

Immediate Consequences of Fukushima Daiichi Accident

Lessons for radiological protection from the Chernobyl and Fukushima Daiichi NPPs accidents

27 April 2026

ICRP



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Accident at Fukushima Daiichi NPS

Impact of earthquake and tsunami

- Loss of off-site power supply
- Failure of emergency power supply
- Damage to seawater pumps



Overheating of reactor core



Melting of nuclear fuel



Containment failure
Hydrogen explosion



Source: TEPCO, Photo collection

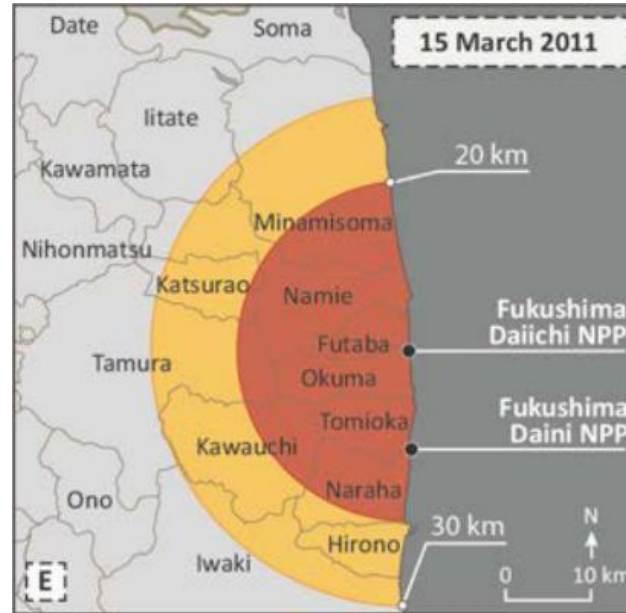
(https://photo.tepco.co.jp/library/110316/110316_1f_chijou_2.jpg)



Urgent Protective Actions



Evacuation (< 2 km)



