

TIME LINE

Earthquake Japan Nuclear Accidents

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FIRST VISITOR (1 MAR 21)

If you are seeing my notes document for the first time, I suggest you check the section on Primary Sources for urls you may wish to visit. I will be adding more there in later editions.

As I explain in other notes documents, the news media often seems to delight in painting any disaster as worst ever, sky is falling, distorting reality, not fomenting coherent cooperation and rescue. My primary sources are a start at getting at latest facts.

You may also wish to visit my overall Nuclear notes document, which includes links to what I consider to be credible science sources, which explain what's going on, what's at risk, without the news media hype.

INTRODUCTION (1 MAR 21)

I split this info from my larger collections of notes, so it would be easier to copy & paste, as I saw more info which maybe belonged in the time line. I am not caught up on digesting the tsunami of additional information. Sometimes when I add new info one place, another section of my notes has an older story.

- EOJ = naming convention for my Earthquake Japan documents, to distinguish them from Haiti notes.
- EOJ Japan Overview = non-nuclear focus ... earthquake and tsunami recovery
- EOJ Nuclear = make sense of what's going on with the nuclear power plants
- EOJ Nuclear Time Line = visualize progression of events and trends, to help make sense without the distortion of the many news media actors with an agenda.
- EOJ Situation Reports
- Map Directory includes Haiti & Japan disasters, other disasters, Democracy foothold in Middle East, how to use some mapping resources.

Version sharing (1 Mar 21)

I have shared some of this info with:

- My Facebook wall (I am Alister Wm Macintyre there)
- My Linked In Profile / files (I am Al Macintyre there) / Japan folder
- Haiti Rewired group = Current Events
- Japanese Resilience (I am user AlMac99)
- E-mail to some contacts (Macwheel99 is a play on my surname)

After sharing, I increment version # to make it easy for people to see which latest version in later uploads.

Document Structure (1 Mar 16)

Topic sub-titles end in a date signifying when that info last updated, so by viewing table of contents, we see where most recent input to these research notes, especially aiding people with copy of an earlier version. Digit 1 in front of month means 2011.

Version numbers are incremented, with this document periodically uploaded various places for convenience of other people who can then pick and choose which of my research efforts they wish to download.

Users of my research hold Alister Wm. Macintyre harmless, and also the places I upload my research to, and agree that my copyright is reserved and that the information is available for the intended purpose of helping in the recovery of Haiti and Japan. Some of my research content is direct quotes from other sources. I try to give credit every time I do this.

PRIMARY SOURCES (1 MAR 20)

Thanks to major problems with news media coverage, many people are asking similar questions. So we need to go to primary sources for clarification.

- Info from Gov of Japan <http://www.kantei.go.jp/foreign/index-e.html> in English.
- IAEA updates on evolving situation in Japan.
<http://www.iaea.org/newscenter/news/tsunamiupdate01.html>
- Recent radiation readings http://eq.wide.ad.jp/index_en.html in English, with comparison of what is normal daily life.
- World Health Organization (WHO) info on health risks associated with various levels of radiation, with some FAQ on Japan situation.
<http://www.who.int/hac/crises/jpn/faqs/en/index.html>
- OCHA = UN agency in charge of coordination of humanitarian relief. Their Relief Web hosts regular updates from many humanitarian efforts at <http://www.reliefweb.int/rw/dbc.nsf> including the Japan crises.

Downloads from NIST (1 Mar 21)

March 20 I renamed downloads I have collected so far,¹ to make easier to read vintage when I upload them other places:

- INES 18 Mar GoJ
- NISA 13 Mar Sitrep
- NISA 14 Mar 7.30 am Sitrep
- NISA 14 Mar 7.30 pm Sitrep
- NISA 15 Mar 11 am Sitrep
- NISA 15 Mar 11.30 pm Sitrep
- NISA 17 Mar 5.30 am Sitrep
- Radiation 15 Mar Explanation

ACRONYMS TERMINOLOGY CONCEPTS (1 MAR 10)

Some specialized terminology used here, which are also good keywords when checking news search engines for the latest developments. Some of the acronyms here are for various outfits whose focus has been on dealing with the rest of the earthquake and tsunami disaster.

I am maintaining this directory of acronyms in my research notes document “**EOJ Nuke News**” but periodically copying the latest contents to “**EOJ Nuke Time Line**” document, typically shortly before sharing the latter with some upload place(s).

American Syndrome² = US News Media paints any event as the worst possible in history. Thus we never know which story really is the worst, and which is the usual spin.

BWR = Boiling Water Reactors

¹ My notes elsewhere, at time of original capture, may have had slightly different naming. But from the clues, hopefully I can find again if someone is seeking a copy of one of these.

² Named after China Syndrome movie.

CET = Central European Time,³ including Vienna, where [International Atomic Energy Agency \(IAEA\)](#) is located. It is GMT+1 where GMT is Greenwich Mean Time in Britain. Due to Daylight savings time, in winter it is UTC+1, in summer it is UTC+2. See UTC.

Chernobyl = worst nuclear accident in history. Many news stories are referencing this in their discussions of Japan situation. [Council on Foreign Relations](#) writes⁴ March 16 on long range consequences of Chernobyl cover-up.

CV = Containment Vessel (see PCV)

DLR = German Aerospace Center. [Here](#) are links to at least a score of downloadable maps of various aspects of the Japan disaster.⁵ Some of the inundation and other maps of interest to geography of the nuclear situation, but here is one satellite perspective more relevant:

[Disaster Extent Map Detail - Japan, Oshika Peninsula - Sheet 4: Onagawa Nuclear Power Plant - Earthquake/Tsunami](#)

13 March 2011, 16:53 CET - last update on 13 March 2011, 22:47 CET

Map type: Satellite Map

Producer: DLR

Scale: 1:7 500

Print size: DIN A1

Also see [these](#) DLR maps,⁶ including images of Fukushima Dai-ichi.

EQJ = Earthquake Japan = something I am using to help organize my research notes.

F + definitions (1 Mar 17)

FAQ = Frequently Asked Questions.

