Japan Nuclear Accidents Glossary of Terminology and Acronyms

Acronyms Glossary and other Translation aids

collected by Al Mac

Alister William Macintyre research notes
5/18/2011 (last updated)

Version **1.6**

Table of Contents

Introduction (1 Feb 16)

Acronyms, Concepts, special Terminology, are defined here, in alphabetical sequence, to try to make it easy when we are reading some document from UN, or government … what the heck is that? Look it up here.

This is a perpetually updated directory of acronyms and related terminology found in write-ups Japan earthquake tsunami aftershock nuclear etc. do what about it., acquired from many different sources, to help locate info again when same topic repeats. Sometimes Al falls a bit behind on keeping some areas current. But as Al sees new examples of "what the heck is that?" in these documents, if not too busy, tracks down the meaning and updates this reference collection.

Collected by Alister Wm Macintyre (Al Mac), Evansville Indiana, while doing pro bono research support for various volunteers who want to do something constructive.

Research notes document structure (1 Feb 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.

Japan notes documents (1 Apr 30)

Over time, I have split my Japan and related notes, and now have them in the following documents:

- Acronyms Glossary for Haiti – many of the acronyms are relevant to many disasters. I also have a Glossary of Housing and other Challenges in Haiti, and have a major Glossary section in my notes on Economic Disaster (the train wreck variously called Great Recession, Financial Earthquake, Economic Melt-down, past present and future).
- EOJ = initial naming convention for some of my Earthquake Japan documents, to distinguish them from Haiti notes.

- EOJ Japan Overview = non-nuclear focus … earthquake and tsunami recovery[1]
- EOJ Japan SitReps = Japan Situation Reports[2]
- EOJ Nuclear News = make sense of what's going on with the nuclear power plants – many topics which I am splitting into more focused notes areas
- EOJ Nuclear Time Line = visualize progression of events and trends, to help make sense without the distortion of the many actors with an agenda
- Japan Nuclear Accidents Glossary of Terminology and Acronyms = Try to explain specialized geek language associated with the Japan nuclear disaster, and related recovery. A person working with any of my EOJ documents also ought to get a copy of this.
- Japan Nuclear Info Navigation Guide = Identifying "The Horse's Mouth" for people who have been overly dependent on the other end of the horse (the news media), and are starving for better information.
- Lessons Japan Disasters for the whole world = what we should have learned from Japan's disasters, to apply to rest of world to mitigate risk of something similar happening some place else.
- Map Directory = directory of map sources relevant to disasters in Haiti and Japan and other places, also Middle Eastern Democracy Movements.
- I have also downloaded some OFFICIAL documents, named them with a mixture of EOJ, what they are about (e.g. Map), date vintage and organizational source.

For a variety of reasons, I began to fall behind on keeping these notes current, so early in April I shifted focus to getting Time Line current, then revert to more of the big picture. Thus some of my other notes may have gaps in detail.

Version Sharing (1 Mar 25)

I periodically upload my research notes documents to various public sites where my friends and contacts may freely cherry pick which of my efforts to download copies for themselves. These include:

- Box net on Linked In
- E-mail to some contacts (Macwheel99 is a play on my surname)
- Facebook = I am Alister Wm Macintyre there

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[1] Info on Mapping sources got moved into Maps Directory document so in one place are where to find Maps about Haiti, Japan, other disasters, and also regarding Democracy seeking a foothold in the Middle East.
[2] Mainly non-nuclear, what I consider to be the bigger disaster for the people more due to tsunami than earthquake.

- Haiti Rewired[3] / For other than Haiti, see group = Current Events
- Japanese Resilience (I am user AlMac99)[4]
- Linked In / my profile = Al Macintyre / my box net files / folders by general topics[5]
- Plan Haiti has some of my early Haiti research[6]
- Prizm – so far mainly Haiti research
- Scribd (I am user AlMac99)[7]
- Yahoo HDRR – only Haiti here, and disaster relief in general, where it applies to Haiti[8]

After sharing, I usually increment version # to make it easy for people to see which latest version in later uploads. But you can also see by verifying table of contents up-to-date, then date in parentheses at ends of headings to see which got most recently updated.

Tags (1 May 04)

When uploading this document to places which make descriptions practical, maybe I should start with the following:

Deciphering reports, on Nuclear Accidents in Japan, can be challenging for the Layman, due to lots of technical terminology, and reports drowning in a high density of unfamiliar acronyms. Here I try to share credible sources of information, translating geek into understandable for the layman.

I have several sister research notes documents, including: time line of the nuclear accident events; credible sources of info such as providing radiation info in perspective; lessons which should be learned; and directory of maps.

Terminology Clarification (1 Mar 25)

A lot of info sources assume their readers have knowledge which they do not, which contributes to mass confusion in need of clarity. Here are some common areas of that confusion.

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[3] http://haitirewired.wired.com/profile/AlisterWmMacintyre
[4] http://japan.resiliencesystem.org/nuclear-engineering-issues
[5] Outside the folders are documents which cross topics, such as Maps Directory of sources relevant to Haiti, Japan, Middle East, and more.
[6] http://sites.google.com/site/planhaiti/home
[7] http://www.scribd.com/explore
[8] http://groups.yahoo.com/group/HaitiDisasterRecoveryResearch/

Radiation Dose Clarifying (1 Mar 25)

We are told that this or that dose is less that we would get at a doctor office. I sought radiation intensities associated with various ordinary incidents other than what's going on in Japan, to put that in perspective. This is on page 4 of a Radiation PDF which I have downloaded,[9] and can send along to people. Lots of graphics there, so I not adding here. However something very similar at end of this sub-section "chapter."

I learn that we are hampered because

- Some science measurement symbols not on our keyboards, nor easily get at, but maybe we can copy-paste them with explanation here.
- M = mili-meter (why not use MM?),
- M = micro-meter (this "science" system is overdue to fix), and
- M = meter

I am seeing radiation intensities in stories out of Japan in the following units: (sources)

mSv to 10 uSv/hr (IAEA news)

18,000 cpm to greater than 100,000 cpm (testing evacuated residents in NISA report)

A reading up to 1,204.2μSv was recorded in what got vented. (briefing by Japan government)

A Japanese government agency has released the results of radiation measurements at dozens of monitoring posts. See the data here: http://www.mext.go.jp/component/a_menu/other/detail/__icsFiles/afieldfile/2011/03/18/1303727_1716.pdf.

According to http://mitnse.com/ which is a great source to visit regularly.

Normally nuclear workers are allowed to receive a dose of 20 millisieverts per year, although in practice they often receive very much less. If that limit is exceeded in any year, the worker cannot undertake nuclear duties for the remainder.

In emergency circumstances safety regulators allow workers to receive up to 100 millisieverts with the same conditions applying, that they must leave the site should that limit be reached. The 100 millisievert level is roughly the point at which health effects from radiation become more likely. Under a special allowance from the Nuclear and Industrial Safety Agency (NISA), workers at Fukushima were permitted doses of up to 250 millisieverts.

Health effects vary depending on size of dose at one time, what element isotopes involved.