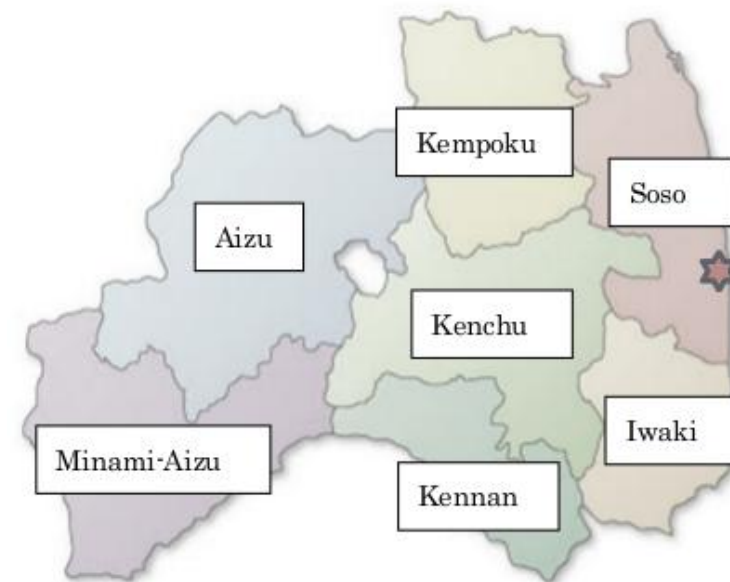
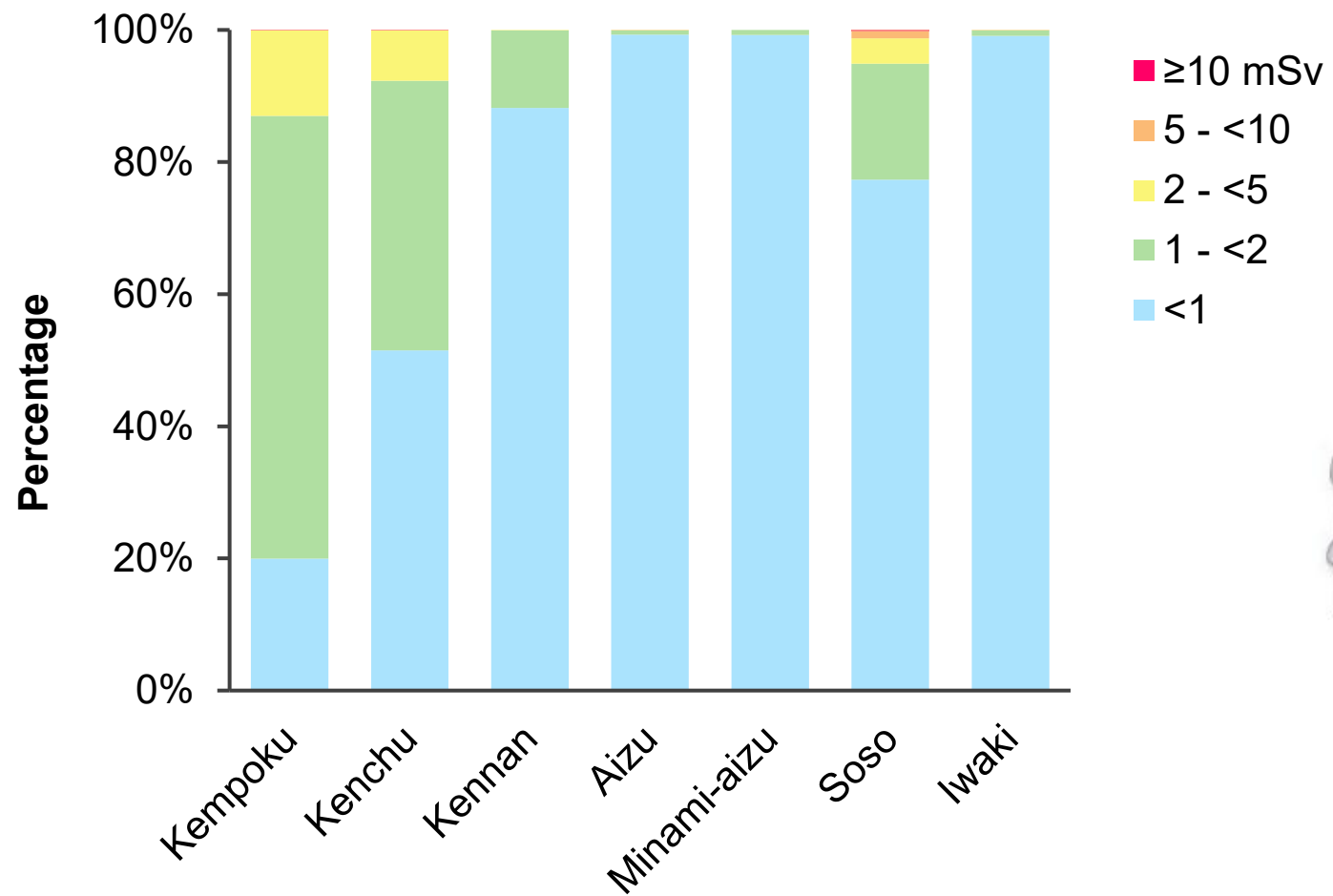
Evacuation (< 20 km)
Sheltering (20-30 km)



Relocation (+ 20 km)

Source: IAEA, The Fukushima Daiichi Accident (2015)