FESL = Fire Extinguishing System Line

[Fukushima I Daiichi](#)⁷

- Fukushima Dai-Ichi I on a map from <http://www.pdc.org> Pacific Disaster Center (PDC), summary⁸ link to detail⁹ PDF. This nuclear power plant is one of three in

³ http://en.wikipedia.org/wiki/Central_European_Time

⁴ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/ADGO-8EZMKL?OpenDocument&rc=3&cc=jpn> OCHA Relief Web

⁵ <http://www.zki.dlr.de/article/1893>

⁶ <http://www.digitalglobe.com/index.php/27/Sample+Imagery+Gallery>

⁷ http://en.wikipedia.org/wiki/Fukushima_I_Nuclear_Power_Plant

⁸ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/RKRR-8EXKVD?OpenDocument&rc=3&cc=jpn> from OCHA Relief Web

⁹ [http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/7DD06A9E7D10C036852578530053F39F/\\$File/map.pdf?OpenElement](http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/7DD06A9E7D10C036852578530053F39F/$File/map.pdf?OpenElement) from OCHA Relief Web

trouble right after March 11 earthquake and tsunami. There's another in trouble much farther south thanks to one of the aftershocks and accompanying tsunami. This map has 2 circles around. Orange middle is 3 km. Yellow outer is 10 km.

These are the initial evacuation and stay indoors zones which later got expanded.

- I downloaded a copy of this map, naming it
- EOJ Map 2011 Mar 11 NPS Fukushima Dai-Ichi I
- EQJ = Earthquake Japan (organizing my documents vs. Haiti)
- NPS = Nuclear Power Station

[Fukushima II Daini](#)¹⁰

GET = Global Expert Team

GFDRR = [Global Facility for Disaster Reduction and Recovery \(GFDRR\)](#)

GoJ = Government of Japan

I + definitions (1 Mar 17)

IAEA = International Atomic Energy Agency. The IAEA estimates that around 20 percent of nuclear reactors around the world are currently operating in areas of significant seismic activity.

IEC = IAEA's Incident and Emergency Center

INES = International Nuclear and Radiological Event Scale runs from 0 (deviation) to 7 (major accident).¹¹ Fukushima Daiichi Unit 1 became a level 4 'Accident with Local Consequences'

- 7 Major event
- 6 Serious accident
- 5 Accident with wider consequences
- 4 Accident with local consequences (Japan 2011 March official situation)¹²
- 3 Serious incident
- 2 incident
- 1 anomaly
- 0 below scale

¹⁰ http://en.wikipedia.org/wiki/Fukushima_II_Nuclear_Power_Plant

¹¹ <http://www.world-nuclear-news.org/nerinfo.aspx?id=11636>

¹² Expected to go up.

INES events are rated in reference to three attributes:

- People & Environment,
- Radiological Barriers & Control, and
- Defence in Depth.

ISSC = IAEA's International Seismological Safety Centre

JACT = Something I added to make some of the content, particularly the Time Line, more readable for me. It means to me that some Japan actions are implemented due to their legal check list of what to do when situation reaches some stage of severity. Later I hope to learn more about these various stages.

- JACT-10 = Article 10 of the Act on Special Measures Concerning Nuclear Emergency Preparedness
- JACT-15 = Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness
- JACT-15-3 = Article 15, Paragraph-3, of the Act on Special Measures Concerning Nuclear Emergency Preparedness
- JACT-64-3 = Article 64, Paragraph-3, of the Act on Special Measures Concerning Nuclear Emergency Preparedness

JST = Japan Standard (local) Time is UTC+9. See UTC.

K + definitions (1 Mar 17)

Key words, other than nuclear detail implications, to use in Search Engine news and Web history. See alphabetically, in this section, for key words to use for nuclear detail searches.

- Earthquake
- FEMA
- IMAT
- Japan
- MPHISE
- Multi-Hazard
- NOAA
- Nuclear
- Tsunami

- USGS
- Ushahidi

KM = Kilometer. 10 Km = 6 miles (approx)

NER = Nuclear Event Reports¹³

NEWS = Nuclear Event Web Based System¹⁴ jointly managed by The International Atomic Energy Agency, the OECD Nuclear Energy Agency and the World Association of Nuclear Operators.

NISA = Japan's Nuclear and Industrial Safety Agency

NPS = Nuclear Power Station

NRC = US Nuclear Regulatory Commission

News releases are available through a free listserv subscription at the following Web address:

<http://www.nrc.gov/public-involve/listserver.html>. The NRC homepage at www.nrc.gov also offers a SUBSCRIBE link. E-mail notifications are sent to subscribers when news releases are posted to NRC's website.

NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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Blog: <http://public-blog.nrc-gateway.gov>

It has sent experts to help Japan.¹⁵

OCHA = United Nations Office for the coordination of humanitarian affairs

OSOCC = UN Onsite Operations and Coordination Centre

P + definitions (1 Mar 17)

PBMR = Pebble Bed Modular Reactor. One is under construction in South Africa.

¹³ <http://www.world-nuclear-news.org/nerlist.aspx?fid=812>

¹⁴ http://89.151.116.69/uploadedFiles/wnn/NER/Supporting_Pages/whatsnews_p.pdf

¹⁵ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/SNAA-8EYS9R?OpenDocument&rc=3&cc=jpn> OCHA Relief Web

For a brief description of the PBMR design, see
http://www.eskom.co.za/nuclear_energy/pebble_bed/pebble_bed.html

See: <http://www.youtube.com/watch?v=UGYTE1oojA> -- for a short video demonstrating this old technology.

PCV = Primary Containment Vessel¹⁶

Q+A = Questions and Answers

QRT = Quick Reaction Team

Radioactive

RANET = IAEA's Response and Assistance Network. The network consists of nations which can offer specialized assistance after a radiation incident or emergency.

