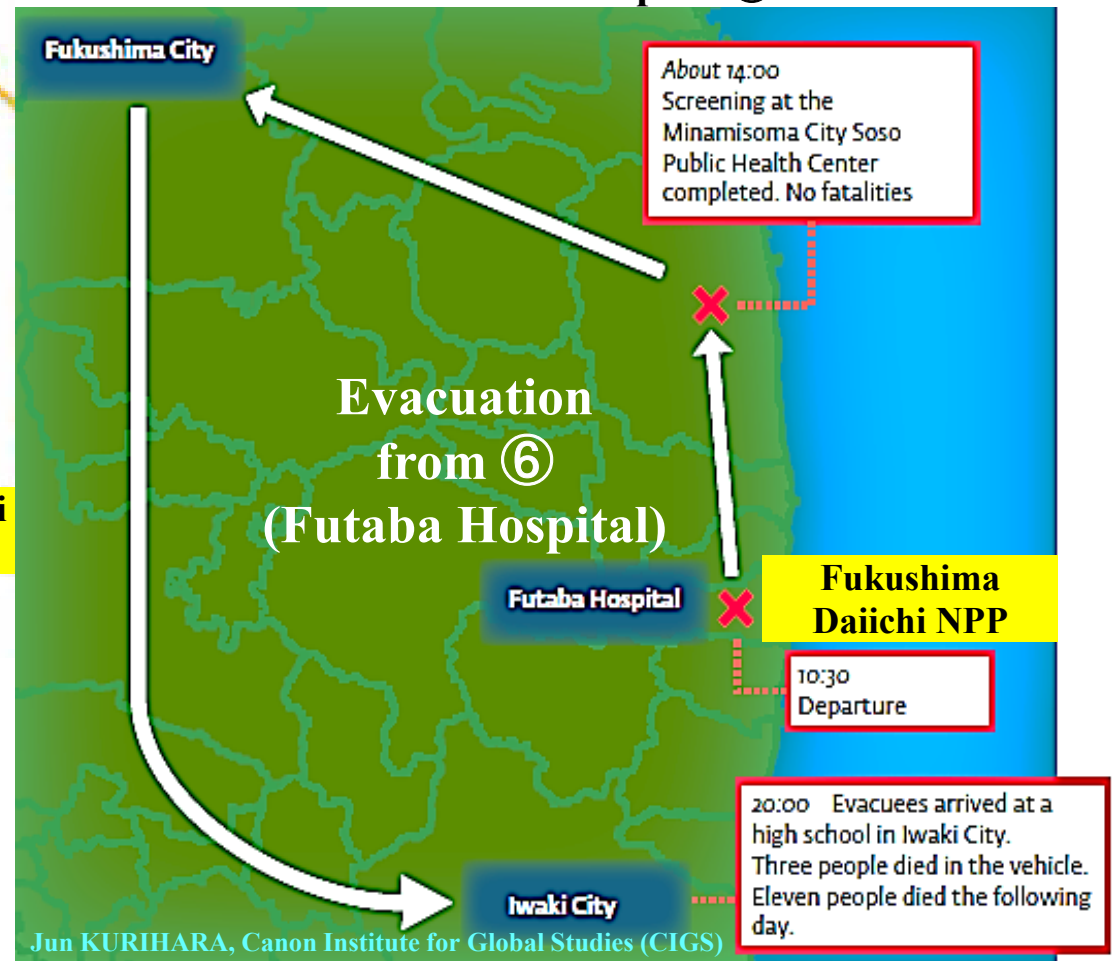
**Vulnerable People during the Disaster (“災害弱者”)
Should Be Well Taken Care of.**

**Hospitals and Their Number of Patients
within a 20km Radius of the Fukushima Daiichi**



Source: NAHC, Final Report, Figures 4.2.3-1 and -3.