External Dose in the First 4 Months

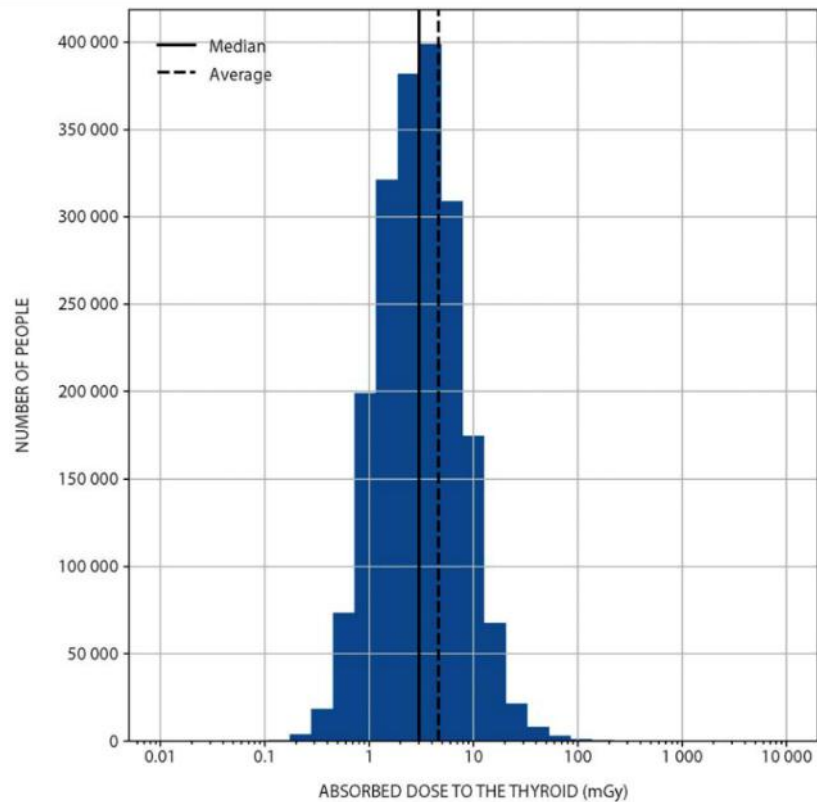


Based on data from Fukushima Health Management Survey

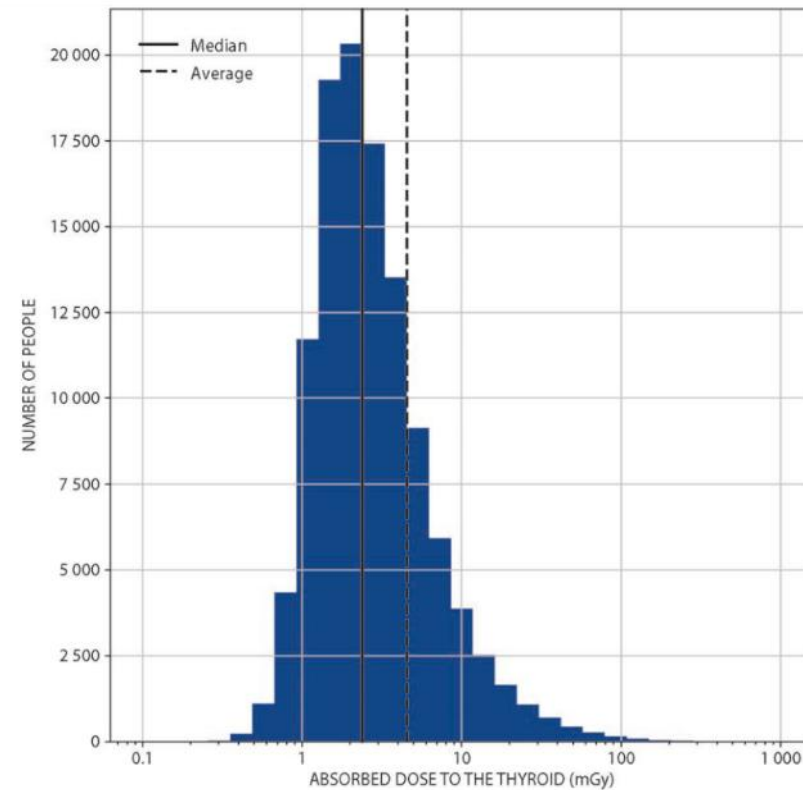


Thyroid Dose in the First Year