REMPAN = WHO's Radiation Emergency Medical Preparedness and Assistance Network

RHR = Residual Heat Removal System

T + definitions (1 Mar 17)

Tepco = Tokyo Electric Power Company – it runs the Fukushima nuclear plants which have been in the news a lot

TMI = Three Mile Island

Tokai =?= Tohoku Electric Power Co., Inc – I think it runs the Onagawa nuclear plant

UNSCEAR = [United Nations Scientific Committee on the Effects of Atomic Radiation \(UNSCEAR\)](#)

USAID = United States Agency for International Development

USAID Map dated Mar 13-14 showing earthquake and tsunami impact¹⁷ with nuclear power plants, railroads, primary and secondary roads. Interestingly Onawaga was closer to the epicenter, but Fukushima seems to be much more damaged. I downloaded a copy of this map naming it:

- EOJ Map 2011 Mar 14 USAID

¹⁶ See Credible Science explanations of the various containment levels.

¹⁷ OCHA Relief Web summary

<http://www.reliefweb.int/rw/rwb.nsf/db900sid/RKRR-8EXKWH?OpenDocument&rc=3&cc=jpn> and PDF detail
[http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/3231FE856A2D07E8852578530056FE5D/\\$File/map.pdf?OpenElement](http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/3231FE856A2D07E8852578530056FE5D/$File/map.pdf?OpenElement)

UTC + definitions (1 Mar 17)

UTC = Coordinated Universal Time.¹⁸ Figuring this out is important due to news about Japan coming out from different agencies in terms of their time zones around the world. See CET, JST. Examples:

- Britain (GMT) = UTC.
- CET (Central Europe) is UTC+1 in winter (daylight savings), UTC+2 in summer.
- American East Coast is UTC+5.
- JST (Japan) is UTC+9.

WHO = World Health Organization

WMO = World Meteorological Organization

WNN = World Nuclear News¹⁹

TIME LINE (1 MAR 18)

I am getting info for this time line from multiple sources. (Horse's mouth and other end.) Clarity of details with each time stamp are obviously very varied.

Also the details raise more questions ... what is significance of Articles 10 and 15?

<http://www.bbc.co.uk/news/science-environment-12722719>

http://en.wikipedia.org/wiki/Fukushima_II_Nuclear_Power_Plant

- Times = local time Japan, JST = Japan Standard Time

When I refer to various sources, where I got the info, that is all within my **EOJ Nuke News** research notes document, unless I state otherwise.

Other people are attempting to construct other time lines.

http://en.wikipedia.org/wiki/Timeline_of_relief_efforts_after_the_2010_Haiti_earthquake

EVENTS PRIOR TO LATEST CHAOS (1 MAR 20)

2010 Aug 14: Fukushima Dai-ichi unit 6 was shut down for routine planned maintenance. Its fuel is in its reactor. (IAEA confirmed)

2010 Nov 30: Fukushima Dai-ichi unit 4 was shut down for routine planned maintenance, and all fuel from the reactor was transferred to spent fuel pool. (IAEA confirmed)

¹⁸ http://en.wikipedia.org/wiki/Time_zone

¹⁹ http://www.world-nuclear-news.org/RS_Battle_to_stabilise_earthquake_reactors_1203111.html

2011 Jan 3: Fukushima Dai-ichi unit 5 was shut down for routine planned maintenance. Its fuel is in its reactor. (IAEA confirmed)

11 MARCH TIME LINE (1 MAR 20)

11 March Friday ... problems with cooling, start evacuations

- Prior to the earthquake and tsunami, IAEA has confirmed:
 - Fukushima Daiichi units 4 5 6 were shut down for routine planned maintenance.
 - Unit 4 fuel had been transferred to spent fuel pool.
 - Unit 5 and 6 fuel are fully loaded in their reactors.
- 1446 earthquake and tsunami. After the earthquake and tsunami, control rods have been inserted immediately in the 11 reactors which were in operation in 3 nuclear power plants in Miyagi, Fukushima and Ibaragi Prefectures, automatically suspending power generation.²⁰ Onagawa unit 2 achieved cold shutdown almost immediately (said NISA). Subsequently the tsunami flooded diesel generators which ran the pumps for water cooling at **Fukushima I Daiichi**, causing reactor core to heat up.
- 14:46 Set up of NISA Emergency Preparedness Headquarters (Tokyo) immediately after the earthquake, and started processing information from the various nuclear power plants, and other utilities in trouble.
- 15:42 TEPCO reported to NISA that Fukushima Dai-ichi, Units 1,2 and 3 at JACT-10
- 1600 national response by Japan's Nuclear and Industrial Safety Agency (NISA)
- 16:36 TEPCO says Fukushima Dai-ichi, Units 1 and 2 at JACT-15 = Loss of Cooling function.
- 16:45 TEPCO reported latest Fukushima Dai-ichi, Units 1 and 2 JACT-15 info to NISA
- 18:08 Unit 1 of Fukushima Dai-ichi notified NISA they at JACT-10
- 18:33 Units 1,2 and 4 of Fukushima Dai-ichi notified NISA they at JACT-10
- 19:03 Government declared the state of nuclear emergency (Establishment of Government Nuclear Emergency Response Headquarters and Local Emergency Response Headquarters)
- 1930 "nuclear emergency status" declared, standard precaution they say
- 2045 IAEA News²¹ overall includes Onagawa fire extinguished
- 2050 Fukushima prefecture's emergency preparedness headquarters - issued a directive regarding the accident occurred at Fukushima-Dai-ichi Nuclear Power Station, TEPCO that the
 - residents living in the area of 2km radius from Unit 1 of the Nuclear Power Station must evacuate.(The population of this area is 1,864)
- 2100
 - residents within a 3km radius of the power station are told to leave their homes, while

²⁰ See info from Gov of Japan 9 am Mar 16

²¹ See Official Primary.