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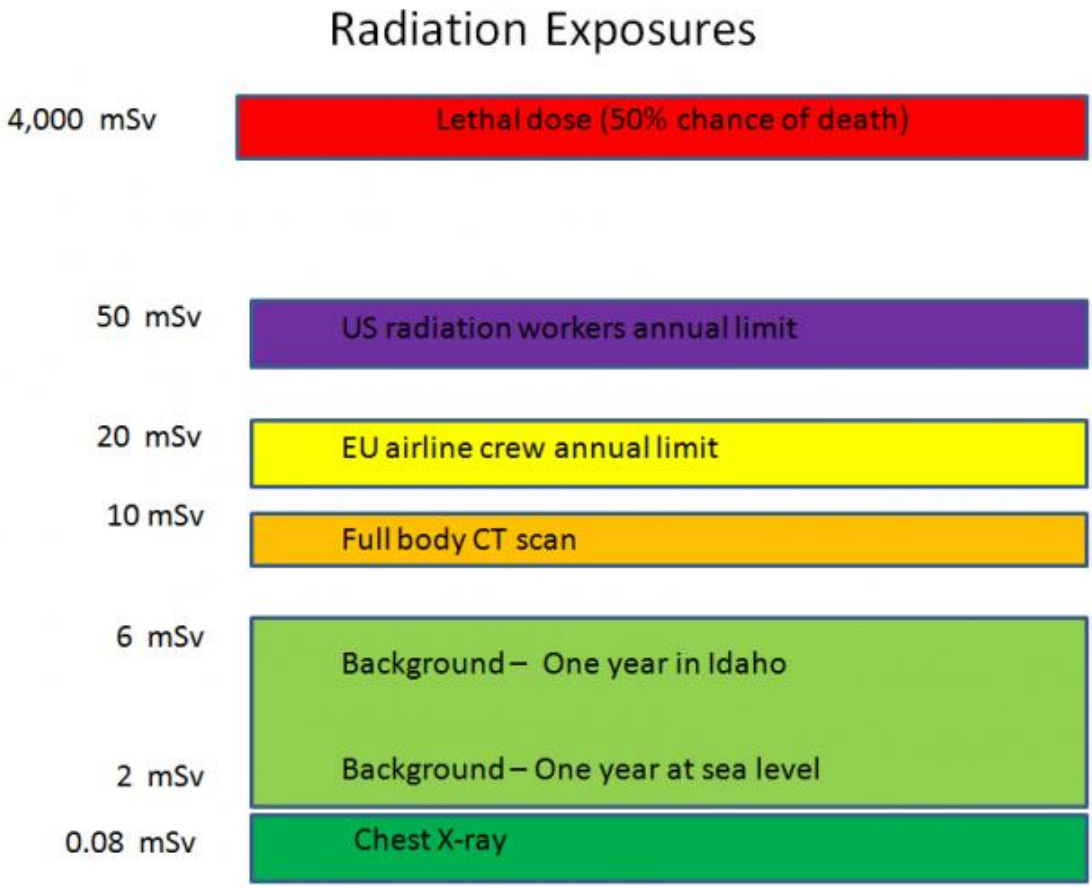
[9] http://eq.sakura.ne.jp/110315fukushima_2030rev2_en.pdf

note: 1 Rem = 1000 millirem; 1Sv = 1000 millisievert

Cumulative Dose = Dose Rate x Time Exposed

Page left intentionally blank before following charts, so all of it on same page.



Source of Radiation	**Dose in millirem (mrem) or Dose Rate (mrem/hr)**	**Dose in milliSv (mSv) or Dose Rate (mSv/hr)**
Background (average in U.S.)	~360 millirem per year (1 millirem per day)	3.6 milliSievert
Chest X-ray	~8 millirem per X-ray	.08 milliSievert
CT scan of abdomen	~800 millirem	8 milliSievert
A cross country flight in the U.S.	2-5 millirem	0.02 - 0.05 milliSievert
Regulatory limit for radiation workers	5000 millirem per year	50 milliSievert

Radiation Scam (1 Mar 17)

In recent days a map has circulated the internet, purporting to predict high doses to the Western U.S. This map bears the seal of the Australian Radiation Service, which did not produce it. The map has been refuted by the U.S. NRC, and experts state that it more closely resembles predictions for doses after deployment of a nuclear weapon than those for a situation such as that unfolding at present.[10]

Radiation Detection Equipment (1 Mar 25)

Is there such a thing as certification of radiation detectors, approved by relevant authorities such as

IAEA = International Atomic Energy Agency

JAEA = Japan Atomic Energy Agency

NEWS = Nuclear Event Web Based System 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

NRC = US Nuclear Regulatory Commission[11] Here's NRC FAQ about Radiation and Radiation Protection.[12] **Where can I learn more about radiation protection?**

On the NRC site, see Related Information or Contact Us About Radiation Protection, or exit this site to access the following resources:

- Facts about Radiation (U.S. Department of Energy) EXIT
- Americans' Average Radiation Exposure (U.S. Department of Energy) EXIT
- RadTown USA (U.S. Environmental Protection Agency) EXIT

UNSCEAR = United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

This is one of several threads I am looking into, as a result of questions raised by Michael D. McDonald, Dr.P.H. of http://japan.resiliencesystem.org/.

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[10] http://mitnse.com/
[11] http://www.nrc.gov/
[12] http://www.nrc.gov/about-nrc/radiation/related-info/faq.html

People Finding (1 Mar 26)

I don't remember where I put it, but both Google and Red Cross have people finder services, various nations foreign office services for their citizens, and I would not be surprised if there are others.

United Nations Office for the Coordination of Humanitarian Affairs - Integrated Regional Information Networks (IRIN) provide[13] summary link[14] to 2 page PDF.[15] I downloaded, calling it: Trace Missing Persons 2011 Mar 16. It has info relevant to Haiti, Japan, other nations with disasters, but may be limited in sources consulted.

Of relevance to reuniting children with their families, and how best to care for them before that is successful, there has been a controversy in Haiti, and other nations after similar disasters, which I address in my "**Glossary of Housing**" (and other) "**Challenges**" document. See section on **Ideological Divides**, focus area **Apparent Orphan Children**.

People Scales (1 Mar 16)

I have seen many maps showing communities impacted by earthquake, aftershock, tsunamis. I have seen directories of what damage happened in what communities. I have seen reports of how far from nuclear plants for people evacuated. What I am not yet seeing is:

- A map with population densities communities before / after estimated, vs. how high the tsunami waves when they got inland there.
- A map with SIZE of Japan vs. kilometer distances of the evacuations.
- A map of Japan crisis areas with the infrastructure damage pin pointed.

Acronyms Terminology Concepts (1 Mar 25)

Some specialized terminology and acronyms, explained here, 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. This info used to be scattered across several of my Japan notes documents, but I began concentrating them one place, on 2011 March 25.

American Syndrome + definitions (1 Mar 24)

American Syndrome[16] = 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.

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[13] A selection of IRIN reports are posted on ReliefWeb. Find more IRIN news and analysis at http://www.irinnews.org

[14] http://www.reliefweb.int/rw/rwb.nsf/db900sid/JARR-8EZDL5?OpenDocument&rc=3&cc=jpn from OCHA Relief Web

[15] http://www.reliefweb.int/rw/rwb.nsf/db900sid/JARR-8EZDL5/$File/full_report.pdf from OCHA Relief Web

[16] Named after China Syndrome movie.

