

# Teaching March 11 and Japan: A Resource Guide for Educators

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*The March 11, 2011 triple disaster in Japan (earthquake, tsunami, and nuclear crisis) continues to have repercussions in Japan today. This lunchtime talk will focus on resources for educators who want to help students at any grade level understand the science and social effects of the 2011 Japan catastrophe.*

## **Summary of the events of March 11, 2011**

On March 11, 2011 at 2:46 in the afternoon, a 9.0 earthquake struck about 70 km offshore of Northern Japan. The earthquake shook violently for over five minutes. Buildings in Tokyo, 373 km away rocked badly, and oil refineries in the Tokyo suburbs caught fire. It was the largest recorded earthquake in Japanese history, and one of the five largest earthquakes since the beginning of earthquake record keeping began.

At 3:35, 49 minutes later, a 14 meter tsunami wave hit the Fukushima nuclear complex, flooding over the seawalls and inundating nuclear plant units 1, 2, 3, & 4.

These two events, the earthquake and the tsunami, substantially exceeded safety design assumptions for the nuclear power plants. They had been designed to withstand an earthquake of 8.2, and had a seawall built to withstand a tsunami of 5.7 meters. The earthquake that struck on 3/11 was eight times larger than design assumptions, and the tsunami was more than twice as high as the design assumptions. The plant designers had assumed that they built the plant to withstand any earthquake and tsunami that was likely for over a thousand years. These assumptions were wrong.

Fukushima units 1, 2, & 3 were operating at the time of the earthquake. Unit #4 was shut down for routine maintenance and refueling. The three operating plants all experienced total meltdown of their nuclear fuel. Unit 4 lost cooling to its large pool of spent fuel rods, and this fuel experienced significant melting as well. All four plants experienced explosions that dispersed radioactive material into the ocean, but also across large areas of Northern Japan, including many parts of Tokyo.

TEPCO, the company that runs the plants, and the government of Japan denied that there had been any meltdowns at Fukushima for over two months, even though they knew for certain that there had been meltdowns during the first week of the crisis.

## **General Information**

New York Times Learning Guide: “20 Ways to Teach About the Disaster in Japan Across the Curriculum”

<http://learning.blogs.nytimes.com/2011/03/15/20-ways-to-teach-about-the-disaster-in-japan-across-the-curriculum/>

(from Wikipedia): **Fukushima Prefecture** (福島県 *Fukushima-ken*<sup>?</sup>) is a [prefecture](#) of [Japan](#) located in the [Tōhoku region](#) on the island of [Honshu](#).<sup>[2]</sup> The capital is the city of [Fukushima](#).<sup>[3]</sup>

The **Tōhoku region** (東北地方 *Tōhoku-chihō*<sup>?</sup>) consists of the northeastern portion of [Honshu](#), the largest [island](#) of Japan. The region consists of six [prefectures](#) (*ken*): [Akita](#), [Aomori](#), [Fukushima](#), [Iwate](#), [Miyagi](#) and [Yamagata](#).<sup>[2]</sup>

Tōhoku retains a reputation as a remote region, offering breathtaking scenery but a harsh [climate](#). In the 20th century, [tourism](#) became a major [industry](#) in the Tōhoku region.

**Tokyo Electric Power Company, Incorporated** (東京電力株式会社 *Tōkyō Denryoku Kabushiki-gaisha*<sup>?</sup>, [TYO: 9501](#)), also known as Toden (東電 *Tōden*<sup>?</sup>) or **TEPCO**, is a Japanese [electric utilities](#) servicing Japan's [Kantō region](#), [Yamanashi Prefecture](#), and the eastern portion of [Shizuoka Prefecture](#). This area includes Tokyo. Its headquarters are located in [Uchisaiwaicho](#), [Chiyoda](#), Tokyo, and international branch offices exist in [Washington, D.C.](#), and [London](#). It is a founding member of strategic consortiums related to energy innovation and research; such as [JINED](#),<sup>[1]</sup> [INCJ](#)<sup>[2]</sup> and MAI.<sup>[3]</sup>

Following the March [2011 Tōhoku earthquake and tsunami](#), its power plant at [Fukushima Daiichi](#) was the site of a [continuing nuclear disaster](#), one of the world's most serious. TEPCO could face ¥2 trillion (\$23.6 billion) in special losses in the current business year to March 2012,<sup>[6]</sup> and the Japanese government plans to put TEPCO under effective state control to guarantee compensation payments to the people affected by the accident.<sup>[7]</sup> The Fukushima disaster displaced 50,000 households in the evacuation zone because of leaks of radioactive materials into the air, soil and sea.<sup>[8]</sup>