- those within a 10km radius are told to stay at home in case it is necessary to extend the evacuation area.
- 21:23 Directives from Prime Minister to Governor of Fukushima, Mayor of Oookuma and Mayor of Futaba were issued regarding the accident occurred at Fukushima-Dai-ichi Nuclear Power Station, TEPCO, at JACT-15-3 as follows:
 - Residents living in the area of 3km radius from Unit 1 of the Nuclear Power Station must evacuate.
 - Residents living in the area of 10km radius from the Unit 1 must take sheltering.
- 22.55 Fire Smoke, on the first basement of the Turbine Building of Onagawa, was confirmed extinguished (says NISA).
- 24:00: Mr. Ikeda, Vice Minister of METI, arrived at the Local Emergency Response Headquarters.

12 MARCH TIME LINE (1 MAR 20)

12 March Saturday ... a large spectrum of different events

- 00.58 Onagawa Unit 1 gets from automatic shutdown to cold shutdown (says NISA), which I think is good news for that unit.
- 01.17 Onagawa Unit 3 gets from automatic shutdown to cold shutdown (says NISA), which I think is good news for that unit. This is now all 3 units of that NPS in that condition.
- 0155 IAEA News²² of initial evacuation
- 0450 IAEA News²³ of diesel challenges and other conditions
- 05:22 Unit 1 of Fukushima Dai-ni notified NISA they at JACT-15 = Loss of pressure suppression function
- 0530 vent some steam
- 5:32 Unit 2 of Fukushima Dai-ni notified NISA they at JACT-15 = Loss of pressure suppression function
- 05:44 Residents living in the area of 10km radius from unit 1 of the Nuclear Power Station must evacuate by the Prime Minister Direction.
- 06:07 Regarding Units 1,2 and 4 of Fukushima Dai-ni NPS, TEPCO reported NISA at JACT-15 = Loss of pressure suppression function
- 0610 IAEA News²⁴ of Fukushima Dai-Ichi plant I unit 2, mobile electric attempt, need to vent unit 1.
- 6:50 Due to JACT-64-3, government order to control the internal pressure in Fukushima-daiichi unit No. 1 and 2
- 7:45 Directives from Prime Minister to Governor of Fukushima, Mayors of Hirono, Naraha, Tomioka, Oookuma and Futaba were issued regarding the

²² See Official Primary.

²³ See Official Primary.

²⁴ See Official Primary.

accident occurred at Fukushima-Dai-ni Nuclear Power Station, TEPCO, due to JACT-15-3 as follows:

- Residents living in the area of 3km radius from Fukushima-Dai-ni Nuclear Power Station must evacuate.
- Residents living in the area of 10km radius from Fukushima-Daini NPS must take sheltering
- 0819 alarm about a control rod
- 1009 vent some more
- 1043 control rod problems solved
- 1058 vent more
- 12.15 **Fukushima Dai-ni Unit 3** gets from automatic shutdown to **cold shut down** (says NISA). I think this is good news for that unit. This is the first of four units reaching that point.
- 15:29 radiation monitor for Fukushima Dai-ichi I was 1015 micro sievert per hour, attributed to earlier venting

12 Mar 15.36 F Dai-ichi unit 1 explosion explained (1 Mar 20)

- 15.36 **hydrogen explosion** at Fukushima Dai-ichi I unit 1 explained by Gov of Japan next day 10 am briefing, and clarified in subsequent briefings.²⁵
 - The roof of unit 1 reactor building had blown off.
 - The cause, of this explosion:
 - The tsunami had wiped out diesel generators, so the pumps could not supply cold water to the core's fuel rods;
 - The water level dropped;
 - Reacted water and metal created hydrogen, which built up and leaked (or was vented) outside the containment vessel;
 - Hydrogen is highly flammable, it exploded;
 - This blew the roof off outer concrete building.
 - **Cesium and Iodine** were detected, it is believed that a part of nuclear fuel was damaged and a small amount of radioactive material leaked into core cooling water. At this point, and for several days after, the probability of radiation leakage, due to this incident, was extremely low. Later incidents could change expectations.
 - **Containment was not breached**, although initially there was some uncertainty. This was very similar to what happened 11.01 of March 14 with unit 3 of the same nuclear plant. In no way can this be called a "melt down" as was misreported by some news media. There is no risk of a hydrogen explosion in the containment vessel because there is no oxygen in it.

²⁵ Also see NIST 11.30 pm March 15.

12 March continues (1 Mar 17)

- 17:00 JACT-15 Notification since the radiation level exceeded the acceptable level of Fukushima Dai-ichi Nuclear Power Station.(NPS).
 - 17:39 Prime Minister directed evacuation of the residents living within the 10 km radius from the Fukushima-Dai-ichi NPS
 - 18:25 Prime Minister directed evacuation of the residents living within the 20km radius from the Fukushima Dai-ichi NPS
- 18:55 radiation monitor for Fukushima Dai-ichi I was 70.5 micro sievert per hour
- 19:55 Directives from Prime Minister was issued regarding sea water injection to Unit No.1 of Fukushima Dai-ichi NPS.
- 20.00 official story, steel containment still intact after explosion # 1
- 20:05 Due to JACT-64-3 and directives from Prime Minister, government ordered to inject sea water Unit No.1 of Fukushima Dai-ichi NPS.
- 20.20 at the Fukushima Dai-ichi Power Plant Unit 1, GOJ began measures to lower the temperature of fuel in the reactor pressure vessel by injecting sea water, and to restrain further nuclear fissions of fuel by mixing some boron into sea water.
- 21.07 sea water to be used in cooling
- 22.15 after shock interrupted sea water solution

13 MARCH TIME LINE (1 MAR 20)

13 March Sunday – cooling challenges

- 0117 Fukushima accident declared to be a level 4 on the INES scale
- 5:38 Unit 3 of Fukushima-Dai-ichi notified NISA of JACT-15 at the specific emergency stage under the loss of all of the coolant injection function. TEPCO is on the progress of the recovering of both of the power source and coolant injection function, and on vent for reducing of the pressure of RPV.
- 09.01 TEPCO told NISA of JACT-15 for Fukushima-Dai-ichi because Unusual increase of radiation dose at the site boundary
- 09:08 Pressure suppression in the Containment Vessel and fresh water injection started at Unit 3 of Fukushima Dai-ichi NPS. (says NISA)
- 09:20 Opening of Pressure vent valve of Unit 3 of Fukushima Dai-ichi NPS. (says NISA) (Also see primary source info from IAEA and Japanese briefings).
- 09:30 NISA directed the Governor of Fukushima Prefecture, the Mayors of Ookuma-machi, Futaba-machi, Tomioka-machi and Namie-machi based on the Act for Special Measures Concerning Nuclear Emergency Preparedness on radioactivity decontamination screening. (says NISA)
- 09:38 TEPCO notified NISA that Unit 1 of Fukushima Dai-ichi NPS reached JACT-15. (says NISA)