Crawford Kilian independently encountered this phenomenon thru his blog H5N1, which he uses to learn how the media report on diseases. And that in turn affects the political response to public-health issues. In the case of Japan, as with earlier outbreaks, the media have tended to go for scare stories, myths, and stereotypes. That in turn will lead to scare politics and misguided policy.[17]

The Japanese themselves, and long-resident foreigners, are keenly aware of how the story arc misrepresents them and their present problems. And in a literate, fully wired society, they are pushing back online against the stereotypes.

Go to #JPQuake and you'll find individuals and Japanese news sources tweeting about the latest developments, including events that never reach the mainstream media. English-language Japanese media like Japan Today and NHK World provide calm, up-to-date reports

Local blogs like Gakuranman and Japan Probe also present pretty straightforward reports, as well as some sharp criticism of media bias.

JPQuake Journalist Wall of Shame cites specific reports and journalists for their errors, ranging from 1 ("probably unintentional") to 10 ("hysterical fear-mongering along with racial/cultural/political bias").

For lots more, check out "Shaky Coverage of Japan."[18]

B + definitions (1 Apr 01)

BWR = Boiling Water Reactors

CET = Central European Time,[19] 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 writes[20] March 16 on long range consequences of Chernobyl cover-up.

Cold Shutdown = reactors are in a safe mode, with cooling systems stable and under control, and with low temperature and pressure within the reactor.

Criticality is explained by MIT NSE.[21]

CST

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[17] http://thetyee.ca/Mediacheck/2011/03/24/JapanCoverage/
[18] http://thetyee.ca/Mediacheck/2011/03/24/JapanCoverage/
[19] http://en.wikipedia.org/wiki/Central_European_Time
[20] http://www.reliefweb.int/rw/rwb.nsf/db900sid/ADGO-8EZMKL?OpenDocument&rc=3&cc=jpn OCHA Relief Web
[21] http://mitnse.com/2011/03/18/what-is-criticality/

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.[22] 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,[23] including images of Fukushima Dai-ichi.

E + definitions (1 Apr 27)

Earthquake predicting: Science is constantly improving. It cannot predict WHEN one will come, like with weather prediction, but scientists have been predicting WHERE there is a high risk of one coming soon.

Haiti had a nasty quake Jan 2010, a couple years after earthquake scientists predicted that Haiti was overdue to get a serious one, right around where it actually arrived. So the quake was a shock to everyone, but not a surprise to earthquake scientists.

According to 2011 March 19 Economist magazine,. Japanese seismologists had warned in Jan 2011 that NE Japan was overdue for a large quake. They calculated that there was a 99% chance of an 8.0 or higher quake in the next 30 years off the Miyagi coast. They were not surprised March 11 by a quake coming pretty close to where they had predicted one, only by its size.

ENAC = Emergency Notification and Assistance Convention Website, designed for member states to exchange information on nuclear accidents.

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

Evacuations: Tsunami victims have been evacuated to shelters.
Residents evacuated

- Within 20 kilometer (12 mile) radius of Fukushima I Nuclear Power Plant
- Within 10 kilometer (6 mile) radius of Fukushima II Nuclear Power Plant

170,000 evacuated, so far, in vicinity of the nuclear accident

Air traffic restricted within 10 km (6 mi)

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[22] http://www.zki.dlr.de/article/1893
[23] http://www.digitalglobe.com/index.php/27/Sample+Imagery+Gallery

http://www.bbc.co.uk/news/world-asia-pacific-12724953

FAQ = Frequently Asked Questions.

- To stay informed on Japan nuclear accident situation, forget usual media outlets, consult websites[24] in listed in my **Japan Nuclear Info Navigation Guide**, and links from them to related articles. Get regular updates from http://mitnse.com/
- **Crisis Commons** has created a Japan Data Profile wiki containing various data sources relevant to the Japan earthquake and tsunami response, and the nuclear situation: http://wiki.crisiscommons.org/wiki/Japan_Data_Profile
- FAO,[25] IAEA[26] and WHO[27] (UN agencies) are committed to mobilizing their knowledge and expertise in support of the Japanese government's ongoing efforts to address food safety and other issues stemming from the events of 11 March.[28] They have created a FAQ to answer common questions about safety in Japan.[29]
    - Current risk
    - Ionizing radiation
    - Human exposure to ionizing radiation
    - Travel advice
    - Health effects
    - Public health actions
    - Personal protective measures
    - Food safety
    - WHO's response

FESL = Fire Extinguishing System Line

Fukushima clarification + (1 Apr 27)

Fukushima I Dai-ichi[30]

Fukushima Dai-ichi (I) is located approximately

230 km from Tokyo[31]
580 km from Osaka[32]
600 km from Sapporo[33]

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[24] https://morgsatlarge.wordpress.com/2011/03/13/why-i-am-not-worried-about-japans-nuclear-reactors/
[25] FAO = Food and Agriculture Organization
[26] IAEA = International Atomic Energy Agency
[27] WHO = World Health Organization
[28] http://www.who.int/mediacentre/news/statements/2011/japan_20110323/en/index.html
[29] http://www.who.int/hac/crises/jpn/faqs/en/index7.html
[30] http://en.wikipedia.org/wiki/Fukushima_I_Nuclear_Power_Plant

[31] Tokyo is south of Fukushima Dai-ichi on east coast of Japan.
[32] Osaka is south west of Fukushima Dai-ichi.
[33] Sapporo is north of Fukushima Dai-ichi.

Located on the Eastern coast of Japan, the six nuclear power reactors at Daiichi are boiling water reactors (BWRs). A massive earthquake on 11 March disabled off-site power to the plant and triggered the automatic shutdown of the three operating reactors ' Units 1, 2, and 3. The control rods in those units were successfully inserted into the reactor cores, ending the fission chain reaction. The remaining reactors -- Units 4, 5, and 6 -- had previously been shut down for routine maintenance purposes.

Backup diesel generators, designed to start up after losing off-site power, began providing electricity to pumps circulating coolant to the six reactors. Soon after the earthquake, a large tsunami washed over the reactor site, knocking out the backup generators. While some batteries remained operable, the entire site lost the ability to maintain normal reactor cooling and water circulation functions.[34]

Fukushima Dai-Ichi I on a map from http://www.pdc.org Pacific Disaster Center (PDC), summary[35] link to detail[36] PDF. This nuclear power plant is one of four in trouble right after March 11 earthquake and tsunami, and for the first week or so having the biggest volume of troubles.[37] There's others in trouble due to aftershocks and accompanying smaller tsunami.

Fukushima Dai-Ichi I has six nuclear reactor buildings, which are called "units."

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 got expanded later.

- I downloaded a copy of this map, naming it[38]
- EOJ Map 2011 Mar 11 NPS Fukushima Dai-Ichi I
- EQJ = Earthquake Japan (organizing most of my documents vs. Haiti research)
- NPS = Nuclear Power Station

http://www.tepco.co.jp/nu/f1-np/camera/index-j.html

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

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

Fukushima II Dai-ni[39]

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[34] International Atomic Energy Agency (IAEA)

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

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

[37] See my "**EOJ Nuclear Time Line**" for the evolving story.

[38] As I got more downloads, my naming conventions evolved.

[39] http://en.wikipedia.org/wiki/Fukushima_II_Nuclear_Power_Plant

This nuclear power plant is one of four in trouble right after March 11 earthquake and tsunami. In the first week or so, it and Onagawa were second most trouble, behind Fukushima Dai-Ichi.

