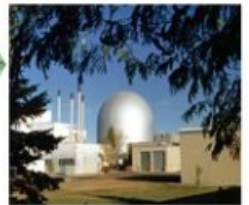
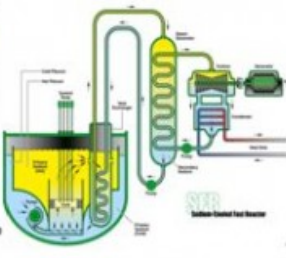
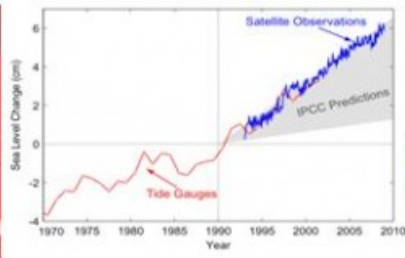


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[Fukushima Nuclear Accident – a simple and accurate explanation](#)

Posted on 13 March 2011 by Barry Brook

Twitter updates: [@BraveNewClimate](#)

New 14 March: [Updates and additional Q&A information here](#) and [Technical details here](#)

[福島原発事故-簡潔で正確な解説](#) (version 2): (東京大学エンジニアリング在学生の翻訳) (thanks to Shota Yamanaka for translation)

Along with reliable sources such as the [IAEA](#) and [WNN](#) updates, there is an incredible amount of misinformation and hyperbole flying around the internet and media right now about the [Fukushima nuclear reactor situation](#). In the BNC post [Discussion Thread – Japanese nuclear reactors and the 11 March 2011 earthquake](#) (and in the many comments that attend the top post), a lot of technical detail is provided, as well as regular updates. But what about a layman’s summary? How do most people get a grasp on what is happening, why, and what the consequences will be?

Below I reproduce a summary on the situation prepared by Dr Josef Oehmen, a research scientist at MIT, in Boston. He is a PhD Scientist, whose father has extensive experience in Germany’s nuclear industry. This was [first posted by Jason Morgan earlier this evening](#), and he has kindly allowed me to reproduce it here. I think it is very important that this information be widely understood.

Please also take the time to read this: [An informed public is key to acceptance of nuclear energy](#) — it was never more relevant than now.

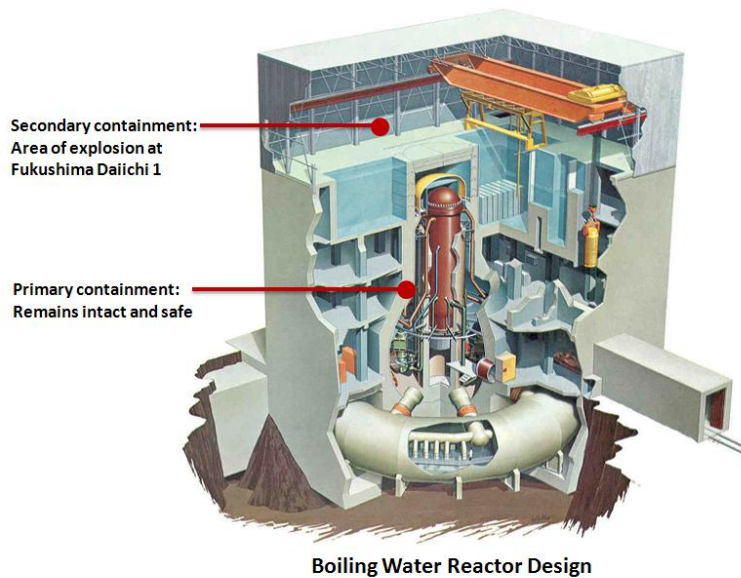
I am writing this text (Mar 12) to give you some peace of mind regarding some of the troubles in Japan, that is the safety of Japan’s nuclear reactors. Up front, the situation is serious, but under control. And this text is long! But you will know more about nuclear power plants after reading it than all journalists on this planet put together.

There was and will *not* be any significant release of radioactivity.

By “significant” I mean a level of radiation of more than what you would receive on – say – a long distance flight, or drinking a glass of beer that comes from certain areas with high levels of natural background radiation.

I have been reading every news release on the incident since the earthquake. There has not been one single (!) report that was accurate and free of errors (and part of that problem is also a weakness in the Japanese crisis communication). By “not free of errors” I do not refer to tendentious anti-nuclear journalism – that is quite normal these days. By “not free of errors” I mean blatant errors regarding physics and natural law, as well as gross misinterpretation of facts, due to an obvious lack of fundamental and basic understanding of the way nuclear reactors are built and operated. I have read a 3 page report on CNN where every single paragraph contained an error.

We will have to cover some fundamentals, before we get into what is going on.



Construction of the Fukushima nuclear power plants

The plants at Fukushima are so called Boiling Water Reactors, or BWR for short. Boiling Water Reactors are similar to a pressure cooker. The nuclear fuel heats water, the water boils and creates steam, the steam then drives turbines that create the electricity, and the steam is then cooled and condensed back to water, and the water sent back to be heated by the nuclear fuel. The pressure cooker operates at about 250 °C.

The nuclear fuel is uranium oxide. Uranium oxide is a ceramic with a very high melting point of about 3000 °C. The fuel is manufactured in pellets (think little cylinders the size of Lego bricks). Those pieces are then put into a long tube made of Zircaloy with a melting point of 2200 °C, and sealed tight. The assembly is called a fuel rod. These fuel rods are then put together to form larger packages, and a number of these packages are then put into the reactor. All these packages together are referred to as “the core”.

The Zircaloy casing is the first containment. It separates the radioactive fuel from the rest of the world.

The core is then placed in the “pressure vessels”. That is the pressure cooker we talked about before. The pressure vessel is the second containment. This is one sturdy piece of a pot, designed to safely contain the core for temperatures several hundred °C. That covers the scenarios where cooling can be restored at some point.

The entire “hardware” of the nuclear reactor – the pressure vessel and all pipes, pumps, coolant (water) reserves, are then encased in the third containment. The third containment is a hermetically (air tight) sealed, very thick bubble of the strongest steel. The third containment is designed, built and tested for one single purpose: To contain, indefinitely, a complete core meltdown. For that purpose, a large and thick concrete basin is cast under the pressure vessel (the second containment), which is filled with graphite, all inside the third containment. This is the so-called “core catcher”. If the core melts and the pressure vessel bursts (and eventually melts), it will catch the molten fuel and everything else. It is built in such a way that the nuclear fuel will be spread out, so it can cool down.

This third containment is then surrounded by the reactor building. The reactor building is an outer shell that is supposed to keep the weather out, but nothing in. (this is the part that was damaged in the explosion, but more to that later).

Fundamentals of nuclear reactions

The uranium fuel generates heat by nuclear fission. Big uranium atoms are split into smaller atoms. That generates heat plus neutrons (one of the particles that forms an atom). When the neutron hits another uranium atom, that splits, generating more neutrons and so on. That is called the nuclear chain reaction.

Now, just packing a lot of fuel rods next to each other would quickly lead to overheating and after about 45 minutes to a melting of the fuel rods. It is worth mentioning at this point that the nuclear fuel in a reactor can *never* cause a nuclear explosion the type of a nuclear bomb. Building a nuclear bomb is actually quite difficult (ask Iran). In Chernobyl, the explosion was caused by excessive pressure buildup, hydrogen explosion and rupture of all containments, propelling molten core material into the environment (a “dirty bomb”). Why that did not and will not happen in Japan, further below.

In order to control the nuclear chain reaction, the reactor operators use so-called “control rods”. The control rods absorb the neutrons and kill the chain reaction instantaneously. A nuclear reactor is built in such a way, that when operating normally, you take out all the control rods. The coolant water then takes away the heat (and converts it into steam and electricity) at the same rate as the core produces it. And you have a lot of leeway around the standard operating point of 250°C.

The challenge is that after inserting the rods and stopping the chain reaction, the core still keeps producing heat. The uranium “stopped” the chain reaction. But a number of intermediate radioactive elements are created by the uranium during its fission process, most notably Cesium and Iodine isotopes, i.e. radioactive versions of these elements that will eventually split up into smaller atoms and not be radioactive anymore. Those elements keep decaying and producing heat. Because they are not regenerated any longer from the uranium (the uranium stopped decaying after the control rods were put in), they get less and less, and so the core cools down over a matter of days, until those intermediate radioactive elements are used up.

This residual heat is causing the headaches right now.

So the first “type” of radioactive material is the uranium in the fuel rods, plus the intermediate radioactive elements that the uranium splits into, also inside the fuel rod (Cesium and Iodine).

There is a second type of radioactive material created, outside the fuel rods. The big main difference up front: Those radioactive materials have a very short half-life, that means that they decay very fast and split into non-radioactive materials. By fast I mean seconds. So if these radioactive materials are released into the environment, yes, radioactivity was released, but no, it is not dangerous, at all. Why? By the time you spelled “R-A-D-I-O-N-U-C-L-I-D-E”, they will be harmless, because they will have split up into non radioactive elements. Those radioactive elements are N-16, the radioactive isotope (or version) of nitrogen (air). The others are noble gases such as Xenon. But where do they come from? When the uranium splits, it generates a neutron (see above). Most of these neutrons will hit other uranium atoms and keep the nuclear chain reaction going. But some will leave the fuel rod and hit the water molecules, or the air that is in the water. Then, a non-radioactive element can “capture” the neutron. It becomes radioactive. As described above, it will quickly (seconds) get rid again of the neutron to return to its former beautiful self.