Non-evacuated municipalities



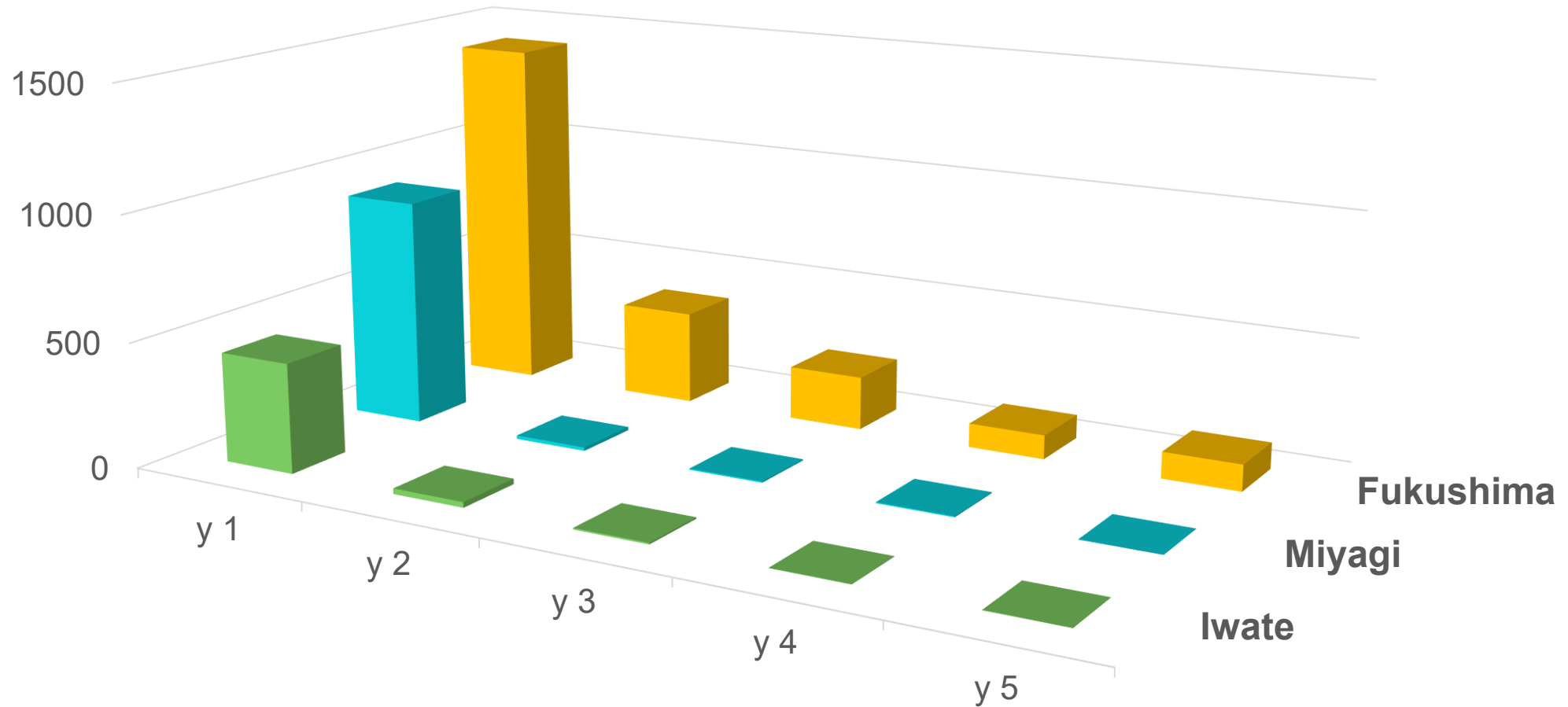
Evacuees



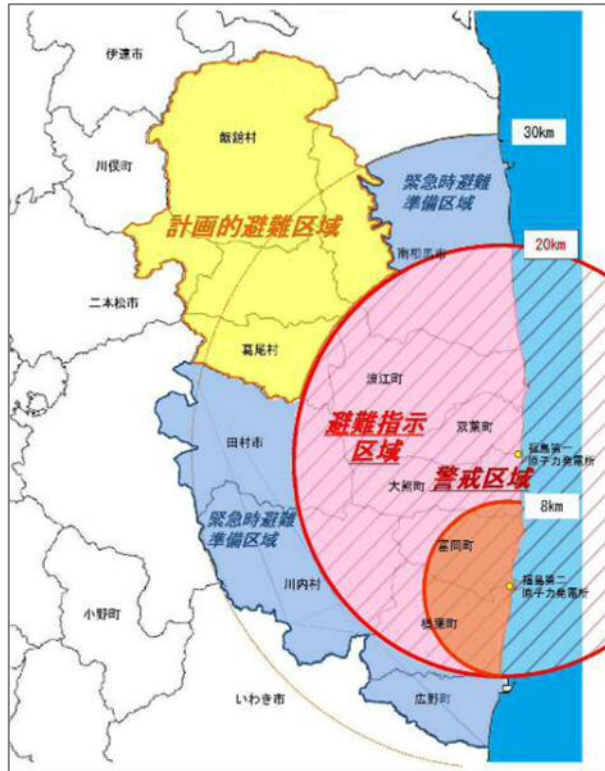
Source: UNSCEAR 2020/2021 Report Annex B (2022)



Disaster-Related Deaths