- 1100 Japan Chief Cabinet Secretary²⁶ briefs news media with lots of info regarding Fukushima Dai-Ichi plant I unit 3.
- 11:55 Unit 1 of **Fukushima-Dai-ichi** gets Sea water injected to the Primary Containment Vessel PCV via the Fire Extinguishing System Line (says NISA), which continues until March 14 01:10
- 11:55 Unit 3 of **Fukushima-Dai-ichi** = Fresh water is being injected to the PCV via Fire Extinguishing System Line (FESL) (says NISA)
- 13:09 Tohoku Electric notified NISA that **Onagawa** now JACT-10 (Unit not identified, but AI is guessing Unit 2 which did NOT achieve cold shut-down on 12 March) (info from NISA)
- 13:12 Unit 3 of **Fukushima-Dai-ichi** = Sea water is being injected to the PCV via FESL (says NISA)
- 14:00 Unit 2 of **Fukushima-Dai-ichi** = Water Injection Function has been sustained (says NISA)
- 14:25 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15. (says NISA)
- 14:36 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15 = Unusual increase of radiation dose at the site boundary

14 MARCH TIME LINE (1 MAR 21)

I am not sure when this started exactly, but NISA told IAEA about increasing temperatures in the spent fuel ponds at **Fukushima-Dai-ichi** Units 5 and 6 since 14 March.

- 01:10 Unit 1 and Unit 3 of **Fukushima-Dai-ichi** = Injection of Sea water injection into PCV is interrupted because of the lack of sea water in pit. (says NISA)
- 01:24 Unit 1 of Fukushima Dai-ichi = Due to Recovery of Residual Heat Removal System (RHR), water in suppression pool is started to cool for cold shut down. restarted (says NISA)
- 03:20 **Fukushima-Dai-ichi** = Injection of Sea water into PCV is restarted (says NISA)
- 04:08 **Fukushima-Dai-ichi** unit 4 **Spent Fuel Storage Pool** water temperature had increased to 84 C. (NISA 5.30 pm March 17 and IAEA 6.10 UTC March 18)
- 04:24 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15
- **04.40** TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 05:38 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 07:52 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15 = Unusual rise of the pressure in PCV
- 07:53 TEPCO notified NISA that Fukushima Dai-ichi NPS reached JACT-15.

²⁶ See Official Primary.

14 Mar 11.01 F Dai-ichi unit 3 explosion explained (1 Mar 20)

- 11:01 **hydrogen explosion** at Fukushima Dai-ichi unit 3, as reported to IAEA by Japanese authorities,²⁷ and also mentioned in multiple briefings from Gov of Japan. 6 workers got injured.
 - According to NIST 11.30 pm Mar 15
 - What happened here was same process as 15.36 Mar 12 with unit 1
 - The tsunami had wiped out diesel generators, so the pumps could not supply cold water to the core's fuel rods;
 - The water level dropped;
 - Reacted water and metal created hydrogen, which built up and leaked (or was vented) outside the containment vessel;
 - Hydrogen is highly flammable, it exploded;
 - This blew the roof off outer concrete building.
 - The primary containment vessel is not damaged, and the control room remains operational.
 - The pressure of the unit's containment vessel fluctuated, but it is becoming stable.
 - In no way is this a melt down, as was misreported by some news media.
 - This event does not threaten radiation leaks, while other events may.
- 11:13 Fukushima Dai-ichi unit 3 condition of containment vessel remains sound, according to 380kPa pressure inside reading.
- 11:30 Fukushima Dai-ichi unit 3 condition of containment vessel remains sound, so presumption is no major release of radioactive materials. They expect a possible increase in radiation levels similar to what followed the hydrogen explosion that occurred in the Unit 1 reactor. Accordingly, instructions have been given to the very small number (500) of people who were in the process of evacuating from a 20km zone around the power station that they should take refuge indoors immediately as a precautionary measure.²⁸
- 11:37 Fukushima Dai-ichi unit 3 radiation reading of 50 μ Sv/h was taken in the service hall inside the power station. Conclusion from multiple readings is that there is no radiation leakage due to the recent explosion.
- 11:44 Fukushima Dai-ichi unit 3 radiation reading of 20 μ Sv/h was recorded at the main entrance. Conclusion from multiple readings is that there is no radiation leakage due to the recent explosion.
- 11:55 Fukushima Dai-ichi unit 3 condition of containment vessel remains sound, according to 360kPa pressure inside reading.
- 12:36 Fukushima Dai-ichi unit 3 radiation reading of 1 μ Sv/h at an off-site center roughly 5 kilometers from the station. This is approximately the same figure as was recorded the previous day.
- 13:25 TEPCO told NISA that Fukushima Dai-ichi Unit 2 reached JACT-15 = Loss of cooling function

²⁷ Also see briefings by Japanese Cabinet Secretary in other primary sources.

²⁸ See briefing by Japanese Cabinet Secretary March 14, near 11 am.

- 14.12 The indoors safety precaution was lifted for residents around Fukushima Dai-ichi and their evacuation has resumed.