Fukushima Dai-ni I has four nuclear reactor buildings, which are called "units."

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

G + definitions (1 Apr 24)

GET = Global Expert Team

GFDRR = Global Facility for Disaster Reduction and Recovery (GFDRR)

GoJ = Government of Japan

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

IEDM = International Environment and Disaster Management Laboratory

INES (1 May 04)

INES = International Nuclear and Radiological Event Scale runs from 0 (deviation) to 7 (major accident).[40] While its online debate[41] considers whether the world would be better off without nuclear, this Economist article[42] discusses the rating of Fukushima as INES level 7

NISA issued temporary INES ratings several times. Those provisional ratings were provided based on "What is known" at the time.[43]

The first temporary rating was issued at 0:30 on March 12 (About 10 hours after the earthquake attack). At that moment, the following units were rated as Level 3 since all heat removal function became inoperable based on "Defense in Depth" criteria.
Fukushima Dai-ichi Unit 1, 2 and 3;
Fukushima Dai-ni Unit 1, 2 and 4.

In the evening of March 12, the rating of Fukushima Dai-ichi Unit 1 was re-evaluated to Level 4 based on the "Radiological Barriers and Control" criteria, since the radiation level in the site increased.

On March 18, re-evaluation was carried out. The rating of Fukushima Dai-ichi Unit 1, 2 and 3 were re-rated to Level 5 based on "Radiological Barriers and

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[40] http://www.world-nuclear-news.org/nerinfo.aspx?id=11636
[41] **http://www.economist.com/debate/debates/overview/201**
[42] http://www.economist.com/blogs/babbage/2011/04/japans_nuclear_crisis
[43] http://japan.resiliencesystem.org/sites/default/files/Fukushima_Report.pdf

Control" criteria because the fuel damage was highly possible. Fukushima Dai-ichi Unit 4 was evaluated to Level 3 based on the "Defense in Depth" criteria.

APRIL 11th, the Japanese authorities announced that they had reassessed the severity of the ongoing crisis at the Fukushima Dai-ichi nuclear plant. Having previously categorized the incidents at reactors 1, 2 and 3 in the plant as three different accidents classified as level 5 on the International Nuclear Event Scale (INES) they were now going to treat them all together as a level seven accident.[44]

- 7 Major event
    - Only level 7 event in history, so far:
    - 1986 USSR Chernobyl (now Ukraine), core criticality, graphite core fire, steam explosion, 9 days of fire, 49 dead, radioactive release.
    - 2011 Japan cluster of nuclear accidents are now categorized as level 7.
- 6 Serious accident
    - French authorities unofficially consider the Fukushima incidents to really be level six, due to the degree of radiation getting out.[45]
    - Past example of level 6:
    - 1957 USSR Mayak Kyshtym Chelyabinsk, cooling system fault, waste tank chemical explosion, 70-80 tons radioactive release, contamination surrounding area.
- 5 Accident with wider consequences
    - Fukushima Dai-ichi units 1 2 3 core damage due to lost cooling[46]
    - Past examples of level 5:
    - 1986 US 3 mile island, small break coolant loss, fuel and core damage, minor radioactive release, no one killed.
    - 1957 UK Windscale Sellafield, graphite reactor core fire, radioactive release, milk sales restricted 1 month.
- 4 Accident with local consequences
    - Fukushima Dai-ichi Unit 1 initial value, since gone up to INES 5[47]
    - Fukushima Dai-ichi Unit 4, unclear for which of many possible reasons
    - Past Example of level 4:

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[44] http://japan.resiliencesystem.org/fukushima-daiichi-power-plant-accident-raised-crisis-level-5-7

[45] https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Fukushima%20Earthquake%20and%20Tsunami%20Station%20Blackout%20Accident.pdf

[46] Problems with spent fuel ponds may also be a factor.

[47] Expected to go up.

    - 1999 Japan Tokaimura incident, workers broke safety rules at nuclear processing facility, criticality accident, 2 dead, 40 injured.

- 3 Serious incident
    - Spent Fuel Pool of unit 4 of I am not sure which Fukushima plant,[48]
    - Spent Fuel Pool of unit 4 of Fukushima Dai-ichi definitely here.[49]
    - Fukushima Dai-ichi unit 4, since gone up to INES 4,[50]
    - Fukushima Dai-ni units 1 2 4 unfinished[51]
- 2 incident
- 1 anomaly
    - Past Example of level 1:
    - 2004 Japan Mihama incident, with broken pipe leaking steam and hot water, no radiation problem, but 5 dead, 7 injured.
- 0 below scale

INES events are rated in reference to three attributes:

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

I downloaded Japan: INES Ratings on the Events in Fukushima Dai-ichi NPS and Fukushima Dai-ni NPS by the Tohoku Regional Pacific Ocean Offshore Earthquake naming it "**EOJ INES 2011 Mar 18 GoJ**."

The Economist says INES can be confusing:[52] it takes into account many different factors, from the level of radiation released to the effects on the environment and how severely safety systems are stretched.

Isotopes explained by MIT NSE.[53]

ISSC = IAEA's International Seismological Safety Centre

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[48] OCHA Relief Web http://www.reliefweb.int/rw/rwb.nsf/db900sid/ASAZ-8F3J56?OpenDocument&rc=3&cc=jpn
[49] International Atomic Energy Agency (IAEA) via Japan Earthquake Update (20 March 2011, 21:00 UTC) (+ 9 hours to get JST)
[50] Spent fuel pool is definitely one of the reasons why.
[51] Incidents are continuing, so INES rating may change.
[52] http://www.economist.com/blogs/dailychart/2011/04/radioactive_accidents
[53] http://mitnse.com/2011/03/17/what-is-an-isotope/

J + definitions (1 Apr 27)

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-10 includes:
    - "loss of power." (JAIF 09 April)
    - Station Blackout Incident (loss of internal and external power sources)
- JACT-15 = Article 15 of the Act on Special Measures Concerning Nuclear Emergency Preparedness.
    - I interpret multiple sources to mean JACT-15 includes:
    - "abnormal rise in containment vessel (CV) pressure."
    - "loss of pressure suppression function."
    - "loss of water cooling function."
    - "Unusual increase of radiation dose"
- JACT-15-3 = Article 15, Paragraph-3, of the Act on Special Measures Concerning Nuclear Emergency Preparedness.
    - I interpret multiple sources to mean JACT-15-3 includes:
    - Residents, living within some distance of a nuclear power plant, need to evacuate.
- JACT-64-3 = Article 64, Paragraph-3, of the Act on Special Measures Concerning Nuclear Emergency Preparedness

JAEA = Japan Atomic Energy Agency

JAIF = Japan Atomic Industrial Forum.[54] I am initially unimpressed, when I see links to info about "THE FUKUSHIMA NUCLEAR POWER PLANT" but as we well know there are TWO of them involved in the disaster:

- Fukushima I = Fukushima Dai-Ichi
- Fukushima II = Fukushima Dai-ni

The earthquake and tsunami initially affected 4 nuclear power plants, with 14 reactors:
Onagawa = 3 reactors
Fukushima I = 6 reactors
Fukushima II = 4 reactors
Tokai II = 1 reactor

[54] http://www.jaif.or.jp/english/

However, I have downloaded some JAIF documents I consider to be first rate info.

JAMSTEC = Japan Agency for Marine-Earth Science and Technology
JNES = Japan Nuclear Energy Safety Organization
JST = Japan Standard (local) Time is UTC+9. See UTC.