This second “type” of radiation is very important when we talk about the radioactivity being released into the environment later on.

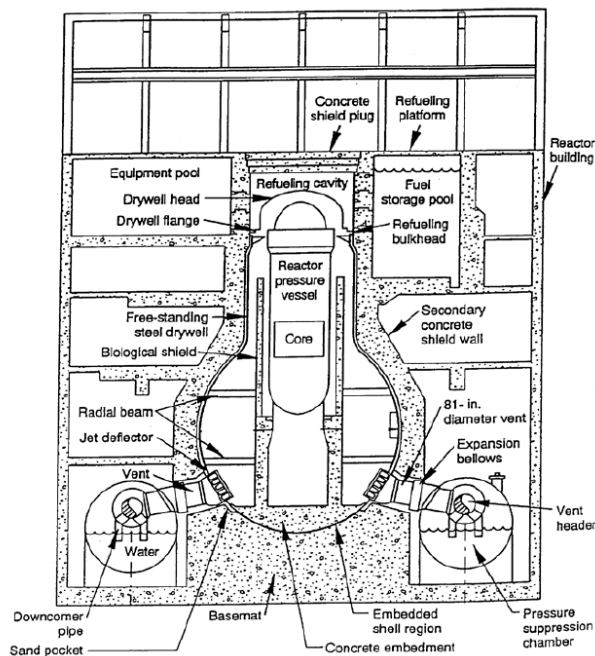


Figure 20. Mark I General Electric, GE BWR Containment.

What happened at Fukushima

I will try to summarize the main facts. The earthquake that hit Japan was 7 times more powerful than the worst earthquake the nuclear power

plant was built for (the Richter scale works logarithmically; the difference between the 8.2 that the plants were built for and the 8.9 that happened is 7 times, not 0.7). So the first hooray for Japanese engineering, everything held up.

When the earthquake hit with 8.9, the nuclear reactors all went into automatic shutdown. Within seconds after the earthquake started, the control rods had been inserted into the core and nuclear chain reaction of the uranium stopped. Now, the cooling system has to carry away the residual heat. The residual heat load is about 3% of the heat load under normal operating conditions.

The earthquake destroyed the external power supply of the nuclear reactor. That is one of the most serious accidents for a nuclear power plant, and accordingly, a “plant black out” receives a lot of attention when designing backup systems. The power is needed to keep the coolant pumps working. Since the power plant had been shut down, it cannot produce any electricity by itself any more.

Things were going well for an hour. One set of multiple sets of emergency Diesel power generators kicked in and provided the electricity that was needed. Then the Tsunami came, much bigger than people had expected when building the power plant (see above, factor 7). The tsunami took out all multiple sets of backup Diesel generators.

When designing a nuclear power plant, engineers follow a philosophy called “Defense of Depth”. That means that you first build everything to withstand the worst catastrophe you can imagine, and then design the plant in such a way that it can still handle one system failure (that you thought could never happen) after the other. A tsunami taking out all backup power in one swift strike is such a scenario. The last line of defense is putting everything into the third containment (see above), that will keep everything, whatever the mess, control rods in or out, core molten or not, inside the reactor.

When the diesel generators were gone, the reactor operators switched to emergency battery power. The batteries were designed as one of the backups to the backups, to provide power for cooling the core for 8 hours. And they did.

Within the 8 hours, another power source had to be found and connected to the power plant. The power grid was down due to the earthquake. The diesel generators were destroyed by the tsunami. So mobile diesel generators were trucked in.

This is where things started to go seriously wrong. The external power generators could not be connected to the power plant (the plugs did not fit). So after the batteries ran out, the residual heat could not be carried away any more.

At this point the plant operators begin to follow emergency procedures that are in place for a “loss of cooling event”. It is again a step along the “Depth of Defense” lines. The power to the cooling systems should never have failed completely, but it did, so they “retreat” to the next line of defense. All of this, however shocking it seems to us, is part of the day-to-day training you go through as an operator, right through to managing a core meltdown.

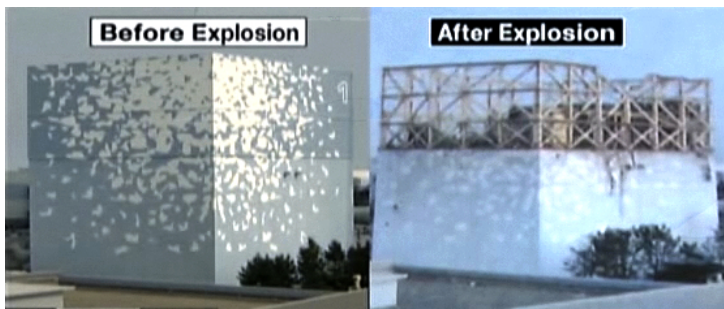
It was at this stage that people started to talk about core meltdown. Because at the end of the day, if cooling cannot be restored, the core will eventually melt (after hours or days), and the last line of defense, the core catcher and third containment, would come into play.

But the goal at this stage was to manage the core while it was heating up, and ensure that the first containment (the Zircaloy tubes that contains the nuclear fuel), as well as the second containment (our pressure cooker) remain intact and operational for as long as possible, to give the engineers time to fix the cooling systems.

Because cooling the core is such a big deal, the reactor has a number of cooling systems, each in multiple versions (the reactor water cleanup system, the decay heat removal, the reactor core isolating cooling, the standby liquid cooling system, and the emergency core cooling system). Which one failed when or did not fail is not clear at this point in time.

So imagine our pressure cooker on the stove, heat on low, but on. The operators use whatever cooling system capacity they have to get rid of as much heat as possible, but the pressure starts building up. The priority now is to maintain integrity of the first containment (keep temperature of the fuel rods below 2200°C), as well as the second containment, the pressure cooker. In order to maintain integrity of the pressure cooker (the second containment), the pressure has to be released from time to time. Because the ability to do that in an emergency is so important, the reactor has 11 pressure release valves. The operators now started venting steam from time to time to control the pressure. The temperature at this stage was about 550°C.

This is when the reports about “radiation leakage” starting coming in. I believe I explained above why venting the steam is theoretically the same as releasing radiation into the environment, but why it was and is not dangerous. The radioactive nitrogen as well as the noble gases do not pose a threat to human health.



At some stage during this venting, the explosion occurred. The explosion took place outside of the third containment (our “last line of defense”), and the reactor building. Remember that the reactor building has no function in keeping the radioactivity contained. It is not entirely clear yet what has happened, but this is the likely scenario: The operators decided to vent the steam from the pressure vessel not directly into the environment, but into the space between the third containment and the reactor building (to give the radioactivity in the steam more time to subside). The problem is that at the high temperatures that the core had reached at this stage, water molecules can “disassociate” into oxygen and hydrogen – an explosive mixture. And it did explode, outside the third containment, damaging the reactor building around. It was that sort of explosion, but inside the pressure vessel (because it was badly designed and not managed properly by the operators) that led to the explosion of Chernobyl. This was never a risk at Fukushima. The problem of hydrogen-oxygen formation is one of the biggies when you design a power plant (if you are not Soviet, that is), so the reactor is built and operated in a way it cannot happen inside the containment. It happened outside, which was not intended but a possible scenario and OK, because it did not pose a risk for the containment.

So the pressure was under control, as steam was vented. Now, if you keep boiling your pot, the problem is that the water level will keep falling and falling. The core is covered by several meters of water in order to allow for some time to pass (hours, days) before it gets exposed. Once the rods start to be exposed at the top, the exposed parts will reach the critical temperature of 2200 °C after about 45 minutes. This is when the first containment, the Zircaloy tube, would fail.

And this started to happen. The cooling could not be restored before there was some (very limited, but still) damage to the casing of some of the fuel. The nuclear material itself was still intact, but the surrounding Zircaloy shell had started melting. What happened now is that some of the byproducts of the uranium decay – radioactive Cesium and Iodine – started to mix with the steam. The big problem, uranium, was still under control, because the uranium oxide rods were good until 3000 °C. It is confirmed that a very small amount of Cesium and Iodine was measured in the steam that was released into the atmosphere.

It seems this was the “go signal” for a major plan B. The small amounts of Cesium that were measured told the operators that the first containment on one of the rods somewhere was about to give. The Plan A had been to restore one of the regular cooling systems to the core. Why that failed is unclear. One plausible explanation is that the tsunami also took away / polluted all the clean water needed for the regular cooling systems.

The water used in the cooling system is very clean, demineralized (like distilled) water. The reason to use pure water is the above mentioned activation by the neutrons from the Uranium: Pure water does not get activated much, so stays practically radioactive-free. Dirt or salt in the water will absorb the neutrons quicker, becoming more radioactive. This has no effect whatsoever on the core – it does not care what it is cooled by. But it makes life more difficult for the operators and mechanics when they have to deal with activated (i.e. slightly radioactive) water.