**Ordeal of Evacuation on March 14:
Patients of Hospital ⑥**



Poorly trained Public Information Officers (PIOs)

Inaccurate and Unclear Information Led Only to

Uncontrollable Confusion and Unallayed Suspicion

The Importance of Recognition of Strengths and Weaknesses of the Mass Media

1. The mass media play a dominant role at almost all levels of communication on nuclear emergency issues (cf. Tanja Perko *et al.*, “Media Reporting of Nuclear Emergencies: The Effect of Transparent Communication in a Minor Nuclear Event,” *Journal of Contingencies and Crisis Management* Vol. 20, No. 1 (March 2012), pp. 52-63; IAEA, “Manual for First Responders to a Radiological Emergency,” in *Emergency Preparedness and Response*, 2006, pp. 1-86).

2. Nuclear events predictably induce enormous media coverage.

3. No one can control over the mass media’s information distribution because of freedom of the press.

4. The mass media can have enormous audiences, but they have several limits—

- (a) Even huge audiences represent only about 10% of the population and the audiences.
- (b) Those large media audiences are often specific segments of the public. Public Information Officers (PIOs) must understand local media and local media audiences.
- (c) The mass media, especially network media, tend to paint a broad picture. Media statements may be sufficient for a general news audience but they do little to inform persons in a specific community whether they should evacuate at the time of emergency.
- (d) Some media do not carry news reports even in a community struck by disaster because of their news-value judgments. (cf. Joseph Scanlon, “Unwelcome Irritant or Useful Ally? The Mass Media in Emergencies,” in *Handbook of Disaster Research*, edited by Havidán Rodríguez, Enrico L. Quarantelli and Russell R. Dynes, New York: Springer, 2007).

Compartmentalized and Segregated Regulatory Agencies

Silo Structure Management and Labyrinthine Regulations Have Led to a Lack of Transparency and a Slovenly System of Checks and Balances

	Safety		Non-proliferation		Security
	Program / Safety regulation on substance	Radiation safety	Import/export control	Safeguards	Nuclear security
<i>Main foundational ordinances</i>	<ul style="list-style-type: none"> • Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors • Electricity Business Act • Industrial Safety and Health Act • RI Act, etc. 	<ul style="list-style-type: none"> • Act on Technical Standards for Prevention of Radiation Hazard 	<ul style="list-style-type: none"> • Foreign Exchange Act • Trade Control Order • Export Control Order 	<ul style="list-style-type: none"> • Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors 	<ul style="list-style-type: none"> • Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors • Act on Punishment of Acts to Endanger Human Lives by Generating Radiation
<i>Japan Atomic Energy Commission</i>	<ul style="list-style-type: none"> • Peaceful use • Screening of planned execution, etc. 		<ul style="list-style-type: none"> • Policy deliberation 	<ul style="list-style-type: none"> • Policy deliberation • Double-checking 	<ul style="list-style-type: none"> • Policy deliberation • Double-checking
<i>NSC</i>	<ul style="list-style-type: none"> • Policy deliberation • Regulation screening • Guide • Double-checking, etc. 	<ul style="list-style-type: none"> • Policy deliberation • Guide 			
<i>MEXT</i>	<ul style="list-style-type: none"> • Research reactor • RI facilities, etc. 	<ul style="list-style-type: none"> • Radiation Council (Radiation Council) • Monitoring 		<ul style="list-style-type: none"> • Safeguards 	<ul style="list-style-type: none"> • Research reactor • RI facilities, etc.
<i>METI</i>	<ul style="list-style-type: none"> • Commercial reactor • Cycle facilities • Waste facilities, etc. 		<ul style="list-style-type: none"> • Imports/exports • Practice in control 		<ul style="list-style-type: none"> • Commercial reactor • Cycle facilities • Waste facilities, etc.
<i>MOFA</i>				<ul style="list-style-type: none"> • International negotiations 	<ul style="list-style-type: none"> • International negotiations
<i>MHLW</i>	<ul style="list-style-type: none"> • Labor safety 	<ul style="list-style-type: none"> • Health impacts 			
<i>MLIT</i>	<ul style="list-style-type: none"> • Transport, ships 				