In July 2012 TEPCO received ¥1 trillion from the Japanese government.<sup>[9]</sup> TEPCO's management subsequently made a proposal to its shareholders for the company to be part-nationalized.<sup>[10]</sup> The total cost of the disaster was estimated at \$100bn in May 2012.<sup>[9]</sup>

The **Fukushima Daiichi nuclear disaster** *Fukushima Dai-ichi* was a series of [equipment failures](#), [nuclear meltdowns](#) and [releases of radioactive materials](#) at the [Fukushima I Nuclear Power Plant](#), following the [Tōhoku earthquake and tsunami](#) on 11 March 2011.<sup>[5][6]</sup> It is the largest nuclear disaster since the [Chernobyl disaster](#) of 1986 and only the second disaster (along with Chernobyl) to measure Level 7 on the [International Nuclear Event Scale](#).<sup>[7]</sup>

## Maps and Graphics

New York Times interactive map of various types of damage (aftershocks, dead/missing, damaged/destroyed buildings, photos, and radiation levels):

<http://www.nytimes.com/packages/flash/newsgraphics/2011/0311-japan-earthquake-map/index.html>

Free USGS Poster (PDF and JPG; prints out at 24x36) summarizing the earthquake and aftershocks:

<http://earthquake.usgs.gov/earthquakes/eqarchives/poster/2011/20110311.php>

YouTube video: “Japan Earthquakes 2011 Visualization Map”

<http://www.youtube.com/watch?v=NSBjEvPH2j4>

9:57 long.; must watch at least the first 3 minutes to appreciate the 3/11 quake & aftershocks in context. Also has audio which is important to understand the seismic levels.

Another animated map of the earthquakes in Japan:

<http://www.japanquakemap.com/>

## **Understanding Earthquakes and Tsunamis**

History of Earthquakes and Tsunamis in Japan

<http://www.japanfocus.org/-Gregory-Smits/3531#>

Earthquake Engineering Research Institute’s (EERI) Tohoku Japan Earthquake and Tsunami Clearinghouse: <http://www.eqclearinghouse.org/2011-03-11-sendai/>

EERI raw video of tsunami at Kamaishi Port office

<http://www.eqclearinghouse.org/2011-03-11-sendai/2011/08/19/japan-tsunami-3112011-unedited-part-1/>

## **Nuclear Reactors and The Fukushima Daiichi Disaster**

2 Minute video animation on “How a Nuclear Reactor Works”

<http://www.youtube.com/watch?v=b4Q9O1vICWs&feature=related>

Shows a pressurized water reactor—very similar to the boiling water reactor at Fukushima. (Wikipedia has good animated diagrams of these two types of water reactors:

[http://en.wikipedia.org/wiki/Light\\_water\\_reactor](http://en.wikipedia.org/wiki/Light_water_reactor))

New York Times Teaching guide

Crisis in Japan: Understanding Nuclear Energy and Reactors

Video: Explaining the Nuclear Accident with Farts and Poop - Nuclear Reactor Boy’s Upset Stomach. (YouTube video, 4:34 min, posted by GenkiRadio, Mar 16, 2011):

<http://teach311.wordpress.com/2011/05/02/film-explaining-the-nuclear-accident-through-farts-and-poop-nuclear-reactor-boy%E2%80%99s-upset-stomache-2011/>

Educational Model: Understanding the International Nuclear Event Scale

<http://teach311.wordpress.com/2011/04/18/educational-module-understanding-the-international-nuclear-event-scale/>

MIT Nuclear Information Hub

<http://mitnse.com/>

Provides excellent resources for understanding nuclear energy, including the free PDF of the Global Seismic Hazard Map and comparison of Nuclear Plant Siting and Earthquake Risk

Article: “Uncomfortable Questions in the Wake of Nuclear Accidents at Fukushima and Chernobyl” by Anders Pape Møller and Timothy A. Mousseau (The Asia-Pacific Journal, Volume 11, Issue No. 13, No. 1, April 1, 2013.)

[http://japanfocus.org/-Timothy-A\\_Mousseau/3921#](http://japanfocus.org/-Timothy-A_Mousseau/3921#)

Nuclear Illinois Map

<http://neis.org/images/nuclearillinoismaponly.jpg>

Radiation Dosage Charts

[http://infobeautiful3.s3.amazonaws.com/2013/01/1276\\_radiation\\_chart.png](http://infobeautiful3.s3.amazonaws.com/2013/01/1276_radiation_chart.png)

<http://imgs.xkcd.com/blog/radiation.png>

Updated info: <http://blog.xkcd.com/2011/04/26/radiation-chart-update/>