K + definitions (1 May 09)

Key words to use in Search Engine news and Web history. See alphabetically, in this section, for more key words to use beyond links I share in my various research notes.

- Chernobyl (for the other end of horse from mouth, and for backlash to it)
- Dai-ichi or Daiichi
- Dai-ni or Daini
- Earthquake
- FEMA
- Fukushima
- IAEA
- IMAT
- Japan
- MPHISE
- Multi-Hazard
- NOAA
- Nuclear
- Radioactive
- Tsunami
- USGS
- Ushahidi

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

MAPS - I have a "**Maps Directory**" to sources for Haiti, Japan, Democracy into Middle East, other topics.

MEXT = Ministry of Education, Culture, Sports, Science and Technology, in Japan

MPHISE[55] = Medical and Public Health Information Sharing Environment.

MUWC = Make up Water Condensate System

NER = Nuclear Event Reports[56]

NEWS = Nuclear Event Web Based System[57] 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

Office of Public Affairs Telephone: 301/415-8200

Washington, D.C. 20555-0001

E-mail: opa.resource@nrc.gov Site: www.nrc.gov

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

It has sent experts to help Japan.[58]

NSC = Nuclear Safety Commission of Japan

NTSB = US National Transportation Safety Board

Nuclear + definitions (1 Apr 13)

Nuclear Plant Inventory in Japan:

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[55] Haiti http://haiti.mphise.net/
[56] http://www.world-nuclear-news.org/nerlist.aspx?fid=812
[57] http://89.151.116.69/uploadedFiles/wnn/NER/Supporting_Pages/whatsnews_p.pdf
[58] http://www.reliefweb.int/rw/rwb.nsf/db900sid/SNAA-8EYS9R?OpenDocument&rc=3&cc=jpn OCHA Relief Web

Japan has 54-55 nuclear plants supplying 30-33% of Japan's electricity (sources have different stories), prior to latest disasters. The United States has 103-104 plants providing 20 percent of total electricity). Another area of info clarity missing is count distinction between nuclear plants, and nuclear reactors. Many Japanese plants have more than one reactor.

Some reports may have incorrectly identified at which nuclear plant and reactor various events were happening. I am trying to combine credible primary sources info in my research notes "**Nuclear Time Line**."

Google Earth and Google Map link[59] to March 14 interactive map[60] with additional links, will no doubt will get additional resources since the last time I peeked.

- KML – you need to have Google Earth installed to see these.[61]
- **Japan's nuclear power plants** KML

  Source: Harvard Center for Geographic Analysis, My Maps

OCHA = United Nations Office for the coordination of humanitarian affairs

Onagawa is a Japanese nuclear power plant, one of four in trouble right after March 11 earthquake and tsunami. In the first week or so, it and Fukushima Dai-ni were second most trouble, behind Fukushima Dai-Ichi. Onagawa has 3 nuclear reactors.

OSOCC = UN Onsite Operations and Coordination Centre

P + definitions (1 Apr 23)

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

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 Vessel[62]

Potassium Iodide, a second medical opinion by Dr. Robert J. Rowen.[63] Different parts of human anatomy are assaulted by different kinds of radioactivity, requiring different kinds of protection.

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

60 http://mw1.google.com/crisisresponse/2011/sendai_earthquake/google/map/sendai_earthquake_2011.html

61 I have guidance on installing Google Earth in my **Haitian Map Directory.**

62 See Credible Science explanations of the various containment levels.

63 http://www.secondopinionnewsletter.com/pages.aspx/31/Radiation%20Alert/SECHA/SOSECHAPPC/?gclid=COHJ_uj14acCFYi8KgodGV-q9Q

Proportion – 1/2 million people into shelters, because they escaped before tsunami obliterated their towns, but tens of thousands dead. This is much more important than the microscopic radiation from the serious, but under control, nuclear accidents. But you would not know that from most mainstream news media.

Q+A = Questions and Answers

QRT = Quick Reaction Team

R + definitions (1 May 18)

Radioactive

Radioactivity Measurement

In the confusing world of the measurement of radioactivity, which also features grays, sieverts and curies, among others, one becquerel represents one nuclear decay per second. A petabecquerel is a thousand trillion becquerels.[64]

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

RPV = Reactor Pressure Vessel

SCR's = Stable Continental Regions

Severity Levels + definitions (1 May 10)

I have organized my research notes by major types of issues, and what needs to be done about them. Two of my documents relevant to severity levels of disaster crises include:

- **Economic disasters** – past present future – in our analysis of recent disasters, we discover a history or pattern of red flag warnings being ignored, which imply that there are specific disaster crises coming soon, which are totally man made, natural phenomena not a major factor.
- **Lessons which should be learned** – we have seen in many disasters, that policy makers, and the general public, failed to heed red flag warning of impending doom, failed to mitigate or abate risk, so the disaster crisis became much more serious than had good or better steps been taken in advance. Since natural phenomena events do strike twice in the same place, this gives us a blue print what should be done so the next time is not so bad.

I got the following info from Mike.D[65] who explained it in a discussion[66] with me on MPHISE.[67] Thanks Mike. I now feel these severity levels should be added to our research

[64] http://www.economist.com/blogs/babbage/2011/04/japans_nuclear_crisis

into future disasters in need of better mitigation, to help prioritize our demands for mitigation planning.

In a ***Severity Level 1 crisis*** (e.g., a fire that burns down a few houses), local incident command systems can easily take care of an emergency of this scale. Local government can be a very efficient way to address these kinds of problems.

In a ***Severity Level 2 crisis***, where a chemical plant has had an explosion and it has caused many deaths and injuries, but the chemicals are contained and mitigated by national-level experts, these types of crises are efficiently managed by incident command systems at the national, and if necessary, the international level.

In a ***Severity Level 3 crises***, of a scale and complexity in which hierarchical incident command systems start to fail, government may or may not be able to handle the crises with favorable outcomes. We saw this very clearly in the ***Hurricane Katrina*** disaster, the U.S. incident command systems (with its very substantial resources, and highly refined and tested hierarchical emergency management infrastructures) broke in strategically important ways due to the size and scale of that crisis.

Japan is at severity level 3+.

Severity Level 3+ is sometimes a euphemism for situation getting worse, and at risk of soon becoming a level 4.

In Japan, the current crises are very likely to take down the political layer of the government leading to a party shift. However, given the unsustainability of Japan, given its deeper demographic problems -- too many old and too few young workers, combined with a cultural inability to accept foreign workers and immigrants, will (at points in the near to middle term future) deepen the crisis of government below the political layer. Widespread nested subnational Resilience Systems will ultimately transform this problem starting with Health Capacity Zones in the impact areas that morph into sustainable Resilience Networks. That is what Mike.D's organization is working on through the Japan Resilience Initiative and the Japan Resilience System. http://japan.resiliencesystem.org/

Vietnam is having a similar problem, but is more nascent and proactive -- especially on climate change impacts in the Lower Mekong Basin, which is likely to be severely affected by both climate change and the dams which are now being built in China.

http://vietnam.resiliencesystem.org/

This is a big problem, given that the Lower Mekong is one of the most productive food generation areas in the world. Its decline will have major impacts on food insecurity and social conflict in Asia.