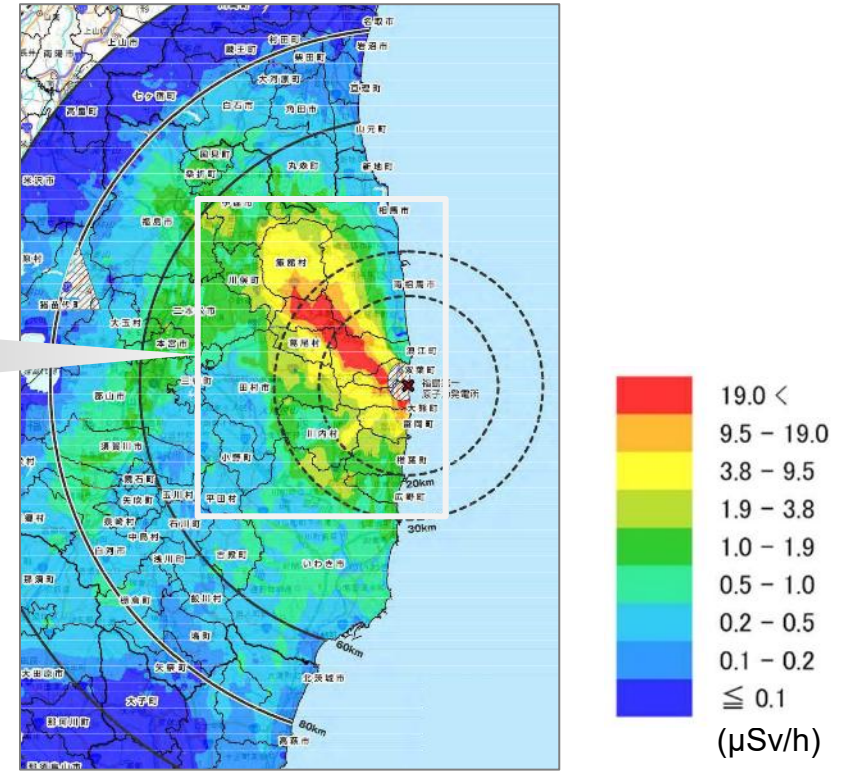


Restricted Areas (22 April 2011)



Source: Fukushima Revitalization Information Portal Site
 (<https://www.pref.fukushima.lg.jp/site/portal/cat01-more.html>)