But Plan A had failed – cooling systems down or additional clean water unavailable – so Plan B came into effect. This is what it looks like happened:

In order to prevent a core meltdown, the operators started to use sea water to cool the core. I am not quite sure if they flooded our pressure cooker with it (the second containment), or if they flooded the third containment, immersing the pressure cooker. But that is not relevant for us.

The point is that the nuclear fuel has now been cooled down. Because the chain reaction has been stopped a long time ago, there is only very little residual heat being produced now. The large amount of cooling water that has been used is sufficient to take up that heat. Because it is a lot of water, the core does not produce sufficient heat any more to produce any significant pressure. Also, boric acid has been added to the seawater. Boric acid is “liquid control rod”. Whatever decay is still going on, the Boron will capture the neutrons and further speed up the cooling down of the core.

The plant came close to a core meltdown. Here is the worst-case scenario that was avoided: If the seawater could not have been used for treatment, the operators would have continued to vent the water steam to avoid pressure buildup. The third containment would then have been completely sealed to allow the core meltdown to happen without releasing radioactive material. After the meltdown, there would have been a waiting period for the intermediate radioactive materials to decay inside the reactor, and all radioactive particles to settle on a surface inside the containment. The cooling system would have been restored eventually, and the molten core cooled to a manageable temperature. The

containment would have been cleaned up on the inside. Then a messy job of removing the molten core from the containment would have begun, packing the (now solid again) fuel bit by bit into transportation containers to be shipped to processing plants. Depending on the damage, the block of the plant would then either be repaired or dismantled.

Now, where does that leave us?

- The plant is safe now and will stay safe.
- Japan is looking at an INES Level 4 Accident: Nuclear accident with local consequences. That is bad for the company that owns the plant, but not for anyone else.
- Some radiation was released when the pressure vessel was vented. All radioactive isotopes from the activated steam have gone (decayed). A very small amount of Cesium was released, as well as Iodine. If you were sitting on top of the plants' chimney when they were venting, you should probably give up smoking to return to your former life expectancy. The Cesium and Iodine isotopes were carried out to the sea and will never be seen again.
- There was some limited damage to the first containment. That means that some amounts of radioactive Cesium and Iodine will also be released into the cooling water, but no Uranium or other nasty stuff (the Uranium oxide does not "dissolve" in the water). There are facilities for treating the cooling water inside the third containment. The radioactive Cesium and Iodine will be removed there and eventually stored as radioactive waste in terminal storage.
- The seawater used as cooling water will be activated to some degree. Because the control rods are fully inserted, the Uranium chain reaction is not happening. That means the "main" nuclear reaction is not happening, thus not contributing to the activation. The intermediate radioactive materials (Cesium and Iodine) are also almost gone at this stage, because the Uranium decay was stopped a long time ago. This further reduces the activation. The bottom line is that there will be some low level of activation of the seawater, which will also be removed by the treatment facilities.
- The seawater will then be replaced over time with the "normal" cooling water
- The reactor core will then be dismantled and transported to a processing facility, just like during a regular fuel change.
- Fuel rods and the entire plant will be checked for potential damage. This will take about 4-5 years.
- The safety systems on all Japanese plants will be upgraded to withstand a 9.0 earthquake and tsunami (or worse)
- I believe the most significant problem will be a prolonged power shortage. About half of Japan's nuclear reactors will probably have to be inspected, reducing the nation's power generating capacity by 15%. This will probably be covered by running gas power plants that are usually only used for peak loads to cover some of the base load as well. That will increase your electricity bill, as well as lead to potential power shortages during peak demand, in Japan.

If you want to stay informed, please forget the usual media outlets and consult the following websites:

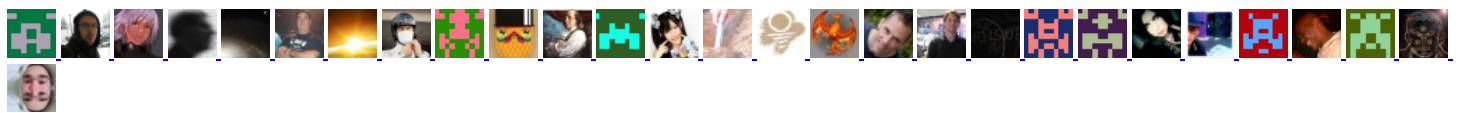
- http://www.world-nuclear-news.org/RS_Battle_to_stabilise_earthquake_reactors_1203111.html
- <http://bravenewclimate.com/2011/03/12/japan-nuclear-earthquake/>
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« [Discussion Thread – Japanese nuclear reactors and the 11 March 2011 earthquake Japan Nuclear Situation – 14 March updates](#) »

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457 Responses



1. [morgsatlarge](#), on [13 March 2011 at 9:17 PM](#) said:

Thank you very much for posting this. I hope it was informative.



- 2.

[DV82XL](#), on [13 March 2011 at 9:28 PM](#) said:

A very good recap of the event. Thank-you



3. [Barry Brook](#), on [13 March 2011 at 9:58 PM](#) said:

Interesting quote [from Rod Adams](#):

According to the writer and editor who approved th[is] summary, “An explosion at a nuclear power plant on Japan’s devastated coast ... made leaking radiation, or even outright meltdown, the central threat menacing a nation.” Apparently aftershocks, fires, broken dams, washed out highways, lack of clean drinking water, damaged sewer systems, destroyed airports, and at least a thousand known fatalities are not as much of a threat to the nation of Japan as the possibility that a few people might be exposed to a radiation dose that is roughly equivalent to the ones administered every day as part of routine medical procedures.



4. [John Newlands](#), on [13 March 2011 at 10:05 PM](#) said:

It could be pointed out that hospitals rely on backup diesel generators to keep essential equipment working. Thankfully they are not close to shorelines. I presume the reactors of this type that are not decommissioned will get better safety systems installed. I think we could overlook some extra emissions if the Japanese relied on gas for a few years. In 50 years we won’t have that option.

So far the death toll from either radiation or explosions appears to be zero. You wouldn’t think so reading the Murdoch press which is hysterical.

5. [The Japanese nuclear reactors: Fukushima simplified « SeekerBlog](#), on [13 March 2011 at 10:15 PM](#) said:

[...] not a 15-second sound-byte TV-casted in front of a “Nuclear Meltdown” graphic. It is a readable layman’s summary. Here’s [...]



6. [John Bennetts](#), on [13 March 2011 at 10:36 PM](#) said:

I just received a response from an executive engineer in an international multidisciplinary consultancy. My close friend for over 40 years, he told me that he had no interest in reading my condensed version of events in Japan or why I consider nuclear power to be an attractive option for at least some of Australia’s future energy needs.

It’s sad to find that he has already made up his mind, and that his answer is not to think.

If his mind is closed, perhaps we shouldn’t be so hard on the journalists who think that their duty is to write what (they think) people want to hear. Nuclear power’s time will not come because people are bludgeoned with facts. It will come when the man in the street decides that nuclear is the way to go.

The journalists will then follow their readers, always pretending that they are the leaders.

So, by all means focus on journalists, but remember that public knowledge is what is ultimately needed.

Dr Oehmen’s article is an excellent step along this path.



7. [Ben Heard](#), on [13 March 2011 at 10:37 PM](#) said:

Outstanding post. Thank you.



8. [Barry Brook](#), on [13 March 2011 at 10:40 PM](#) said:

Here is another Ch9 TV interview I did on Fukushima, covers some issues not raised in the other interview I posted:

<http://video.au.msn.com/watch/video/nuclear-reactor-releases-radioactive-vapor/x2ro1hc>

I will be speaking to them again at 6:15 and 7am tomorrow morning.



9. **armchairpilot**, on [13 March 2011 at 10:42 PM](#) said:

Thank you for an easy to understand yet explanation of the event!

I am wondering about this however:

–

The intermediate radioactive materials (Cesium and Iodine) are also almost gone at this stage, because the Uranium decay was stopped a long time ago.

–

Isn't the half life of the radioactive Cesium something like 30 years? How can it be gone just a few days after the reactor shutdown?

10. **starkes Erdbeben in Japan**, on [13 March 2011 at 10:45 PM](#) said:

[...] Hier gibt's eine gute Erklärung der Ereignisse um das AKW in Fukushima. Free Airline Route Mapper tool with over 600 airlines! Updated monthly Zitieren [...]



11. **Peter Stewart**, on [13 March 2011 at 10:46 PM](#) said:

Thanks Barry. "I feel better now."



12. **Barry Brook**, on [13 March 2011 at 10:47 PM](#) said:

The cesium was in trace amounts and dispersed via the prevailing winds over the ocean. It then reacts immediately with water to produce cesium hydroxide (CsOH) and is dissipated.



13. **quartus**, on [13 March 2011 at 11:02 PM](#) said:

Two questions, if I may:

1. Why these reactors built along the east coast of Japan – ie facing the subduction zone – and not on the west coast?
2. Will this reactor at Fukushima be able to go online again? If so, when?



14. **UNF**, on [13 March 2011 at 11:06 PM](#) said:

Good article, apart from the gratuitous innuendo about Iran "building a nuclear bomb", a lame warmongering propaganda claim which has been demonstrated false long ago.

If you really want information on the difficulties of building a nuclear arsenal, you'd better ask a nation which actually has one, like Israel, or USA.