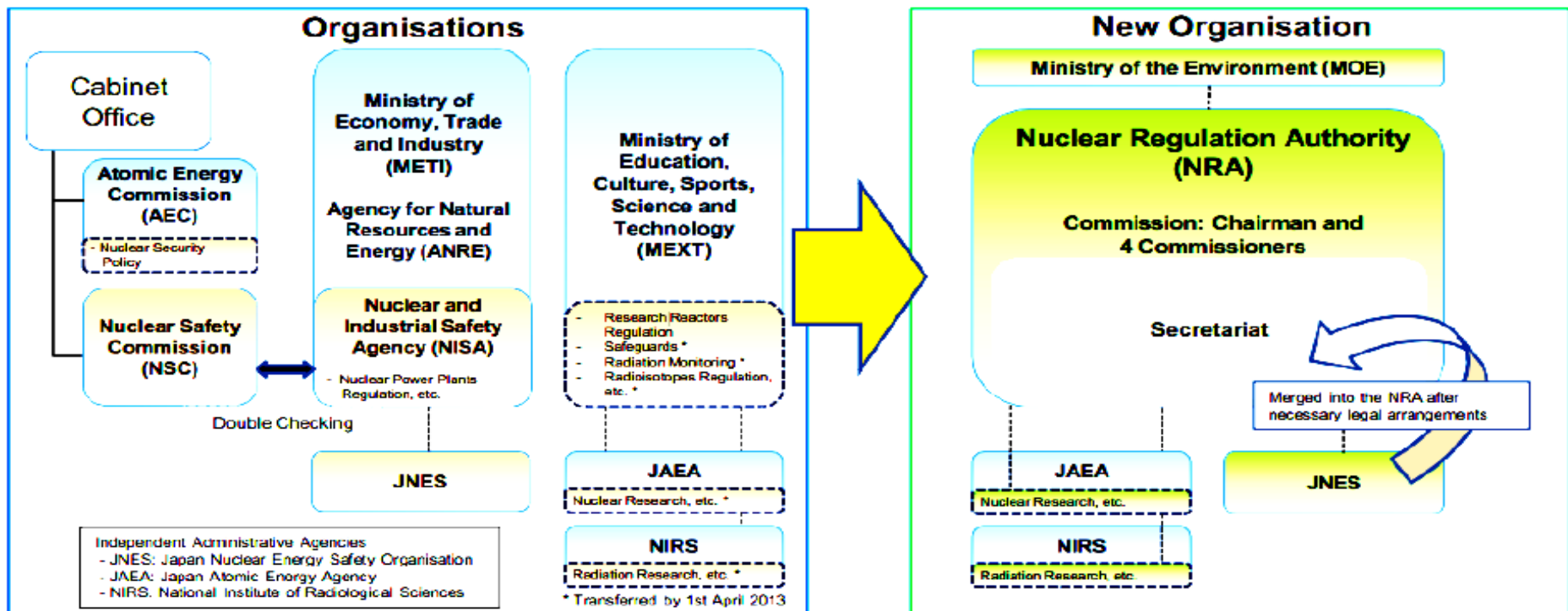
Compartmentalized and Segregated Regulatory Agencies

Silo Structure Management Have Led to

a Lack of Transparency and a Slovenly System of Checks and Balances

New Nuclear Regulatory Organization

- **Independence:** Separate nuclear regulation function and nuclear promotion function and establish the “Nuclear Regulation Authority (NRA)”, as an independent commission body affiliated to the MOE. Chairman and Commissioners are appointed by the Prime Minister after the approval of the National Diet.
- **Integration:** Integrate nuclear regulation functions, namely, nuclear safety, security, safeguards, radiation monitoring and radioisotopes regulation, into the NRA.
- **Crisis Management:** Establish “Nuclear Emergency Preparedness Commission (NEPC)” in a cabinet and implement nuclear emergency prevention measures in close cooperation with relevant organisations.