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[65] http://haiti.mphise.net/users/michael-d-mcdonald
[66] http://haiti.mphise.net/mike-research-question#comment-525
[67] MPHISE = Medical and Public Health Information Sharing Environment

In a ***Severity Level 4 crisis***, when national incident command systems become overburdened to the point of irrelevance, and even international command and control capabilities are stretched to the breaking point, governments are highly susceptible to failure, even if they are propped up to look viable.

The challenges of Severity Level 4 crises go far deeper than the political layer of government to very the nature of its society's form of governance. However, within a resilient society aware of its carrying capacities, a society can recover, despite the collapse of its government, if it has sustainable Resilience Systems.

Haiti is at severity level 4+.

In ***Severity Level 5 crises***, like the ***Irish Potato Famine***, where there is a fundamental collapse in the social ecology,[68] the likely outcome is a catastrophic drop in population that brings the population down to a size that is within the limits of its carrying capacity -- in other words, that can live within the ecosystem services of the territory that the dependent population lives within. This can happen by out migration or die-offs due to disease outbreaks (like cholera), starvation, or violent social crisis.

This is a politically hazardous topic to discuss, because then the victim population attributes conspiracy theory explanations to specific actions by international interference in their nations.

However, our entire world is at risk of a severity level 5 crisis due to our civilization having become dependent upon natural resources, which the world is running out of, and agricultural systems which cannot continue to function under current climate change predictions. So we must address these risks.

SFP = Spent Fuel Pools + definitions (1 Apr 23)

SFP = Spent Fuel Pools

Sources, Primary = the horse's mouth, where often the news media is the other end of the horse.

Sources, Secondary = people who we hope are quoting primary sources, but may be influenced by what communicated by other end of the horse.

Spent fuel removed from a nuclear reactor is highly radioactive and generates intense heat. Nuclear plant operators typically store this material in pools of water which cool the fuel and shield the radioactivity. Water in a spent fuel pool is continuously cooled to remove heat produced by spent fuel assemblies. According to IAEA experts, a typical

[68] There are writers who argue that the Potato Famine was engineered by the English Monarchy and Upper Classes, in an effort to fight their fear of a Revolution in Britain, similar to what they had recently witnessed with the French Revolution and American Revolution.

spent fuel pool temperature is kept below 25 °C under normal operating conditions. The temperature of a spent fuel pool is maintained by constant cooling, which requires a constant power source.

Given the intense heat and radiation which spent fuel assemblies can generate, spent fuel pools must be constantly checked for water level and temperature. If fuel is no longer covered by water or temperatures reach a boiling point, fuel can become exposed and create a risk of radioactive release. The concern about the spent fuel pools at Fukushima Dai-ichi is that sources of power to cool the pools have been compromised.

T + definitions (1 Mar 31)

TEPCO = Tokyo Electric Power Company – it runs the Fukushima nuclear plants which have been in the news a lot.[69]

TMI = Three Mile Island

TMI info – lots available, including this backgrounder.[70]

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

Tokai also is name of a nuclear power plant, one of 4 in trouble right after March 11 tsunami etc. but the other 3 in worse trouble than Tokai, the other 3 being Fukushima Dai-ichi, Fukushima Dai-ni, and Onagawa. Tokai only has one nuclear power reactor.

UCSUSA = Union of Concerned Scientists USA. They provide Japan Nuclear Power Crisis Daily Briefings and analysis on potential threats to public health and the environment and review of potential US policy implications. Here is link to main page, where all briefings may be downloaded to date.[71] The info is spoken by experts in the industry ... clearly, and easily understood.[72] Here is their FAQ on current crisis.[73]

UNSCEAR = United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

USAID = United States Agency for International Development

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[69] TEPCO facilities in Japan:
http://japan.resiliencesystem.org/detailed-status-report-all-tepco-owned-facilities-japan

[70]
https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Three%20Mile%20Island%20Accident.pdf

[71]http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/japan-nuclear-crisis-briefings.html?utm_source=SP&utm_medium=link2&utm_campaign=japan-nuclear-crisis-link2-3-15-11

[72] Thanks to Japan Resilience for this link.
http://japan.resiliencesystem.org/reports-status-fukushima-nuclear-power-plant

[73] http://japan.resiliencesystem.org/faqs-nuclear-reactor-crisis-japan
http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/nuclear-reactor-crisis-faq.html#risks%20of%20spent%20fuel%20pools

USAID Map dated Mar 13-14 showing earthquake and tsunami impact[74] 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

UTC + definitions (1 Mar 17)

UTC = Coordinated Universal Time.[75] 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 News[76]

FAQ Nuclear Accidents (1 Mar 31)

Here is an effort to try to simplify for the layman.[77] Typically a nuclear accident is a cascade or snowball effect of unexpected events, starting with what is called an initiating event. Any of these could be caused by:

- Human errors[78]
- Design flaws
- Equipment failures

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[74] 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/3231FE856A2D07E8852578530056FF5D/$File/map.pdf?OpenElement

[75] http://en.wikipedia.org/wiki/Time_zone

[76] http://www.world-nuclear-news.org/RS_Battle_to_stabilise_earthquake_reactors_1203111.html

[77] https://morgsatlarge.wordpress.com/2011/03/13/why-i-am-not-worried-about-japans-nuclear-reactors/ http://japan.resiliencesystem.org/summaries-fukushima-chernobyl-and-three-mile-island-professor-magdi-ragheb-phd

[78] Or terrorists sabotage accident on purpose.

The latest incidents with Japan Earthquake and Tsunami Nuclear Accidents are still on-going, so various explanations will be incomplete, or the story so far. See my **Japan Nuclear Info Navigation Guide** section on **Nuclear for the Layman**.

FAQ Nuclear Accident at Chernobyl (1 Mar 31)

During a routine safety test, of what might happen with various safety errors, there were additional human errors with safety rules, in addition to the ones being tested. The test was to find out if the backup turbo-generator power supply would work properly during an electrical power outage, long enough until the backup diesel generators came on-line.[79]

The engineers, in charge, were not nuclear engineering experts. What they were doing would be the equivalent of passengers, on a commercial airliner, dismantling one of the engines, while the plane was in flight, and speculating what happens if we do this or that, then doing so. I have seen conspiracy theorists claiming it really was the secret police doing it, because they were bored, a form of ignorant Russian roulette.

There were too many cooks. You have the people running the power plant, the local community needing their power, and probably the secret police of the USSR. The city of Kiev wanted their power, when the plant was supposed to go to reduced power output, so instead of the day shift doing the test, which they had trained to do, it was delayed to the night shift, inexperienced in the conditions of the test. Unexpected things happened, so the operators were trying to respond to the unexpected, in addition with continuing with the test.

While it seems obvious to most people, that the test should be halted until the authorities can get together with the city of Kiev to supply them electricity from an alternate source, so that the test can be conducted by personnel trained to do it, a review panel concluded that had the test been cancelled, it would have been a whole year before it could be done again. This led some participants to push the envelope.

It is evident to me, a geek of irrelevant background, that this design is far too complex for all but the most expert nuclear engineer to figure out the problems. They need to have the kind of auto-cad which can run simulations "What happens if?" to locate any potential "short circuits" in the overall design. Placing pressure suppression pool underneath reactor core, means that in the event of containment breach, you have added complication of molten fuel with the water. The system is unstable. Various things, which can go wrong, have the potential for a run-away situation, which is what happened at Chernobyl.