15. **Barry Brook**, on [13 March 2011 at 11:07 PM](#) said:

1. East coast is near major load centres and transmission infrastructure. There are clearly questions about the preparedness of these plants for a tsunami, which will have to be looked at carefully for future planning.
2. Unit #1 will be decommissioned – it was 40 years old anyway and was due to be shut down. Unit #3 will probably also be written off. Units #2 and #4 will probably be restarted, but not for quite some time, anywhere from 6 months to 3+ years.



16. **Dan Reynolds**, on [13 March 2011 at 11:12 PM](#) said:

Thanks for this from those of us living in Japan. It made it to facebook and is being passed around to those living here. Very reassuring!



17. **Martin**, on [13 March 2011 at 11:14 PM](#) said:

Thank you for this post, clear, concise, based on facts and straight to the point – unlike the media.



18. **Sandy**, on [13 March 2011 at 11:18 PM](#) said:

Thanks for this! I am not a supporter of nuclear reactors, but think of them as a necessary “evil” until we can devise safer ways to make energy. The recurrent thought running through my head while reading your article was “Thank God these are Japanese designed” since I truly respect the engineering of Japanese products.

I hope that all plays out as you have described.



19. **CB**, on [13 March 2011 at 11:18 PM](#) said:

I’m as lay a person as it gets when it comes to chemistry and the like. Thank you for this.



20. **esquilax**, on [13 March 2011 at 11:26 PM](#) said:

What a long winded apology.

Could the designers or the operators of the plant have foreseen this event? Answer; yes.

When dealing with the potential menace to many hundreds of thousands of people, is it possible to design around this event? Answer; no.

Conclusion; there is no way to price nuclear power.

We’re witnessing the death of nuclear power, here, today, now.



21. **Soylent**, on [13 March 2011 at 11:48 PM](#) said:

Moderator rods exist in some types of reactor, but common PWRs and BWRs use light water flowing around the fuel bundles as both moderator and coolant.

The rods that absorb neutrons are control rods, not moderator rods.

A moderator is any material which moderates, slows down, neutrons.

It is not a delicate balancing act to make sure the reactor stays precisely critical, in order that the reaction not quickly run away towards zero or towards infinity(until something breaks or explodes).

Reactor are stable and manageable for several reasons. By stable I mean that the power output responds slowly and injection of a small amount of reactivity(e.g. partially withdrawing a control rod) will cause power to increase slightly before leveling off at a new, higher value without any operator intervention.

There are delayed neutrons from some short-lived fission products. In a nuclear bomb only the prompt neutrons are needed to sustain a super-critical state, the rate of the reaction increases so quickly that an enormous amount of energy can be produced before the fissile core of the bomb blows itself apart. A reactor is not like a bomb; it’s not prompt critical; if it weren’t for these delayed neutrons the

reaction would quickly die down(we're talking miliseconds here) these delayed neutrons come from isotopes with half-lives of between a second and a minute. When you rely on delayed neutrons to maintain criticality the power level can't change very rapidly; the reaction increases or decreases on time scales appropriate for human intervention.

There is also a whole host of effects that tend to stabilize the power level. These can be anything from thermal expansion of moderator, thermal expansion of fuel pins, doppler broadening, chemical dissociation(hyperion's uranium hydride design) formation of voids in the coolant/moderator(e.g. the bubbles of steam in a boiling water reactor).

The purpose of slowing down neutrons in a thermal reactor is that it increases the fission capture cross section for fissile U-235(and Pu-239 if present). You can build these reactors with small fissile inventories or very slight enrichment(or none, as in a CANDU).

Reactors that slow neutrons down to such low energies that most of them are at a similar temperature as the reactor itself are called thermal reactors. Light water reactors are all thermal reactors.

In a fast reactor the neutrons remain very fast because the core contains no good moderators(compounds of light elements with a large collision cross section and a small capture cross section, such as water, heavy water, carbon, beryllium and fluoride salts). The purpose of operating in the fast spectrum is that it enables breeding with the plutonium fuel cycle; although the fission cross section is smaller(necessitating more fissile inventory; about 10 metric tonnes per GW), the capture cross section of fission products is reduced even faster, reducing parasitic losses and thereby improving the neutron economy.

Thorium reactors can breed in the thermal spectrum given some online removal of fission products as in the molten salt reactors.

The moderator can also play an important role in making a reactor stable or unstable against increases in temperature or formation of voids(of steam, typically).

In reactors with light water as coolant/moderator the effect of partially withdrawing a control rod is to inject a certain amount of reactivity; neutrons multiply and power increases. But this is self-limiting; as water heats up, it expands, becoming less dense and a poorer moderator.

In a light water reactor the formation of bubbles of steam reduce moderation, causing the reaction to die down.

In RBMK reactors they used both graphite and light water as moderator; graphite is better moderator, so bubbles of steam in the core would tend to increase moderation, not reduce it. In an RBMK the void coefficient is strongly positive, this means that if ever the water in the core were to begin to boil the reactivity would increase, causing power to increase, causing more water to boil and increasing reactivity further in a vicious circle; this run-away reaction happened at chernobyl and the control rods took too long to be inserted stop it in time before the steam explosion.

[Ed: Thanks for picking that up Solyent, I missed it in my rapid read through. Have updated]



22. **JC**, on [13 March 2011 at 11:50 PM](#) said:

Great work, Barry.

this and the earlier thread are great information sources.



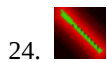
23. **em1ss**, on [13 March 2011 at 11:52 PM](#) said:

Good write up. Only thing I would say different is that the Reactor Building is designed to maintain a negative pressure relative to the outside atmosphere to prevent the spread of radioactive contamination. Its ventilation exhaust is monitored for Radiation/ Contamination and isolates if sensed. This is the standard GE BWR design and called "secondary containment".

Part of that purpose is to also address a fuel handling event on the Refueling floor. Unfortunately the spent fuel pool and the Refueling floor area is where the walls were lost during the hydrogen explosion.

That is the top area of the Reactor Building image which shows the crane used for vessel disassembly in the overhead. These walls are not as robust as the balance of the Reactor Building walls which would explain why they failed first.

No real word on that status, but current Radiation levels seem to imply adequate water level remains in the Spent Fuel Pool. The actual pool is steel lined and concrete walled.



24. **Jack Campin**, on [13 March 2011 at 11:58 PM](#) said:

The most significant problem is not going to be power shortage, but finding the funds to decommission the wrecked reactors. This will cost far more than it did to construct them in the first place.

Presumably TEPCO will declare itself insolvent and leave the next few generations of the Japanese public paying for it.



25. **Soylent**, on [14 March 2011 at 12:03 AM](#) said:

UNF, if Iran isn't building nuclear bomb and developing ICBMs they're crazy; just nucking futs.

The history of US intervention in the middle east and latin america in general and Iran in particular demonstrates the need for a credible deterrent.

Everything from the CIA instigated coup in '53 to prevent nationalization of oil, the support and training for the brutal SAVAK secret police, the military financial and intelligence aid to Iraq during the brutal Iran-Iraq war, the build up of US military on the borders of Iran, the military exercises off Iran's coast, the frequent thinly veiled threats against Iran.

Iran has every reason to be pursuing nuclear deterrent capability until the threat from the US ceases.



26. **fluutekies**, on [14 March 2011 at 12:08 AM](#) said:

The author seems to have missed the vertical shock wave just before the outer walls were torn apart. IMHO the hydrogen explosion took place within the third containment and blew away the concrete shield plug (vertical shock wave).



27. **charles**, on [14 March 2011 at 12:11 AM](#) said:

@ esquilax

Actually it is no and yes.

Regarding the first question, this is what the Japanese experts came up with :

<http://www.physorg.com/news10267.html>

The 500 years event was a 8.6 magnitude quake. The present earthquake was 5 times more powerful !

Hindsight bias anyone ?

Regarding the second question, here is one solution : <http://en.dcnsgroup.com/energie/civil-nuclear-engineering/flexblue> although there is a good chance that a "simple" EPR, with its air-tight and water tight redundant ECCS would have stood the tsunami test.



28. **PJK**, on [14 March 2011 at 12:23 AM](#) said:

Thank you for a clear, well-supported summary of the likely events at Fukushima. We're in Tokyo and are fairly stressed about the ongoing crisis. I'd be grateful if you could confirm whether the summary you've provided can be applied all the reactors at the Fukushima site. Evidently, a number are affected.

Really helpful. I'm a big fan of nuclear energy and can't frankly understand why folks in the US are so frightened of it. The part about the plugs not fitting sent chills up my spine. Beyond that, the lessons of Fukushima seem to be: build better protection for cooling systems, back-up the back-up, and ensure the plugs match. Things not to do? Continue to rely on obsolete systems or curl into the fetal position.

Cheers!



29.

Cristina Hansell, on [14 March 2011 at 12:27 AM](#) said:

Wonderful explanation, thank you! I have just one remaining question: if the worst-case scenario brought the core catcher into play — where does the SNF end up? Is that storage pool completely separate & does it remain intact? Or could we have a LOCA up there?

Thanks again for your insights!

30. **За Фукушима, наглостта и страха**, on [14 March 2011 at 12:27 AM](#) said:

[...] [...]