**A Segregated Nuclear Energy Sector as well as Govn't Agencies
—Japan's Nuclear Sector Is An Epitome of Japan's Stovepipe Culture —**

Stovepipe Culture of the Nuclear Energy Sector (both Business and Academic) Has Led to

(a) Lack of Transparency, and Rigid and Empty Formalism,

(b) Lack of Inter-disciplinary Communication among Academics,

*(c) Negligence of Closely Related Fields and Multidisciplinary Approaches to
Develop Safety Measures,*

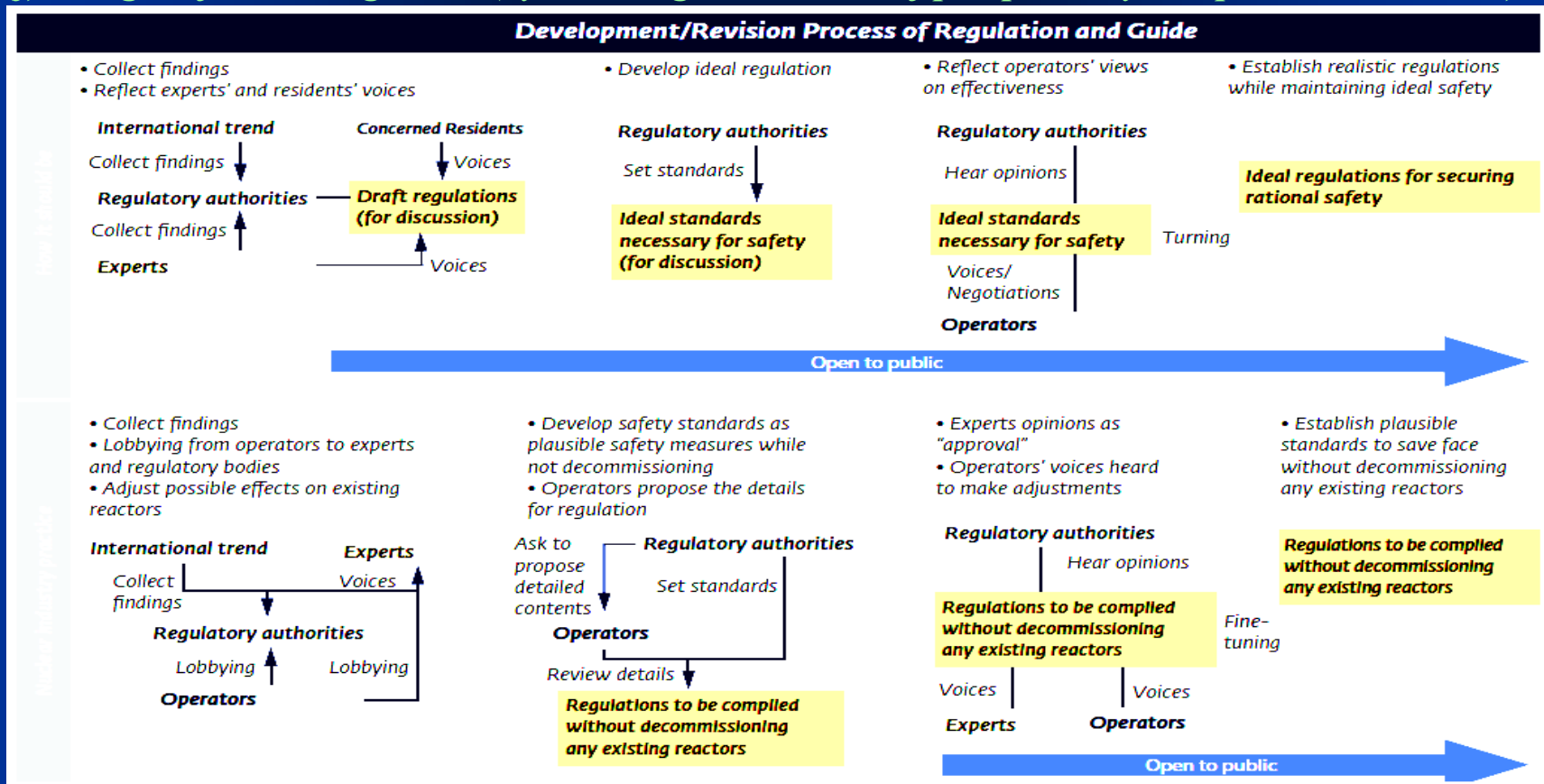
*(d) Resultantly, an Obsolescent, Vulnerable, Ineffective and Inefficient Safety
Scheme, and*