It is normal for nuclear power plant control rods to be inserted from above, so in case of power interruption, they still can be slid in. Chernobyl had some which came from below.

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79 https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Chernobyl%20Accident.pdf

FAQ Nuclear Accident at Three Mile Island (1 Mar 31)

During routine maintenance of water feed pumps at **Three Mile Island**,[80] a water pump was inadvertently turned off, and not turned back on. (**One Human error**.) The design of switches and indicators, with tags attached in prior work, meant that a red warning light was obscured, from operator notice, for 8 minutes. (**Compound Human errors**.)

As a result of the water stoppage, various equipment shut down. More heat was generated than could be cooled, because of the water stoppage. This caused a pressure release valve to open to release the pressure. The automatic safety equipment detected the excess heat and pressure, so it initiated a scram, inserting control rods to shut down the nuclear reaction, and most of the power generation. This lowered the pressure, so the pressure release valve should have closed, but it remained open. (**Equipment failure**.) This caused steam to drain. No one noticed this problem for 2 ¼ hours. (**Human error # 3 due to a design flaw**.) Had they noticed this, they could have closed a valve which is designed to handle this eventuality. The design flaw was that the position of the valve is shown by an indicator light associated with a command to close the valve, which was stuck and not really closed.

Due to the stuck steam valve, the pressure dropped dangerously low, so two pumps kicked in to supply enough water. Operator training led them to switch off those pumps, because if it had not been for the stuck valve, which they did not yet know about, having both pumps on would have been in error. (**Human Training Error**.) Thus, without the needed water, and having the release valve stuck open, the core got exposed, wasn't being cooled properly, and the situation boiled over. The main cooling pumps now had a mixture of steam and water, and were not running properly. They had to be shut down. The core heated up and parts began to melt.

Then the operators discovered the valve that had been stuck open. But by this point, damage was done from radiation from melted core, so a site area emergency was declared 2 hours 55 minutes into the event. This was elevated to a general area emergency at 3 hours 20 minutes due to radiation throughout many systems. Additional water delivery was insufficient to cool the situation, and now there was the release of hydrogen gas, due to the high temperatures with the fuel cladding. Hydrogen is highly explosive, and probably did explode, but did not breach containment. This meant the cooling lines were now ruptured. A series of actions were taken to try to contain the mess.

In addition to the errors I indicated in red above, there had also been a complacent attitude towards safety in the nuclear industry, and government regulation. Those of us who remember the news from the time, also remember that explanations for the general public.

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80 https://netfiles.uiuc.edu/mragheb/www/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/Three%20Mile%20Island%20Accident.pdf

nor top political leadership, were not forthcoming. President Jimmy Carter, a former nuclear engineer, had to go there in person, to find out what the heck was going on.

FAQ Containment (1 May 04)

Containment is a term thrown around a lot in many reports, so let's try to include a science definition for the layman.[81] The nuclear stuff is extremely dangerous, so it is stored in a series of prisons, with all kinds of guards to prevent a jail break.

- Primary holds the inmate fuel pellets or fuel rods. It comes in 2 parts, drywell and wetwell or torus.[82] The drywell is intended to catch anything which escapes the wetwell. The wetwell manages the water cooling of the nuclear fuel.
- Secondary is a pressure cooker, kept at a lower pressure than outdoors, so that any leaking is from the inside, not the other direction.
- Third is the core catcher
- Then there's like a shed to keep rainwater etc. off the third nuclear power plant outer shell. This shed is what was blasted in explosion # 1. # 2 # 3, then the other buildings had holes punched in ceiling so the hydrogen could escape without explosion, and the radiation (from the spent fuel rods) also escaped through those holes. A design problem.

So long as the three containments have not been breached, and the fuel rods kept cool enough, we are Ok. However, there is a whole other problem with the spent fuel rods outside of containment, which need to be cooled by water pumped in there, but Japan's nuclear reactors suffered a total power failure, thanks to the tsunami. For more scientific explanation, less layman, see section titled "Peace of Mind."[83]

FAQ Decay Heat (1 Mar 17)

Decay Heat is a big part of understanding what the heck is going on, so let's try to include a science definition for the layman.[84]

The nuclear power plant has radioactive fuel which creates heat via nuclear fission, and this heat is used to create electricity. The rate at which the heat is produced depends on control rods which absorb most of the nuclear radiation. In a shutdown, which was initiated at all

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[81] https://morgsatlarge.wordpress.com/2011/03/13/why-i-am-not-worried-about-japans-nuclear-reactors/
[82] http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/nuclear-reactor-crisis-faq.html#risks%20of%20spent%20fuel%20pools
[83] Also http://japan.resiliencesystem.org/faqs-nuclear-reactor-crisis-japan
[84] http://mitnse.com/
"Nuclear melt down for dummies" via KABC talk-radio
http://www.kabc.com/Article.asp?id=2135334&spid=38628
This article should more accurately be called "Nuclear melt down BY dummies"

the plants affected by the earthquake, the amount of heat does not go down to zero, but to a tiny fraction of what is involved in normal operations, due to where the various radioactive isotopes were in their normal nuclear processing.

Eventually we reach a stable situation of no more heat, or minimum practical, which is called a cold shutdown.[85] My understanding is evolving, and as it does so, I periodically update my notes.

If the decay heat can be removed at the same rate that it is created, then the cooling systems are stable, nothing in the power plant is heating up abnormally to threaten a meltdown. Thus there needs to be a process of supplying cooling water, then removing the heated water. This system was severely disrupted by the earthquake then tsunami.

FAQ Meltdown (1 Mar 23)

Meltdown is a term thrown around a lot in the media, sometimes they say partial meltdown, so let's try to include a science definition for the layman.[86]

The fuel, for a nuclear power plant, generates heat, which needs to be cooled when the plant is shut down. The shut down involves a combination of insertion of control rods, and water taking the heat away, for the nuclear power plants in Japan. There are a variety of designs around the world, so this process might not be universally true.

If only SOME of the fuel melts, that is called a partial meltdown. That is not necessarily the same thing as some of the fuel, or their containers, getting damaged.

A partial meltdown happened at Three Mile Island.

A complete meltdown is when all of the fuel is exposed, cooling wiped out, all fuel melted, high risk of melting thru floor of containment.

Also the spent fuel goes in "ponds."[87] If not properly cooled, high temperatures release a variety of unwanted chemicals and other effects. If, due to high temperatures, the fuel becomes sufficiently liquid, it can pour downwards.

In some countries the "ponds" are out-doors. In Japan, they are in the top floor of the reactor buildings. In both cases, there is MUCH less containment protection, than for the reactor core, so greater risk of radiation getting out, if the cooling system fails. These pools are greater danger in USA than in Japan, because so much more is stored in them.

Depending on the design of the containment, there is then what happens to the concrete and steel bottom when this extremely hot fuel gets there. With good containment design, we can have a meltdown which does not penetrate containment.

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[85] http://en.wikipedia.org/wiki/Cold_shutdown
[86] http://mitnse.com/ and http://japan.resiliencesystem.org/faqs-nuclear-reactor-crisis-japan and http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/nuclear-reactor-crisis-faq.html#risks%20of%20spent%20fuel%20pools
[87] For USA see Yucca Mountain, around which there is some controversy.