31. **Dan Meneley**, on [14 March 2011 at 12:32 AM](#) said:

Bravo, Barry! A very useful post.

The details will keep on coming for a long time — but your estimates and predictions are right on target. The BWR experts in the US are bringing in their materials regularly, now. The disaster speculators will be disappointed — the crisis is about over now.

Dan

32. **[BBC] - Possible Meltdown at Fukushima Reactor #1 & #3 + Cooling Failure In Reactor 2 - Page 67 - Overclock.net - Overclocking.net**, on [14 March 2011 at 12:37 AM](#) said:

[...] interesting article that might help alleviate fears. <http://bravenewclimate.com/2011/03/1...e-explanation/> _____ “I wish all mankind had one neck so I could choke [...]



33. **Gregory Meyerson**, on [14 March 2011 at 12:44 AM](#) said:

em: is it certain that this plant had negative pressure?

and what exactly was negatively pressurized? the containment (third)?

Barry: great job. Wolf Blitzer of CNN could not get the word “Chernobyl” out of his mouth enough.

the japanese ambassador never corrected him.



34. **esquilax**, on [14 March 2011 at 12:48 AM](#) said:

@ charles

The operator (TEPCO) is blaming the tsunami which was/is completely foreseeable, given the site is on the coast (duh!). Which one do the apologists want?

BTW, earth quake magnitude and the size of (any) tsunami wave are not always correlated.



35. **Shijas**, on [14 March 2011 at 12:58 AM](#) said:

That wa simple and Informative...



36. **Colin Walker**, on [14 March 2011 at 1:19 AM](#) said:

Great post, this is what we all need to know. Thank you!



37.

esquilax, on [14 March 2011 at 1:21 AM](#) said:

“the crisis is about over now”

The BBC just reported a State Of Nuclear Emergency for Onagana NPP, confirmed by the UN/IAEA because of “excessive radiation levels”.

and,

“(The) water level gauge in Fukushima nuclear reactor 3 may have failed – ‘We don’t know what’s going on’, says chief cabinet secretary.”



38. **Landreneau**, on [14 March 2011 at 1:26 AM](#) said:

Thank you! I have been pulling my hair out over the garbage the media has been incorrectly and dangerously spewing to the public. It is at relief to find an article that accurately describes the accident, written in a manner that most people should understand. Again, thanks!



39. **Greg**, on [14 March 2011 at 1:41 AM](#) said:

Well written, but some references to support your claims would go a long way. Particularly on points regarding the specific construction of THIS reactor and its rated specifications. You’re certainly correct on many points but, without references, you only appear as authoritative as the inaccurate media you are chastising.

Also, the difference between 8.2 and 8.9 on the Richter scale is $10^{0.7}$, which is 5, not 7 (the Richter scale is base 10 logarithmic).



40. **Kaj Luukko**, on [14 March 2011 at 1:56 AM](#) said:

There has been some discussion about the MOX-fuel used in unit 3. Is there some difference of behavior of MOX and UO-fuel in a meltdown event?



41. **eahd**, on [14 March 2011 at 2:03 AM](#) said:

Some easily verifiable objective facts: (not from a ‘scientist’ working for the nuclear lobby)

“Chief Cabinet Secretary Yukio Edano said an explosion could take place in the building housing the No. 3 reactor at the Fukushima Daiichi plant in northeastern Japan.

“There is a possibility that the third reactor may have hydrogen gas that is accumulating in the reactor (that) may potentially cause an explosion,” he said.

An explosion caused by hydrogen buildup Saturday blew the roof off a concrete building housing the plant’s No. 1 reactor, but the reactor and its containment system were not damaged in the explosion.

Edano said the No. 3 reactor would also likely withstand a similar blast, noting that workers had already released gas from the building to try to prevent an explosion.

”

Hydrogen means at least partial core’s meltdown.

MOX very dangerous nuclear fuel is used at the No. 3 Daiichi reactor, maybe at the No. 2 also.

Zirconium liner fuel is only used in Kashiwazaki-6 and 7 (ABWR 1350MW), not in BWR (500MW or 800MW) plant design of Fukushima Daiichi and Onagawa.

Japanese Nuclear Reactors have a strong design, that’s true, but they have to resist to several small/medium earthquake/year.

Since 11 march, they took level 9 earthquake (designed for max level 7) + tsunami 2-10meters wave + many replica level 5 and more.

These reactors aren't designed to be cooled by sea water.

No. 1 reactor Fukushima Daiichi is 40+ year old.

At least 69 officially irradiated persons.

Last news say :

1. water level don't increase in reactor No1 2 and 3, sea water don't work, they don't understand why

2. Japanese authorities have informed the IAEA that the first, or lowest, state of emergency at the Onagawa nuclear power plant has been reported by Tohoku Electric Power Company + Onagawa had an fire emergency at 11 march.

Japanese people need support and real infos, i really hope things will go better.



velofisch, on [14 March 2011 at 2:14 AM](#) said:

You offer a great amount of details and mix it with false information about the dangers of radiation.

Only some of the radioactive particles will decay within seconds. Other will stay for years. It is also not sure at all, that during a core meltdown everything will be contained. In the contrary it is highly likely that vaporized core particles will either have to be vented or the containment will explode. This is particularly dangerous with reactor 3 which contains MOX elements with a substantial amount of plutonium.



Luke Weston, on [14 March 2011 at 2:15 AM](#) said:

Kaj, there might be some slightly different effects on the void reactivity coefficient and stuff like that because the fission cross section for Pu as a function of the neutron energy is different than U-235.

And of course there's plutonium phobia to contend with with the MOX fuel, irrespective of the real science and engineering information.

Anyway... in the GE BWR-3 like Fukushima I Unit 1... if there is excessive pressure within the primary containment vessel, where will it be vented to? Will it be vented out into the reactor building, outside the inner containment structure?

What about venting excessive pressure from the torus? Will that be vented out into the reactor building?

I'm trying to better understand the path of the hydrogen from within the torus into the area on top of the reactor building, where the fuel transfer crane is, where the steel walls were blown out by the explosion.

The outermost layer of the multiple layers of containment – the reactor building – has walls and a roof made of solid concrete, and it's roughly cube-shaped.

On top of the concrete reactor building, however, there is an additional part of the structure – it is not made of concrete, but it is made of steel, with steel sheets over a steel frame. Refer to the drawings posted previously above.

This steel building on top of the reactor building houses the fuel transfer crane, and it is built on top of the concrete roof of the reactor building. I'm referring to the part of the structure above the concrete shield plug and the refueling platform at the top of the concrete reactor building.

It is this relatively weak steel structure on top of the concrete reactor building, which is not really part of the reactor building proper, which seems to have been blown out by a hydrogen explosion.

The explosion does not appear to have occurred within nor does it appear to have breached any of the fundamental layers of containment structure.

It appears that the building has been breached as a result of a hydrogen explosion. It's probable that excessive hydrogen generation within the reactor core, either radiolytically or chemically by reduction of water in the presence of the zirconium cladding at significantly elevated temperatures, has been vented into the torus, and as temperatures and pressures have begun to rise within the torus

steam pressure in the torus has been vented out into the reactor building surrounding the torus.

From there, the hydrogen mixed with that steam and water vapor has risen, as hydrogen does, and worked its way through the reactor building, escaping at the top of the reactor building, and accumulating at the top, in the area around the fuel transfer crane. It then appears that the accumulated hydrogen has mixed with air and exploded.



44. [Luke Weston](#), on [14 March 2011 at 2:17 AM](#) said:

Cristina,

Regarding the used fuel storage pool, it is not in the reactor building, as far as I'm aware. It's a separate building, which is designed to be very robust and seismically hardened as well.

There is a very small pool in the reactor building near the top of the reactor vessel which is used to temporarily hold the used fuel during its unloading from the reactor.



45. [Stan Focht](#), on [14 March 2011 at 2:21 AM](#) said:

"The Zircaloy casing is the first containment."

** Not Correct **

1st containment is the ceramic fuel pellet itself. The fission process produces fission fragments, or radionuclides, which almost entirely remain within the ceramic fuel pellets. Only a very small fraction of fission fragments escape the fuel pellet, unless the pellet integrity is compromised by melting or some other degradation.

The 2nd barrier is the zircalloy tube; 3rd – primary coolant system; and so on...

This is not quibbling, but rather an important and fundamental reactor design safety feature.

46. [Balloon Juice » Earthquake News](#), on [14 March 2011 at 2:27 AM](#) said:

[...] This is the best analysis I've found so far, from one of the links Crank Observer [...]



47. [Frank Kandrnl](#), on [14 March 2011 at 2:31 AM](#) said:

Hmmm. The plugs on trucked in temporary diesel generators did not fit? Did anyone in Japan ever heard of temporary connection rigging. Or is the status quo in Japan entrenched like here in US where electrical inspectors will threaten you with multi million dollar fine if you don't comply with polished electrical code so the guys who try to help in emergency will spit in disgust and walk away? 8 hours is very long time in which temporary electric power should be connected by any means or batteries should be charged with temporary hook-up to prolong the time. Most electrical engineers will be scratching their heads why this was not done in 8 hours time. This accident in Japan is another classical case how mother nature wins when she is allowed to run her natural course. Add to it the human status quo and you have a screw up of first magnitude.