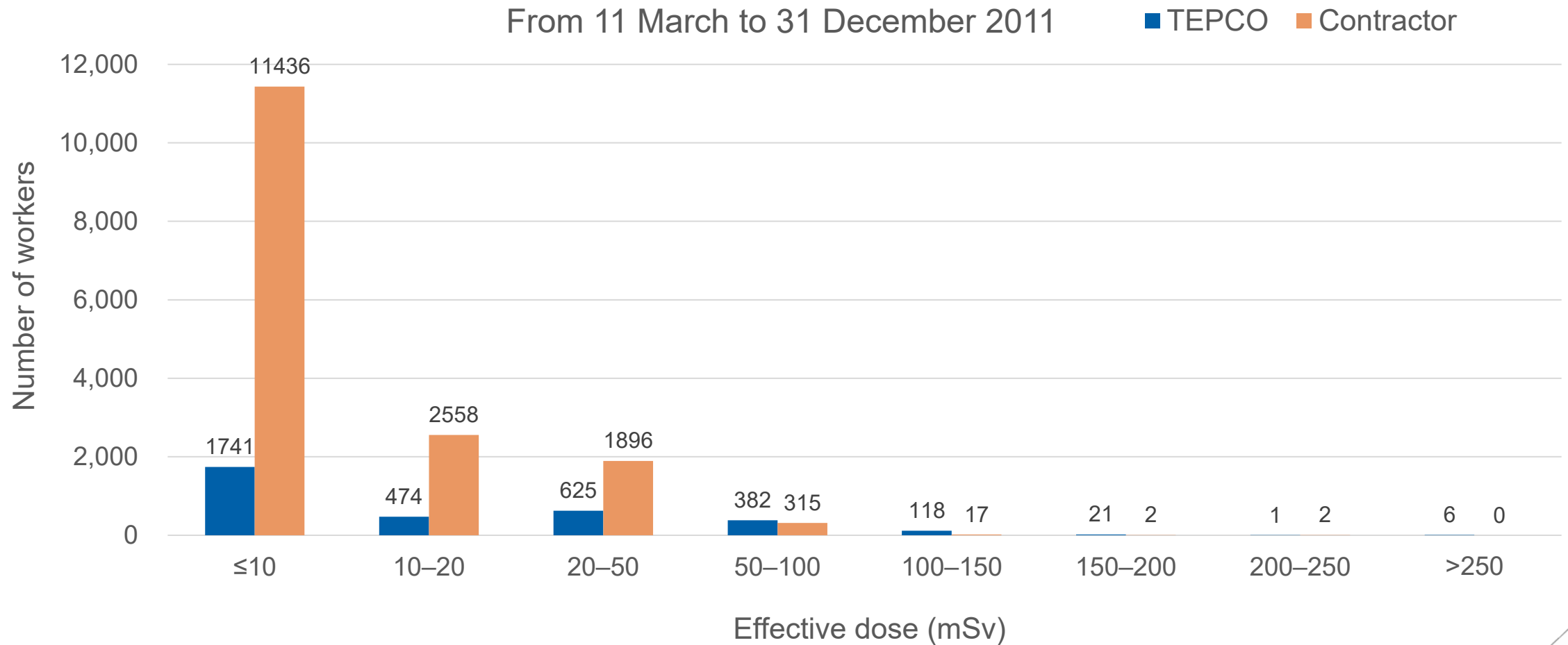
Dose rate as of 26 May 2011



Source: NRA, RAMDAS
 (<https://radioactivity.nra.go.jp/ja/results/airborne/air-dose>)



Doses from Emergency Work



Based on TEPCO's re



Thyroid Doses from ^{131}I Intake

Subject code	Absorbed dose to the thyroid (Gy)	
	Recorded value	Reevaluated value
A	11.6	8.4
B	10.8	32
C	8.7	14
D	6.5	9.0
E	5.2	7.9
F	4.8	4.8

Source: UNSCEAR 20213 Report Annex A (2014), Kunishima et al, Health Phys 116, 647-656 (2019)



Controversial Issues

Radiological protection criteria

- Relocation and returning
- Decontamination of the living environment
- Restriction on foods

Thyroid screening

- Significance and objective
- Ethical accountability for continuation



Summary

- Doses to the public were kept relatively low.
- Adverse effects of protective measures against radiation were substantial.
- Socioeconomic impact was significant.
- Loss of public trust in the government and experts made the situation further difficult and complicated.



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