14 March continues (1 Mar 18)

- 15.30 Fire Dept reports²⁹ that the fire, at Tohoku Electric Power Company's Haramachi Thermal Power Station, started when a crane inside the power station collapsed and the crane's fuel ignited.
- 17.00 Fukushima Dai-ni unit 1 reaches cold shutdown (per NISA), the second to get there (unit 3 got there 12.15 March 12).
- 18.00 Fukushima Dai-ni unit 2 reaches cold shutdown (per NISA), third to get there.
- 20.00 just after this time Fukushima Dai-ichi units 1 2 3 water injection resumed, after debris from explosion had got cleared away. Earlier, pumping for unit 2 had been interrupted because they ran out of fuel, and getting more had taken longer than expected, during this delay there was a short period of time when the fuel rods were exposed above the water surface. Operations are now properly cooling the reactors again. (per Gov of Japan briefings)
- 22.13 TEPCO told NISA that Fukushima Dai-ni reached JACT-10
- 22.14 TEPCO evaluated that core damage of Fukushima Dai-ichi Unit 2 is “less than 5%” (per NISA Sitrep 11 am 2011 Mar 15)
- 22.35 TEPCO told NISA that Fukushima Dai-ichi reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 22.50 Water level in RPV in Fukushima Dai-ichi Unit 2 is decreasing. (per NISA Sitrep 11 am 2011 Mar 15)

15 MARCH TIME LINE (1 MAR 20)

I don't have the time of this March 15 update from [Government of Japan](#) but here are the latest evacuation instructions³⁰ to residents near Fukushima power plants, as of March 15.

Areas in which counter-emergency measures should be taken:

Residents staying within a 20-kilometer radius from the Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co.,Inc. (TEPCO) (continuation)

Residents staying in the area from 20-kilometre to 30-kilometer radius from the Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co.,Inc. (TEPCO) (NEW)

Direction:

²⁹ See briefing by Japanese Cabinet Secretary March 14, near 4 pm.

³⁰ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/MUMA-8EZ4DA?OpenDocument&rc=3&cc=jpn> from OCHA Relief Web

Residents staying within a 20-kilometer radius from the Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co.,Inc. (TEPCO) shall be evacuated.(continuation)

Residents staying in the area from 20-kilometre to 30-kilometer radius from the Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co.,Inc. (TEPCO) shall stay inside the houses or buildings. (NEW)

Observe directions by the relevant authorities if such directions are given.

Kashiwazaki-Kariwa is a nuclear power plant close to one of the aftershocks, shown on map (NW coast of Japan), of aftershocks Swarm ([MAP](#)) [Japan: Earthquakes Swarm \(15 Mar 2011\)](#) from United Nations World Food Programme (WFP) summary link³¹ to detail PDF³² which I downloaded with name “**EOJ Map 2011 Mar 15 WFP Aftershocks.**” Aftershock circles are sized according to magnitude of the earthquakes, along with locations of nuclear power plants, in the North, where most of the damage has been, so far.

15 March Tuesday

- 00.00 NISA accepted experts on NPS damage from IAEA.
- 00.00 NISA accepted experts dispatched from NRC.
- 00.40 Cold Shutdown of Tokai Dai-ni NPS confirmed. (per NISA Sitrep 11 am 2011 Mar 15) I believe any cold shutdown is a good thing.
- 02.00 Continue to remove residual heat by Residual Heat Removal System (RHR) in Fukushima Dai-ni Unit 1, 2, 3 and 4. (per NISA Sitrep 11 am 2011 Mar 15)
- 05.06 JST March 15 = 21.05 CET March 14 = when Japan notified IAEA that Fukushima Dai-ni reactor units 1, 2 and 3 are all in cold shutdown. This means that the pressure of the water coolant is at around atmospheric level and the temperature is below 100 degrees Celsius. Under these conditions, the reactors are considered to be safely under control. Tepco still working to bring unit 4 to same condition.
 - However, as we have seen with the spent fuel pools, news media panic, urban legend pranks, and other incidents, there’s more that needs to be under control, than the reactors. By Al Mac count, there are a total of FIVE nuclear power plants in trouble, and at least one non-nuclear power plant with lesser chaos.

15 Mar 6.10 F Dai-ichi unit 2 explosion explained (1 Mar 20)

- 06.10 Explosion # 2 noticed or reported by news media, but I think counts are off.
- 06.14 may now be official time of explosion at Fukushima Dai-ichi unit 2.
 - While earlier explosions with units 1 and 3 did not breach the primary containment, integrity of Unit 2 primary containment vessel is now in doubt.

³¹ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/RKRR-8EZLQD?OpenDocument&rc=3&cc=jpn> OCHA Relief Web

³² [http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/DAFF3E05B66C08E7852578550057E51B/\\$File/map.pdf?OpenElement](http://www.reliefweb.int/rw/fullmaps_sa.nsf/luFullMap/DAFF3E05B66C08E7852578550057E51B/$File/map.pdf?OpenElement) OCHA Relief Web

- **All 3 explosions** (so far) **were hydrogen**. (IAEA)
- 06.14 Part of wall in operation area of Fukushima Dai-ichi unit 4 was damaged. (NISA Sitrep 5.30 pm March 17)
- 06.20 Sound of explosion heard in Fukushima Dai-ichi unit 2. As the pressure in Suppression Chamber decreased, there was possibility that an incident occurred in this Chamber. (per NISA Sitrep 11 am JST Mar 15, and IAEA 6.15 CET Mar 15)
 - Understanding (per NIST Sitrep 11.30 pm JST Mar 15)
 - Automatic shutdown was initiated immediately after the earthquake and tsunami, with efforts to supply water to cool the fuel rods, but the water level dropped.
 - As stated above, the loss of pressure in Suppression Chamber led to belief that it has been damaged.