I am sure after the investigation is done a lot of heads will be rolling. I would not be surprised if some individuals commit hara kiri. Nevertheless, after the fact solutions are no consolation to reactor owners who face massive financial losses for clean up and overall further damage to nuclear industry that anti nuclear elements will surely exploit.

This is why only three weeks ago I was pointing to unbeatable natural safety features of Molten Salt Reactors as a preferred method to generate nuclear power.

One thing is certain, this accident will not play well for IFR acceptance.

48. [We who oppose nuclear energy offer the Japanese people hysteria in their time of need.... » Heavy Metal Bullet](#), on [14 March 2011 at 2:39 AM](#) said:

[...] The hysteria really is ridiculous at this point. The way this tragedy has been used is changing my thinking about certain groups and organizations that I may have previously aligned myself with. Instead of a rational, calm discussion about what is going on in Japan and how we can help the Japanese people. classic opportunist theater is on display. If you want a rational explanation of what is going on, do yourself a favor and head over to Brave New Climate. [...]



49. **Dan Meneley**, on [14 March 2011 at 2:50 AM](#) said:

Frank: An old Naval invocation: “Point the Guns Outboard, Lads!!”

Personally, I cannot understand people who take advantage of any opportunity to further their own limited objectives, even in the midst of a most difficult situation such as exists in Japan.

The next time a 10 meter wave washes over a nuclear power plant of any particular design, I hope all of us will take a moment to recognize that the situation on the ground is somewhat less than ideal.

I think the Japanese are doing rather well in controlling this 40-year-old reactor, which was scheduled for final shutdown a couple of months from now.



50. **Elli D.**, on [14 March 2011 at 2:51 AM](#) said:

I can hardly imagine what people, who work in the nuclear station, are surviving right now. I believe that they are aware of how big responsibility is laying on their shoulders. It's too late and too early to blame somebody, it has already happened. The major task is to save as many lives as possible.

51. **Balloon Juice » Earthquake News**, on [14 March 2011 at 3:17 AM](#) said:

[...] This is a best analysis I've found so far, from one of a links Cranky Observer [...]



52. **Sonya terBorg**, on [14 March 2011 at 3:26 AM](#) said:

A very interesting post and great to know given that many friends are still living in Japan – the place I called home for two years.

However, ‘safe’ or not, I am still very much relieved that New Zealand, my home country, is Nuclear free – and long may it stay that way! Thank you David Lange for leaving us that!



53. **drkrick**, on [14 March 2011 at 3:35 AM](#) said:

Excellent summary, thanks. A small point – it would have helped if the diagram had not labeled as primary and secondary containment what the text refers to as secondary and tertiary.

I certainly hope your assessment of the situation at Fukushima plays out.



54. **evnow**, on [14 March 2011 at 3:39 AM](#) said:

Barry, thanks for the explanation.

Just one note – we haven't heard the last of this. Invariably governments & companies lie. Just think about the gulf drilling disaster.

Next time someone compares costs with PV or Wind these scenarios should be included. Tax payers shouldn't be the ones funding all these ...



55. **Admiral Komack**, on [14 March 2011 at 3:45 AM](#) said:

Thank you for this article.



56.

David Lewis, on [14 March 2011 at 3:50 AM](#) said:

Here's a graphic showing what's been blown away and what's still there at the Japanese reactor building. The red brackets indicate the flimsy walls that have been blown away:



57. [disdaniel](#), on [14 March 2011 at 4:00 AM](#) said:

So there is a hydrogen explosion that "pulverizes" the top of the building the reactor sits in, and your first assumption is that no damage has been done to the reactor containment vessel?

sings Don't worry...be happy.

58. [Cranky-D » Japan's Nuke Plants](#), on [14 March 2011 at 4:02 AM](#) said:

[...] you are concerned, go here and be at ease. Some radiation got out, but that radioactive steam is nothing to worry about at all [...]



59. [Bill DeJager](#), on [14 March 2011 at 4:10 AM](#) said:

This part of Japan is next to a subduction zone. Subduction zones are known for their ability to create magnitude 9+ earthquakes with large tsunamis, such as the 1960 Chile earthquake and the 1964 Alaska earthquake. It's not rocket science to understand that nuclear plants in this kind of environment need to be designed and operated to handle seismic and tsunami events that are quite large.

BTW, the Richter scale is no longer used much, but its most common replacement the moment-magnitude scale uses the same logarithmic scale, just with a different calibration.



60. [Andy Dawson](#), on [14 March 2011 at 4:12 AM](#) said:

Comment on three areas:

1 – the explosion in the reactor building.

It obviously wasn't hugely powerful – it seems to have removed cladding, but left the structural steelwork substantially undamaged.

I can't see an obvious pathway for hydrogen generated in the core to the into the building. Or at least, not one that wouldn't have radioactive material coming along with it, and a substantially greater level of radioactivity.

There is, however, another source of hydrogen on the plant – that's the hydrogen coolant for turbine stators. There are some reports that the explosion originated in the turbine hall.

2 – the overall impact. Dependent on the end outcome, it's obviously not good for the pro-nuclear argument. But, there's a counter-argument, and that's "in an unforeseeably bad combination of circumstances, a 40-year old plant not only survives the initial fault, but is then managed to a successful outcome, then how bad would it have to be to actually cause significant release?"

3 – timing of any action. Just doing some basic sums, and I think the heat generation is probably down to under 10% of what it was immediately post-trip – perhaps 8MW versus 90+, and 1500 or so under full power.

So far as I can see, researching online, it's usual to open up a BWR RPV about 4-7 days into a refuelling shutdown – heat generation at that point, on a plant of Fukushima 1's size is 7-8MW. Now, obviously, at that point, there's no boiling, and unpressurised water circulation is enough to maintain cooling.

Can anyone who knows BWRs reasonably well confirm that? My background is AGRs, rather than light water designs. It strikes me that at that point, we can reasonably assume all's under control.



61. [G.R.L. Cowan, hydrogen energy fan until ~1996](#), on [14 March 2011 at 4:19 AM](#) said:

. Invariably governments & companies lie.

I wouldn't go so far as *invariably*. But that's a quibble.

What's more important is the direction in which they lie. Today Japan is full of power plants and fuel reservoirs that have been killing people. All the plants had been burning, and all the reservoirs contained, much more expensive fuels than the Fukushima plants, and the Japanese government is a major beneficiary of that expense.

If it must lie, won't it lie in the direction of favouring its fossil fuel income?



62. [c2cinmay](#), on [14 March 2011 at 4:25 AM](#) said:

Shame that this isn't true

"Some radiation was released when the pressure vessel was vented. All radioactive isotopes from the activated steam have gone (decayed)."

<http://www.reuters.com/article/2011/03/13/japan-quake-onagawa-idUSTKG00708020110313>

Japan's nuclear safety agency said on Sunday there was no problem with the cooling process at Tohoku Electric Power Co's (9506.T) Onagawa nuclear power plant and that a rise in radiation levels there was due to radiation leakage at another plant in a neighbouring prefecture.

100Km away the leaked radioactivity is being detected

63. [Marginalia](#), on [14 March 2011 at 5:01 AM](#) said:

[...] ***** update 2: Never mind. Spiny found a link. [...]



64. [Vinay Raveendran](#), on [14 March 2011 at 5:08 AM](#) said:

Thanks Barry for this brilliant analysis. :)

65. [Nuclear Risk Contained In Japan | But If Nots](#), on [14 March 2011 at 5:32 AM](#) said:

[...] reading the news I have come across this link at BraveNewClimate quoting Dr Josef Oehmen, a research scientist at MIT. The long and short of it, according to him, is [...]



66. [andreze](#), on [14 March 2011 at 5:35 AM](#) said:

It is time for everyone to look at facts, not emotionally respond, nor ignore the realities of living on the Earth. The recent article in the Times Magazine published yesterday, <http://ecocentric.blogs.time.com/2011/03/12/japans-radiation-exposure-how-serious-is-it>, demonstrates how poor research, bad writing, and incomplete and or incorrect facts can skew and misinform the reader.

The article suggests a doomsday is approaching, and that the slightest amount of pollution of various materials involved in the nuclear process will be fatal to the existence on Earth. Let us examine the facts.

One common email this past week shows the proliferation of 3000 RADS of Nuclear fallout to the Aleutian Islands in three days, 1500 RADS of Nuclear fallout to the coast of Canada in six days, and 750 RADS of Nuclear fallout to Nebraska and Nortyh Central Mexico in ten days. Pollution would travel in the upper atmosphere if it were to spread, and exposure would only be probably caused by particulates from dust or attachment to rain. So far, there is not a dust cloud from the nuclear plants. There is probably small amounts of steam. The likelihood of exposure over more than a few miles is improbable.

