Fukushima Nuclear Accident - Radiation Comparison

International Nuclear Event Scale [1]

Level 7 - **Major**

Level 6 - **Serious**

Level 4/5 - **Accident**

Level 3 - **Serious** (> 1000 mSv)

Level 2 - **Incident** (> 10 mSv)

Level 1 - **Anomaly** (> local background)

Level 0 - **Normal**

Radiation Poisoning

High 8000
hemmoraging, dementia, death in one day

Med 4000
nausea, infection lymph nodes

Low 1000
itching, nausea
Cancer risk:
1:20
1:200

mSv/h

milli-sieverts per hour

100000
10000
1000
100
10
1.0
0.1
0.01
0.001
.0001

World Events

- **Chernobyl core [6]** Core explosion >300,000 mSv/h
- **K-19 Submarine** 8 deaths, 1961. 54,000 mSv/h
- **Atomic bomb [5]** crater region, 30,000 mSv/h
- **Louis Slotin** Scientific accident, 1946 Manhattan project
- **Harry Daghnian** Scientific accident, 1945
- **Chernobyl workers average dose** 170 mSv/h
- **Radiation Poisoning starts**
- **International Limit for Nuclear workers** 100 mSv/year = .01 mSv/h
- **Geological radiation [8]** Ramsar, Iran. Yiangjing, China. Brazil
- Most cities — **Smoking** 1 pack/day
- **Household Radon**
- **Three Mile Island**
- **Natural Background** 0.5 to 5 mSv/year

Site Map

1.1 km West Gate
0.4 km Admin Building
Units 1 2 3 4
1 km Main Gate
* Cooling water discharge

Alititude [7]

15 km High jet .01 mSv/h
10 km Jets .005 mSv/h
6.7 km Himalaya Mountains .0001 mSv/h
2.0 km High cities (Denver) .00001 mSv/h

Radiation Increases with altitude

Radiation by Distance [2]

- Chernobyl core
- **30 m** Chernobyl circulation pumps
- **80 m** Chernobyl turbine hall
- **5 km** Krasnoe village
- **15 km** Usov village [5]
- **Fukushima** core peak 400 mSv/h
- **Fukushima** main gate 11 mSv
- March 15th
- March 30th
- **100 km** Ibaraki prefecture
- **206 km** Tokyo
- * Cooling water discharge
- **20 km Evacuation zone**
- March 10th background

0 | 1 km | 10 km | 100 km | 1000

Radiation falls with the square of distance from source. Both axes are logarithmic.

March 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th

Time Elapsed Regional Effects [3]

March 11 10:00 am — Fuku-shima, Ibaraki, Tokyo, No data

March 15 10:00 am

March 18 10:00 am — effect reaches Tokyo 6 days

March 21 9:00 am — Ibaraki, Tokyo

March 26 8:00 pm

March 30 9:00 am

Fukushima I Nuclear Accident Events [4]

March 11th 2:46 pm Earthquake & Tsunami

8:41 am Unit 3 Manual venting

11:15 am Unit 3 Hydrogen Explosion

4:36 pm Emergency declared

3:36 pm Unit 1 Hydrogen Explosion

6:14 am Unit 2 Explosion

6:00 am Unit 4 Explosion near fuel pool

5:45 am Unit 4 2nd Fire

2:30 pm Unit 4 Storage pool possibly boiling

3:00 am Thirty five fire engines

7:00 pm Unit 3 & 4 Helicopter water & fire hoses

3:55 pm Unit 3 Gray smoke appears

Unit 3 Fire put out

1:00 pm Unit 3 Gray & black smoke again

Unit 1,2,3 Seawater cooling continues

Unit 3 Containment vessel breach

Unit 2 Radioactive seawater leaking to outside

*

Admin Building 0.4 km
Main gate 1.0 km
West gate 1.1 km

Unit 1 Events | Unit 3 Events | Unit 2 | Unit 4 Events

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News Reporting

CNN | FOX | REUTERS

- Bottled water scarce 2x> gov't limit
- Tokyo 5x >background
- Radiation fears spark panic, evacuations
- A radioactive hazard zone? "50 mSv higher than Chernobyl resident"
- IAEA Tracks Radiation leaks 126x >iodine limit
- Elevated levels outside 30-Km 1000 mSv/persn, 30km away
- Tokyo residents hoard water
- Japan encourages voluntary evac. near plant 13x >norm, 16 km away 28x >norm, 10 km away
- Workes touch radiation 100,000x >norm
- Radiaton test 10,000,000 times above normal *(retracted)*
- Utility retests reactor water 100,000x >coolant norm 330x >ave per person/yr
- Japan mulls new steps.. 3,355x >legal water limit

Notes:

[1] Nuclear event levels are triggered by particular events regardless of radiation doseage. Partially melted rods at Fukushima warrants Level 5. Levels 1, 2 and 3 have specific radiation dosage limits. Source: Internation Atomic Energy Agency (IAEA), Nuclear Incident Event Scale (INES)
[2] Chernobyl Source: B. Medvedev, JPRS Report on Soviet Union Economic Affairs Chernobyl Notebook, 1989.
[3] Time data harvested by Marian Steinbach, "A Crowdsourced Japan Radiation Spreadsheet", Mar 30th Data source: Japan Ministry of Education, Culture, Sports, Science and Technology (MEXT)
[4] Fukushima events from numerous sources. Listed on wikipedia page for Fukushima I Nuclear Accident. Data source: TEPCO, Monitoring data, Mar. 11th-30th
[5] Atomic bomb radiation inside crater region (<10 km). Fallout is more deadly in long-term because radiation is no longer localized.
[6] Source: Health Effects of the Chernobyl Accident, European Committee on Radiation Risk, 2006. Busby & Yablokov.
[7] Source: NOAA, Radiation Hazard at Aircraft Altitude. Oct, 2007. (http://www.swpc.noaa.gov/info/RadHaz.html)
[8] Certain locations have very high natural radiation. Source: Very High Background Radiation Areas of Ramsar, Iran: Preliminary Biological Studies, 2002, M. Ghiassi-nejad et al.