Thus it is important to know at what temperatures the unwanted effects occur, and what temperatures were reached in the Japanese reactors. From what I have heard, we are not there yet.

FAQ How do we get to Safe? (1 Mar 26)

SAFE is in the eyes of the beholder, but lots of people would like to see some proof or certification, that relevant qualified people have studied the geeky technical details, and can say with some certainty that the critical infrastructure is in fact designed to withstand certain crises, such as some intensity earthquake, tornado, etc.

http://japan.resiliencesystem.org/japanese-disaster-spawns-nuclear-safety-reviews-worldwide

http://www.colorado.edu/hazards/dr/currentdr.html

"Our nuclear power plants have undergone exhaustive study and have been declared safe for any number of extreme contingencies," President Barak Obama said in a **press conference**. "But when we see a crisis like the one in Japan, we have a responsibility to learn from this event and to draw from those lessons to ensure the safety and security of our people."

That will be happening on a number of fronts, including a Presidential mandated review of U.S. nuclear plants to be conducted by the U.S. Nuclear Regulatory Commission. The commission will consider lessons learned from the Japanese event before issuing a short-term report on U.S. facilities within 90 days, according to a **statement**. A full report will follow after that.

"This work will help determine if any additional NRC responses, such as orders requiring immediate action by U.S. plants, are called for, prior to completing an in-depth investigation of the information from events in Japan," stated Bill Borchardt, NRC Executive Director for Operations.

The NRC won't be alone in scrutinizing the safety of nuclear plants during disasters and normal operations. In fact, reviews are all the rage, ranging from **California** and **Florida** assessing nuclear safety response plans to examinations being undertaken by the **European Union** and the **UN International Atomic Energy Agency**. Industry leaders are also committed to learning from the circumstances that plague Daiichi, according to Anthony Pietrangelo, vice-president of a lobbying group called the Nuclear Energy Institute.

Despite the forward-looking sentiment of almost every nation with a nuke, it's easy to imagine how all this reviewing might be for naught. After all, Japan just wrapped up an extensive review of nuclear power plants in 2009, including a 14-month study of potential earthquake impacts on the Dai-ichi plant, according to the ***Washington Post***.

In that review, the danger of a tsunami—the event that actually caused the Dai-ichi nuclear emergency by wiping out the backup generators sustaining the plant's cooling system—was only voiced by one scientist and dismissed as an unlikely threat, according to the *Post*. The

plant's hazard mitigation measures, which included retaining walls that could withstand waves of up to 20 feet, were considered adequate.[88]

The *Post* article points out that the disaster "highlights the government's miscalculation in prioritizing one natural disaster over another," as well as the laxity that stems from chummy relationships with the industry they monitor.

That issue has been seen in the United States as well, **most recently** between the former Minerals Management Service the oil industry it regulated. A report released this month by the Union of Concerned Scientists indicates the NRC could lean the same way, if not so dissolutely.

The NRC and Nuclear Power Plant Safety in 2010: A Brighter Spotlight Needed found the commission made some "outstanding catches" but could have stopped at least 14 "near misses" from happening at all. When the NRC tolerates unresolved safety problems—as it did last year at Peach Bottom, Indian Point, and Vermont Yankee—this lax oversight allows that risk to rise."

"The engineers will say, 'You tell me what you want, we'll protect it to that level,'" Ken Brockman, former IAEA director of nuclear installation safety, said. "It's just an issue of raising the elevation, building the retainer walls. The engineering can be done. You just have to give them the criteria."

Now someone just needs to engineer a system to overcome regulatory entropy.

FAQ Spent Fuel Pools (1 Mar 17)

One of these pools allegedly ran out of cooling water, and caused one of the Japanese problems, so let's try to include a science definition for the layman.[89]

After nuclear fuel has exhausted what nuclear energy we can get from it in the reactor, it moves to water pools and large casks which use air to cool the fuel rods. The pools are often located near the reactor, in containment arrangements similar to the reactor, both because of the cooling needed, plus to shield the radiation coming from there. This spent nuclear fuel (SNF) has heat, but not as intense as the heat from a reactor recently shut down, like those threatened by earthquake and tsunami.

Normally the SNF can be stored in the pools indefinitely, so long as the cooling system is working. Unfortunately the cooling system got broke by the earthquake and tsunami, and some of the later incidents.

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[88] As we saw from other reports, the walls were not in fact that high.
[89] http://mitnse.com/

FAQ 1986 Chernobyl vs. 2011 Fukushima (1 Apr 25)

Both are now level 7 on INES scale but they are very different.[90] At this time, the Fukushima disaster is continuing so we do not yet know what the whole story will be.[91]

- Government secrecy was before during and after with Chernobyl. People found out about Chernobyl when the radiation was detected in other nations, like people finding out about SARS when travelers from China infected people in other nations.
- Authorities secrecy was only before with Fukushima. They are coming clean with the Japanese people, and the world, as soon as they know anything. The secrecy before, was a failure to communicate the risks.
- Chernobyl had 4 reactors, but only 1 had a disaster.
- Fukushima, and other nuclear power plants in the region of the earthquake and tsunami, have several reactors and spent fuel ponds with varying disaster intensities.
- Chernobyl had Graphite-moderated boiling water reactor. The graphite made it highly combustible. The reactor had no containment structure so nothing stopped the trajectory of radioactive materials into the air. After the disaster, $ 1 billion was spent on a concrete shell over the mess, with anticipated life span of 20-30 years. That life span is now over. There are holes in the shell large enough to drive a truck through. There is another (very expensive) plan to do something about that.
- Fukushima Dai-ichi uses Boiling-water reactors. Japanese authorities stress that unlike at Chernobyl, the containment vessels at Fukushima remain intact, although there were times when this was in doubt. Also, unlike Chernobyl, the reactors at Fukushima do not have a combustible graphite core.
- Chernobyl released 5.2 million terabecquerels, contaminating an area as far as 500 km (300 miles) from the plant, according to the UN. But animals and plants were also affected much further away. Evacuation was a few hundred thousand people, up to 30 km (18 miles) away.
- Fukushima, as of April 12, has so far released 370 thousand terabecquerels, contaminating areas extending more than 60km (36 miles) to the north-west of the plant, and about 40km to the south-southwest, plus sea water. Evacuation so far was tens of thousands of people 20-30 km away, and several communities just outside the 20-30 km zone. There's also a no-fly zone except for people involved in measuring radiation and delivering cooling water.
- Injuries, and health effects from this are too soon to confirm for Fukushima, and mired in secrecy with Chernobyl.

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[90] http://www.bbc.co.uk/news/world-asia-pacific-13050228

[91] See my related research notes such as: **Nuclear Time Line**; **Lessons** (not yet) learned Japan disaster.

- **Chernobyl nuclear accident was caused by** poor planning and implementation of a nuclear accident test. First shift employees were well trained in the planned test, but recipients of the electricity demanded the shutdown be delayed. So the test was held with late nite employees who had had no training in the test. This ultimately led to explosions and a fire which burned for 10 days.
- **Fukushima nuclear accident was caused by** design inadequate to anticipate a major earthquake and tsunami of the size which led to total station electrical blackout, so they could not properly cool the fuel rods, or deal with hydrogen escaping to explosion, except by knocking holes in building which also held spent fuel rods pond, so that radiation escaped. The larger regional disaster, thanks to tsunami, impeded prompt delivery of aid to the nuclear power plant.