The fact is the "Nuclear Fallout Map" is a hoax based on jet stream maps and little additional facts. See further

<http://bhalomanush.posterous.com/my-take-on-the-japanese-nuclear-fallout-map-h>. A "RAD" is a term associated with radiation and nuclear fallout. It refers to exposure, but is not meaningful in itself. (The rad is a unit of absorbed radiation dose. The rad was first proposed in 1918 as "that quantity of X rays which when absorbed will cause the destruction of the [malignant mammalian] cells in question..."[1] It was defined in CGS units in 1953 as the dose causing 100 ergs of energy to be absorbed by one gram of matter. It was restated in SI units in 1970 as the dose causing 0.01 joule of energy to be absorbed per kilogram of matter. The United States Nuclear Regulatory Commission requires the use of the units curie, rad and rem as part of the Code of Federal Regulations 10CFR20.) [http://en.wikipedia.org/wiki/Rad_\(unit\)](http://en.wikipedia.org/wiki/Rad_(unit)) Rem is more likely to be used. (The röntgen (roentgen) equivalent in man (or mammal[1]) or rem (symbol rem) is a unit of radiation dose equivalent. It is the product of the absorbed dose in rads and a weighting factor, WR, which

accounts for the effectiveness of the radiation to cause biological damage.)

http://en.wikipedia.org/wiki/R%C3%B6ntgen_equivalent_man .

So what is sieverts? “The sievert (symbol: Sv) is the SI derived unit of dose equivalent. It attempts to reflect the biological effects of radiation as opposed to the physical aspects, which are characterised by the absorbed dose, measured in gray. It is named after Rolf Sievert, a Swedish medical physicist famous for work on radiation dosage measurement and research into the biological effects of radiation.” <http://en.wikipedia.org/wiki/Sievert>.

Now, given the definitions, a better understanding of nuclear fallout is appropriate. Is it in the atmosphere or will it be on the ground? If it exists, it will start at very high altitudes with the jet stream. Will it reach the ground? Possibly if there is enough up there. Are the Japanese reactors emitting significant amounts of nuclear waste? Probably not. There are layers of containment. A melt down is the destruction of the fuel rods, but a meltdown is a possibility considered in the construction of nuclear facilities. The probable consequence is that local people will be evacuated for safety after the experience with a far less safe nuclear facility, Chernobyl. Additionally, as a society, we should watch for safety flaws, but not over react.

A more serious problem to Earthlings is the rate we are using up natural resources and not replenishing them, the pollution of fresh and salt water, the pollution of the upper atmosphere, and the rapid population explosion that may make the Earth uninhabitable within 500 years.

[This article is published in Time Magazine comments this week.] <http://ecocentric.blogs.time.com/2011/03/12/japans-radiation-exposure-how-serious-is-it>
legalresearch@cox.net



67. **Elisabeth Nolan**, on [14 March 2011 at 5:41 AM](#) said:

i've been looking for a sensible interpretation of the japan events—this is very comprehensive—thank you for posting it!



68. **Brave New Climate – Where are We in the Nuclear Event? « Climate Denial Crock of the Week**, on [14 March 2011 at 5:52 AM](#) said:

[...] Brave New Climate has an informative and lengthy post on where we are in the nuclear accident process. Here are the conclusions: Now, where does that leave us? [...]



69. **mk**, on [14 March 2011 at 6:09 AM](#) said:

How can you be sure that in the case of a full meltdown, the nuclear fuel wont melt through the steel and concrete containment vessel? Ive heard the steel there is only 6” thick, whereas newer reactors are much thicker?



70. **unclpete**, on [14 March 2011 at 6:13 AM](#) said:

The line about “ask Iran ” , did not come across as warmongering, rather it is good shorthand for : Building a Nuke bomb represents a formidable engineering challenge. That’s all



71. **Jeff in Iowa**, on [14 March 2011 at 6:17 AM](#) said:

As a former NRC licensed operator of a BWR, the write-up was spot on (minor quibbles with some terms). How would anybody fare is every back-up failed when it was called on?

It has been suggested that the designers failed to consider an earthquake of sufficient magnitude (design 8.2 vs. actual 8.9). My question to those would be this: what would be a good enough design earthquake? Magnitude 10? 11? Nothing could be built economically if that is your criteria. That is pure wishful fantasy.

It is possible to economically design something to withstand foreseeable casualties. It is possible to design something to withstand every possible casualty, foreseeable or not. It is not possible to economically do both.

72. **Das klingt gar nicht gut - Japan -Seite 19 - Kaffee-Netz - Die Community rund ums Thema Kaffee**, on [14 March 2011 at 6:46 AM](#) said:

[...] [...]



73. **Gimp Hag**, on [14 March 2011 at 6:53 AM](#) said:

“The small amounts of Cesium that were measured told the operators that the first containment on one of the rods somewhere was about to give.” – Que? Surely this would indicate that the casing was broke, not about to break?

“ I am not quite sure if they flooded our pressure cooker with it (the second containment), or if they flooded the third containment, immersing the pressure cooker. But that is not relevant for us.” – Umm... flooding a nuclear reactor with sea water kinda seems desperate to a non-specialist like me.

Also it's not over yet. But, thank you for staying calm however.

Also what's the fatality rate for petrochemical power vs nuclear? I'm guessing oil kills more...

74. **Una simple explicación de lo ocurrido en Fukushima [ENG]**, on [14 March 2011 at 6:54 AM](#) said:

[...] Una simple explicación de lo ocurrido en Fukushima [ENG] bravenewclimate.com/2011/03/13/fukushima-simple-explanation/ por paublico hace 3 segundos [...]



75. **Luke Weston**, on [14 March 2011 at 7:00 AM](#) said:

I know some people at Australian Radiation Services – the Melbourne-based health physics and radiation safety firm whose logo appears on that extremely dodgy looking plume map.

I do not think they would really turn out crap science. They're serious professionals in a serious field, and they know what they're doing. I'm seriously tempted to flick them an email to confirm whether or not their organisation did actually produce that chart or if someone else has mendaciously put their name on it.



76. **Ic**, on [14 March 2011 at 7:07 AM](#) said:

Thank you. From someone familiar with BWRs, this is a nice synopsis. Agree that we should be celebrating the engineers who had the forethought to have multiple cooling systems, multiple layers of containment, backup generators and batteries, and, when many of these failed, yet another backup in the seawater. Let us continue to give the situation the attention needed to maintain containment integrity while we focus on the immediate needs of thousands stranded without food or water.



77. **futzinfarb**, on [14 March 2011 at 7:11 AM](#) said:

While the radioactive Cs and I isotopes are obviously important and a primary focus in nuclear incidents of the type that is occurring at these plants, I think that it is counterproductive (ultimately, in the same way that all the more egregious media misinformation is counterproductive) to frame the discussion as though those are the ONLY two fission product radioisotopes that have been and will be released. As a minimum an informed perspective requires an understanding of why the other radioisotopes of the fission product yield (e.g., http://en.wikipedia.org/wiki/Fission_product_yield#References) are of less significance in this incident.

78. **Fukushima Nuclear Accident – a simple and accurate explanation » Patrx's Favorites**, on [14 March 2011 at 7:18 AM](#) said:

[...] to Fukushima Nuclear Accident – a simple and accurate explanation] Tags: facts, Japan, nuclear Previous Post blog comments powered by Disqus [...]



79. **spark**, on [14 March 2011 at 7:19 AM](#) said:

Here is another easily accessible writeup on the situation:

<http://theautomaticearth.blogspot.com/2011/03/march-13-2011-how-black-is-japanese.html>

plus, it comes from someone who has actually been working and publishing in the field, unlike Josef Oehmen.



80. **scf**, on [14 March 2011 at 7:19 AM](#) said:

“A Japanese official said 22 people have been confirmed to have suffered radiation contamination”

This contradicts your claim that “If you were sitting on top of the plants’ chimney when they were venting, you should probably give up smoking to return to your former life expectancy. The Cesium and Iodine isotopes were carried out to the sea and will never be seen again.”

Or perhaps you are suggesting that 22 people were sitting on the chimney?

Please drop the patronizing attitude. Just because the operators are trained for these events, that does not mean they are not serious events.

I don’t think I’ve seen any media reports anywhere that claimed that the chain reaction had not been stopped or some other catastrophic situation remained. You do not need to debunk non-existent stories. The media has done a good job.

However, you have written a good summary, despite the patronizing attitude.



81. **Finrod**, on [14 March 2011 at 7:24 AM](#) said:

Following.



82. **Danram**, on [14 March 2011 at 7:24 AM](#) said:

Sure doesn’t inspire a whole lot of confidence in our news media, does it?



83. **valwayne**, on [14 March 2011 at 7:28 AM](#) said:

Thank you Mr Brooks. That was excellent. I would like to think that our news media is just ignorant and trying to catch up to reality. However, they surely had experts to call upon that gave this information to them within hours. That means they’ve just been hyping things with their talk of meltdown etc for ratings. That’s not surprising, but no less disgusting! Thank you for the truth!

84. **Mitä Fukushimaa tapahtui? « Ydinreaktioita**, on [14 March 2011 at 7:28 AM](#) said:

[...] tässä jutussa on käytetty eri uutistoimistoja, blogeja ja erityisesti MIT:n proffan Josef Oehmen BNC:n sivuilla julkaistua kuvausta laitoksen tapahtumista) AKPC_IDS += “1362,”; Lauri Muranen Asiantuntija, [...]



85. **Martin Becker**, on [14 March 2011 at 7:35 AM](#) said:

It very helpful read the account provided here. As a retired nuclear professional, I learned specifics about the plant and the sequence of events that I did not see elsewhere. I came across this account via a citation on Real Clear Politics, so hopefully the article will receive additional attention.