*(e) Danger of Knowledge Loss (by reducing the number of prospectively competent
researchers).*

The Nuclear Sector Is An Epitome of Japan's Stovepipe Culture

Stovepipe Culture of the Nuclear Energy Sector (both Business and Academic) Has Led to

- (a) Lack of Transparency, and Rigid and Empty Formalism,
- (b) Lack of Inter-disciplinary Communication among Academics
- (c) Negligence of Closely Related Fields and Multidisciplinary Approaches to Develop Safety Measures,
- (d) Resultantly, an Obsolescent, Vulnerable, Ineffective and Inefficient Safety Scheme, and
- (f) Danger of Knowledge Loss (by reducing the number of prospectively competent researchers).



4.4.1. Global Implications of Fukushima

Slide No. 36

Lessons Should Be Learned from the Fukushima Tragedy, Because Nuclear Threats Do Not Recognize National Borders

The “Lessons Learned”: A Precious Legacy for Entire Human Beings Irrespective of Nationality

The World’s Nuclear Reactors (as of October 2012)

Country	No. of Reactors				Electricity Generation
	Operable	Under Construction	Planned	Proposed	Billion kWh
United States	104	1	13	13	790.4
France	58	1	1	1	423.5
Japan	50	3	10	5	156.2
Russia	33	10	17	24	162.0
South Korea	23	4	5	0	147.6
India	20	7	18	39	28.9
Canada	18	2	2	3	88.3
United Kingdom	16	0	4	9	62.7
Ukraine	15	0	2	11	84.9
China	15	26	51	120	82.6
Sweden	10	0	0	0	58.1
World	434	64	160	323	2,518