15 March continues (1 Mar 20)

- 07.00 Radiation readings of Onagawa NPS monitoring post indicate 6.1 micro Sv/h. (per NISA Sitrep 11 am 2011 Mar 15)
- 07.15 Cold Shutdown of Fukushima Dai-ichi Unit 4 confirmed. (per NISA Sitrep 11 am 2011 Mar 15) I believe any cold shutdown is a good thing, and now all 4 units of this NPS got here.
- 07.21 TEPCO told NISA that Fukushima Dai-ichi reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 07.24 Incorporated Administration Agency, Japan Atomic Energy Agency (JAEA) told NISA that Nuclear Fuel Cycle Engineering Laboratories, Tokai Research and Development Centre reached JACT-10
- 07.44 JAEA told NISA that Nuclear Science Research Institute reached JACT-10
- 08.54 Fukushima Dai-ichi unit 4 had a fire which lasted approx 2 hours before it got put out (per Gov of Japan briefings).
- 08.54 TEPCO told NISA that Fukushima Dai-ichi reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 09:16 Plant operators were considering the removal of panels from Fukushima Dai-ichi Units 5 and 6 reactor buildings to prevent a possible build-up of hydrogen in the future. It was a build-up of hydrogen at Units 1, 2 and 3 that led to explosions at the Dai-ichi facilities in recent days. (IAEA info)
- 10.30 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued directives:
 - For Unit 4: To extinguish fire and to prevent occurrence of re-criticality
 - For Unit 2: To inject water to reactor vessel promptly and to vent Drywell.
- 10.59 Function of Local Emergency Response Headquarters moved to the Fukushima Prefectural Office.
- 11.00 Fukushima Dai-ichi unit 4 fire confirmed out.³³ The temperature of the Spent Fuel Storage Pool has increased.³⁴

³³ See IAEA for details ... hopefully I translated the time zones correctly.

³⁴ NIST 15 Mar 11.30 pm Sitrep.

- 11.00 Prime Minister extended from 20 to 30 km, around the Fukushima power plants, the area for residents to stay indoors.
- 12.20 JST = 4.20 CET = when Japan informed IAEA that Fukushima Dai-ichi unit 4 spent fuel storage pond is on fire, and radioactivity is being released directly into the atmosphere. Dose rates of up to 400 millisievert per hour have been reported at the site. The Japanese authorities are saying that there is a possibility that the fire was caused by a hydrogen explosion.³⁵
- 16.00 Fukushima Dai-ichi unit 5 water level had decreased to 241 cm above the top of the fuel.
- 16.30 TEPCO told NISA that Fukushima Dai-ichi reached JACT-15 = Unusual increase of radiation dose at the site boundary
- 21.00 Fukushima Dai-ichi unit 5 water level had decreased to 201 cm above the top of the fuel. Officials planning to use an operational diesel generator in unit 6 to supply water to unit 5.
- 22.00 According to the Nuclear Regulation Act, Minister of Economy, Trade and Industry issued the following directive:
 - For Unit 4: implement injection of water to Spent Fuel Storage Pool.
- 22.31 Eastern Honshu, Japan experienced a 6.1 quake. Hamaoka nuclear power plant is an estimated 100 kilometres from the epicentre. That plant continues to operate safely. (IAEA confirmed this with Japan.) Units 1 and 2 are decommissioned, Unit 3 is under inspection and not operational, and Units 4 and 5 remain in safe operational status after the 6.1 aftershock.
- 23.10 All units at the Fukushima Daini, Onagawa, and Tokai nuclear power plants are in a safe and stable condition (i.e. cold shutdown).³⁶
 - Fukushima Dai-ichi nuclear power plant has most authorities concerned, where sea water injections to cool the reactors in Units 1, 2 and 3 are continuing. Attempts to return power to the entire Daiichi site are also continuing.
 - After explosions at both Units 1 and 3, the primary containment vessels of both Units are reported to be intact. However, the explosion that occurred at 06:14 UTC on 15 March at the Fukushima Dai-ichi Unit 2 may have affected the integrity of its primary containment vessel. All three explosions were due to an accumulation of hydrogen gas.
 - There was a fire at Fukushima Dai-ichi unit 4 which lasted 2 hours.

³⁵ <http://www.reliefweb.int/rw/rwb.nsf/db900SID/KKAA-8EYA5D?OpenDocument> OCHA Relief Web

³⁶ Info via IAEA.

- Evacuation and indoors zone has been increased from 20 to 30 kilometers. Ditto no-fly zone. The Japan Coast Guard established evacuation warnings within 10 kilometres of Fukushima Daiichi and 3 kilometres of Fukushima Daini.
- 23.46 TEPCO told NISA that Fukushima Dai-ichi reached JACT-15 = Unusual increase of radiation dose at the site boundary

16 MARCH TIME LINE (1 MAR 20)

Per [Japan: Nuclear and Industrial Safety Agency Tohoku Pacific Earthquake and the seismic damage to the NPSs \(As of 23:30 March 15, 2011\)](#) of the [Government of Japan](#) (NISA info as of 11.30 pm JST) summary link³⁷ to 6 page detail PDF,³⁸ including map showing where relevant nuclear plants located, which I downloaded as “**NISA 15 Mar 11.30 pm Sitrep**” (intending to share via my Linked In profile / my box.net files / Japan / official):

The Tohoku Pacific Earthquake of magnitude 9.0 struck the northeastern part of Japan at 2:46 pm on March 11th, 2011.

The earthquake and tsunami affected 4 nuclear power plants, with 14 reactors:

Onagawa = 3 reactors

Fukushima I = 6 reactors

Fukushima II = 4 reactors

Tokai II = 1 reactor

While 3 reactors (Fukushima Dai-ichi (I) Unit 4,5,6) were under periodic inspection, 11 reactors (Onagawa Unit 1,2,3; Fukushima Dai-ichi (I) 1,2,3; Fukushima-Dai-ri (II) Unit 1,2,3,4; and Tokai Dai-ri (II)) were automatically shut-down.

After the automatic shut-down, the Unit 1-3 at Onagawa Nuclear Power Station, the Unit 1-4 at Fukushima II Nuclear Power Station, and the Unit at Tokai II Nuclear Power Station have been cold shut down safely.

16 March Wednesday

- 07.30 Evacuation of population from the 20-kilometre zone around Fukushima Dai-ichi has been successfully completed.
- 08.30 Japan is investigating source of white smoke detected at Fukushima Dai-ichi unit 3. Japan is also examining to see whether there is a direct connection-the radiation levels near the main entrance are changing considerably from moment to moment, and overall, we understand they remain within a range that would impact the human body. At one point last night, a radiation level of 1,000 $\mu\text{Sv/h}$ was detected, and as of this morning it had fallen to the 600-800 $\mu\text{Sv/h}$ range.³⁹

³⁷<http://www.reliefweb.int/rw/rwb.nsf/db900sid/ADGO-8EZLNU?OpenDocument&rc=3&cc=jpn> OCHA Relief Web

³⁸[http://www.reliefweb.int/rw/RWFiles2011.nsf/FilesByRWDocUnidFilename/ADGO-8EZLNU-full_report.pdf/\\$File/full_report.pdf](http://www.reliefweb.int/rw/RWFiles2011.nsf/FilesByRWDocUnidFilename/ADGO-8EZLNU-full_report.pdf/$File/full_report.pdf) OCHA Relief Web

³⁹ <http://www.reliefweb.int/rw/rwb.nsf/db900sid/ADGO-8EZLBA?OpenDocument&rc=3&cc=jpn> OCHA Relief Web

- 10.00 (just after) radiation levels near Fukushima Dai-ichi unit 3 main entrance jumped rapidly, reaching the mSv/h range. For this reason, reflecting this situation, the minimum necessary personnel on hand temporarily evacuated to a safe area.
- 10.45 workers evacuated from shared control room for Fukushima Dai-ichi units 3 and 4, until it was certain safe to return.
- 10.54 radiation levels began to fall at Fukushima Dai-ichi unit 3. Experts are hard at work analyzing the situation, but at present, we have not confirmed anything, in the reports shared so far.
 - The most probable case is that vapor is being released from part of the containment vessel, as took place in the Unit 2 reactor, and this is appearing as white smoke. As this is vapor which has been absorbing the contained radiation, this may be the reason for the temporary rise in measured radiation levels. This is the situation judged to be most likely according to the analysis at this time. People are monitoring the radiation levels, and confirming conditions such as whether water is actually continuing to flow, with the end goal of swiftly analyzing this situation and deciding measures to take in response.
- 11.30 workers returned to shared control room for Fukushima Dai-ichi units 3 and 4, restarted water injection.

17 MARCH TIME LINE (1 MAR 21)

17 March Thursday

Emergency Diesel Generator (1 unit) for Fukushima Dai-ichi Unit 6 operable. Supplying electricity to Unit 5 and 6. Water injection to Spent Fuel Pool through the Make up Water Condensate System (MUWC) progressing. Schedule to inject water to the Reactor Pressure Vessel (RPV) after the recovery of external power source.

- 05.30 Fukushima Dai-ichi unit 2 is getting external grid power line cable installed. (IAEA) They plan to reconnect power to Unit 2 once the spraying of water on the Unit 3 reactor building is completed.
- 09:48 Fukushima Dai-ichi unit 3 received sea water via Self-Defense Force helicopters. (NISA)
- 09:52 Fukushima Dai-ichi unit 3 received sea water via Self-Defense Force helicopters.
- 09:58 Fukushima Dai-ichi unit 3 received sea water via Self-Defense Force helicopters.
- 10.01 Fukushima Dai-ichi unit 3 received sea water via Self-Defense Force helicopters.
- 12.00 Fukushima Dai-ichi unit 5 spent nuclear fuel pool water temperature had increased to 64.2 °C (IAEA 6.10 UTC March 18)
- 12.00 Fukushima Dai-ichi unit 6 spent nuclear fuel pool water temperature had increased to 62.5 °C (IAEA 6.10 UTC March 18)
- 16.01 Fukushima Dai-ichi unit 3 arrival of riot police for grand discharge.

- 17.30 Fukushima Dai-ichi unit 2 gets cable installation to receive electricity from the transmission line of Tohoku Electric Power Company. To be connected after completion of discharge work at unit 3. (NISA)
- 17.30 Sea water now going into Fukushima Dai-ichi units 1 2 3.
- 17.30 Water stopped into Fukushima Dai-ichi unit 4.
- 20.09 Spraying water on Fukushima Dai-ichi unit 3 temporarily interrupted. (IAEA)

18 MARCH TIME LINE (1 MAR 21)

18 March Friday

- 03.00 Fukushima Dai-ichi unit 5 spent nuclear fuel pool water temperature had increased to 65.5 °C (IAEA 6.10 UTC March 18)
- 03.00 Fukushima Dai-ichi unit 6 spent nuclear fuel pool water temperature had increased to 62.0 °C (IAEA 6.10 UTC March 18)
-

19 March Saturday

20 March Sunday

21 March Monday

LESSONS HOPE LEARNED (1 MARCH 18)

This impacts energy policies for all nations.

Japan designed nuclear plants to be secure against 8.2 quake, which they thought was worst case scenario. But if you check quake history, there was a 9.5 in Chile in 1960.

http://en.wikipedia.org/wiki/Lists_of_earthquakes#Largest_earthquakes_by_magnitude

http://en.wikipedia.org/wiki/List_of_deadly_earthquakes_since_1900

The 9.0 which Japan received, was 8 times more powerful than the 8.2 they had designed for. Maybe it is reasonable to design buildings more inexpensively, so they fall down if worse than 8.2, but nuclear power plants should be designed for a REAL worst case scenario.

Various US commissions have been making nuclear recommendations for YEARS, which have yet to be implemented. Nuclear is perhaps more critical than other areas of safety.

We have an airplane crash, which kills a few hundred people. The NTSB figures out what causes it, and recommends certain safety improvements. Nothing happens because they are too expensive. Another crash kills a few hundred more people. NTSB figures out it was

same cause, repeats what solution is needed. Nothing happens. Finally after we have over 1,000 dead people, the authorities finally decide we need to fix this problem.

The same kind of thinking is across a lot of USA industry. All sorts of investigations have found all sorts of problems in need of fixing, but nothing happens for a variety of reasons.

One year before Hurricane Katrina there was Hurricane Pam, which was a simulation, what would happen if the Gulf Coast got the most powerful Hurricane then known to man. Pam exactly predicted Katrina, and what needed to be done to protect the people. When Katrina came along, none of the protections had been implemented, and all the lessons of Pam had fallen out of authorities brains.