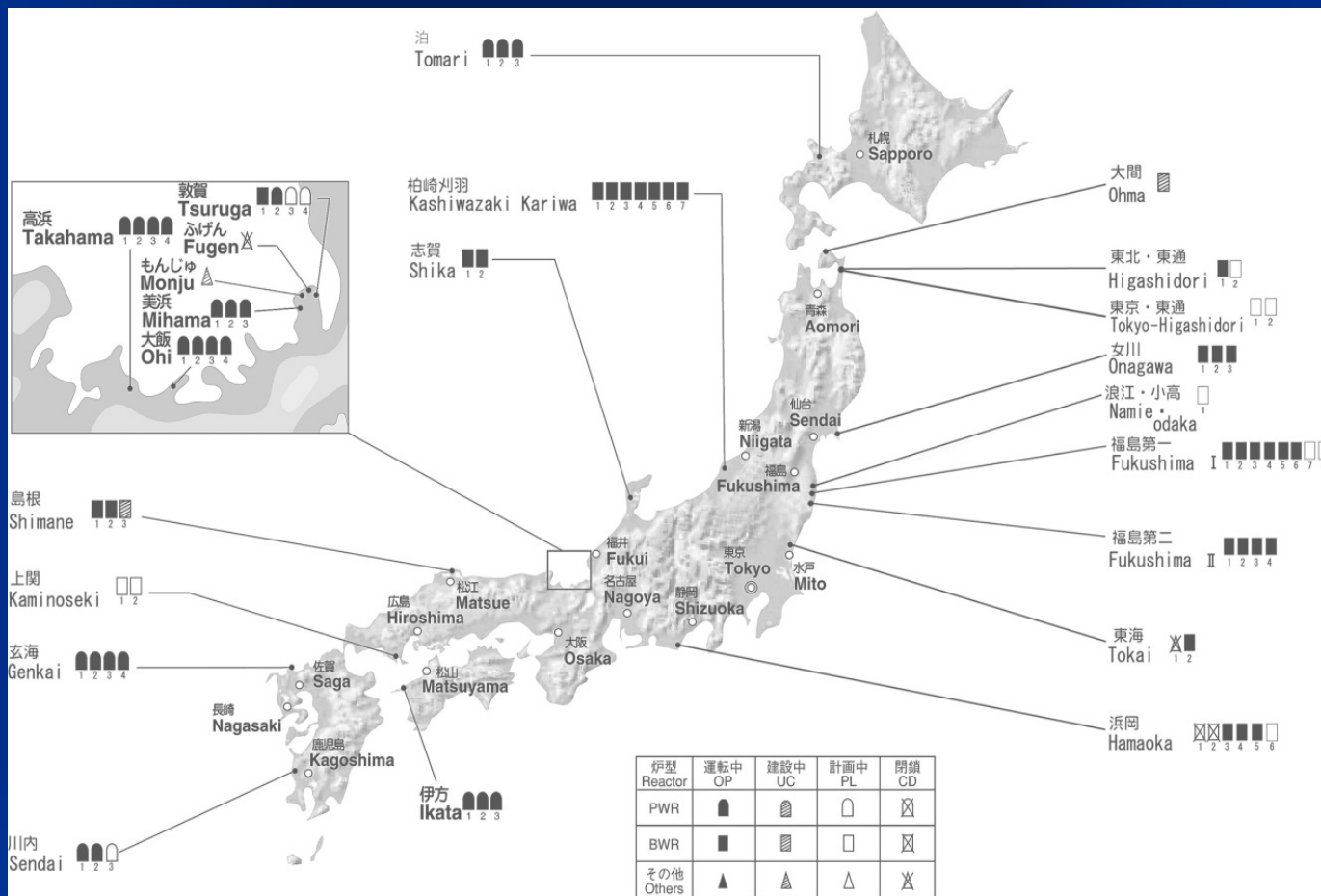
4.4.2. Global Implications of Fukushima

Slide No. 37

Lessons Should Be Fully Utilized for

A More Robust, Effective and Efficient, Versatile and Resilient,
and Collaborative Nuclear Safety Scheme

Irrespective of Future Energy Policy, Japan Has and Will Have to Maintain Rich Human and Technological Resources for A Safer Nuclear Energy World



Source: Japan Atomic Industry Forum Inc. (JAIF)

Jun KURIHARA, Canon Institute for Global Studies (CIGS)

Post-Fukushima Nuclear Safety Scheme

—*In Search of a Confluence of Nature and Science*—

Now is the Time for Making Lemonade from Fukushima Lemons
(*Zhuǎn Huò ér Wéi Fú, Yīn Bài ér Chéng Gōng*/轉禍而為福，因敗而成功)
To Share the Lessons Learned from the Bitter but Valuable Experience
at the Fukushima Tragedy

1. Keep A Humble and Cautious Attitude toward Nuclear Technology and Accidents

As August Strindberg warns:

“What men call success serves always as a basis for their next failure
(*Det människan kallar framgång blir alltid anledningen till deras nästa motgång*).”

2. Maintain A Strenuous Effort toward a Confluence of Nature and Science

As Johann Wolfgang von Goethe teaches:

“Profoundly learned I would grow, . . . Nature and science I desire to know
(*Ich wünschte recht gelehrt zu werden, . . . Die Wissenschaft und die Natur*).”

**Thank You! / Tack Så Mycket! / 谢谢大家! / Merci beaucoup! /
감사합니다! / Arigato Gozaimasu (有難うございます)!**