I do have a comment to an assertion by esquilax that it is not possible to design around the problems experienced by the Fukushima plants. In 20-20 hindsight, design solution is clear. The diesel generators for backup power should be in an enclosure protected from the effects of a tsunami (as the reactor itself is).

It is reassuring to learn that despite encountering an earthquake five times as severe as the design basis earthquake (which itself is twice as severe as the worst earthquake ever to hit Japan previously), the plants withstood the earthquake.

Let us hope that the scenario does play out as forecast in the article (i.e no new unpleasant surprises) and that the worst is over.



86. **Todd**, on [14 March 2011 at 7:35 AM](#) said:

Great explanation. It is unfortunate, however, that the ignorant left will ignore this and call for the death of nuclear power anyway.



87. **Gregory Meyerson**, on [14 March 2011 at 7:42 AM](#) said:

I don't think a meltdown from loss of coolant in a water reactor is the same thing as a chain reaction. At Chernobyl, loss of coolant increased the rate of fission due to the particulars of the graphite moderator. That was a chain reaction.



88. **Kim in USA**, on [14 March 2011 at 7:42 AM](#) said:

Very nice summary. I am a health physicist but with no NPP experience. If you update the information here I would find this helpful: (1) regarding the facility design: where are the operators located and what protects them? (2) What is the design and location of the coolant piping systems – they apparently are robust enough to have survived the explosion but still must somehow not be completely inside the protected structures if seawater can be brought in. And (3) NISA reports 40 microSv/h (4 mrem/h for US readers) measured at the site boundary – would this have been a short term measurement while noble gases were being vented, and if not what would explain that?



89. **stas peterson**, on [14 March 2011 at 7:42 AM](#) said:

The Fukushima nuclear reactors are Boiling Water Reactors, BWRs. So they were designed and built by the GE-led, BWR reactor consortium.

It is reassuring to note that the new American “Standard Design” reactors, so painstakingly being designed, reviewed, modified and certified, ALREADY INCLUDE extra provisions for the remote set of circumstances that affected one of the 53 nuclear reactors in Japan forced by the Japanese Earthquake and subsequent tsunami.

New American “Standard Designs” are re-designed so that they have no problems if commercial power is unavailable; and All not just some of the emergency diesel generators did not start.

The new “Standard Designs” nearing final approval, after almost five exhaustive years, of analysis, modification, and approval and final certification of every nut and bolt in the design. They were redesigned to not need the power for the pumps, at all. These new “Standard Designs” rely on placing the coolant tank above the reactors and letting the emergency cooling water flow down into the reactor vessel by gravity, without needing any pumps. Secondly, they have been redesigned so that the coolant capacity is much larger inside the reactor vessel, requiring less from outside to be added.

Third, the larger coolant capacity reactors are not so time critical to a meltdown. They extend the time to a meltdown without cooling to several hours instead of 45 minutes, allowing more time to thoughtfully react.

Fourth, they have been redesigned so that natural thermal convection will circulate the coolant water, inside the reactor, thus eliminating the need for power to the pumps, or the pumps at all.

Isn't it further proof that the new reactors and the new NRC certification scheme of “Standard Design”, makes much more sense. It used to be that letting progress occur by each new plant be a single design, perhaps incorporating new features unique to itself, and much more anticipatory rather than reviews while under construction, or in post-accident design fixes.



90. **Nic**, on [14 March 2011 at 7:47 AM](#) said:

If there was no power, how did they pump the sea water?



91. **spark**, on [14 March 2011 at 7:47 AM](#) said:

As to the question how the hydrogen ended up in the reactor building, my (layman) understanding that it first formed inside the reactor vessel and entered the suppression pool system via approaches to cool the reactor (RCIC/HPCI). As suppression pool temperature increased, pressure was released into the containment. After pressure in the containment subsequently reached a critical state, containment was vented – leading to hydrogen mixing with oxygen in the reactor building.

I may of course be totally off. Based on:

<http://linkinghub.elsevier.com/retrieve/pii/002954939090022P>

<http://www.nrc.gov/reading-rm/basic-ref/teachers/03.pdf>



92. **John Newlands**, on [14 March 2011 at 7:56 AM](#) said:

Reading the Fukushima thread at The Oil Drum I see many assert that we must replace nuclear with wind and solar. Fair enough but how are we going to also replace coal, oil and gas?

There has been a fatality with the death of a crane operator at the Daini group of reactors.



93. **Paul K2**, on [14 March 2011 at 7:57 AM](#) said:

Some experts talk about new hazards from Unit 3:

From BBC:

#

2011: A former adviser on radiation to the UK government, Dr Christopher Busby, has told the BBC the situation at the nuclear plants is extremely serious. “Particularly concerning is the [Fukushima] number three reactor which I understand is in trouble now, because... it runs on a different sort of fuel; it doesn’t run on uranium, it runs on a mixed uranium plutonium fuel, and plutonium is an extremely serious hazard so if this stuff comes out then it’s going to make what’s happened so far, in terms of the tsunami damage, look a little bit like an entrée to the real course.”



94. **spepper**, on [14 March 2011 at 8:02 AM](#) said:

The main thing that needs to happen if or when they overhaul the reactor plants in Japan, is to move the darn things on the WEST coasts, OPPOSITE of the eastern coasts of the Japanese islands that are in the direct line of exposure to major seismic and tsunamic activity.....while no place on earth is completely invulnerable to natural disasters, there are some places that are statistically better than others.....



95. **Chris Harries**, on [14 March 2011 at 8:12 AM](#) said:

Wait a minute, has this website not been championing a new generation of nuclear technology (Gen IV) that would largely eliminate most of the multifarious risks that have been associated with traditional nuclear reactors?

If so, does this incident not add weight to the case that the new technology ought to be pursued when building any new nuclear plant?

And if so, should this incident not be viewed as a positive, prescient signal to the world that other technology may soon be available – if not already – and to immediately forsake investments in nuclear plant using older technology?

If Brave New Climate is really certain about its prognostications re the new safer technology, then it should have nothing to fear from this incident. It presents a golden opportunity to put its case for a technology transition, surely?



96. **TerjeP**, on [14 March 2011 at 8:18 AM](#) said:

“Kim in USA” asks some very sensible questions in the above comment. I would also like to know the answer to Q1.



97. **Moritz**, on [14 March 2011 at 8:19 AM](#) said:

W. Krueger replied to the original post:

Much has already been said about the author, his qualifications to talk about nuclear power plants as a food researcher and a supply chain management expert and the way even the very moderate press releases from Japan contradict his views.

Let's take a look at the websites he recommends:

- <http://www.world-nuclear-news.org>: This site belongs to the "World Nuclear Association (WNA)". So, what does Wikipedia tells us about it? "The World Nuclear Association (WNA), formerly the Uranium Institute, is an international organization that promotes nuclear power and supports the many companies that comprise the global nuclear industry."

[http://en.wikipedia.org/wiki/World_Nuclear_Association]

So, basically, a lobbying enterprise. And we are to expect *serious*, *unbiased* information about power plants and their safety from such an organisation?

- <http://bravenewclimate.com>: Registered by Mr. Barry Brook from the University of Adelaide where he holds a professorship for "Climate Change & Sustainability". As such, he's not exactly likely to be an expert on nuclear power plants as such either. Furthermore, he's a *strong* lobbyist for nuclear power as well but let his words speak for himself: "Fortunately, the world is passing them [Greenpeace & other environmentalists, Ed. note] by. Australia should too. It's time to go nuclear green."

<http://www.adelaidenow.com.au/news/barry-brook-follow-britains-lead-on-nuclear-power/story-e6freo8c-1225796177006>

To get a complete picture, read Greenpeace's rebuttal to his article at <http://www.adelaidenow.com.au/news/greenpeace-outlines-its-alternative-to-nuclear-energy/story-e6freo8c-1225796226672>

- <http://ansnuclearcafe.org>: This website belongs to American Nuclear Society (ANS), another lobbying organisation. Let's cite Wikipedia again: "Its main objective is to promote the advancement of science and engineering relating to the atomic nucleus."

[http://en.wikipedia.org/wiki/American_Nuclear_Society]

Note the word "promote" – these guys *promote* nuclear power plants and that stuff. They're (among other topics) in *marketing*. Do you *really*, *seriously* expect them to report anything *critical* on the very subject they've been marketing for more than 50 years?

Really, this article maybe be nice and soothing, indeed, and give you a warm fuzzy feeling but even the websites the author recommends are made by nuclear power lobbyists. But the author doesn't only recommend reading those but advises *not* to use *independent* sources (the media as a whole don't profit nor suffer from nuclear energy). A really bad advice from an engineer/scientist.

So, everyone who reads this should be *very* critical about the contents and make up his own mind and do his own research *and* check *different* media for their reports. Don't just listen to Mr. Oehmen, don't just listen to me either. Be critical, ask question, look into things yourself and whatever conclusion you come to, *never* rely on a single source.



98. **Barry Brook**, on [14 March 2011 at 8:20 AM](#) said:

Here I am talking on Channel 9 TV TODAY on Fukushima situation update (3 min vid):

<http://video.au.msn.com/watch/video/nuclear-fear/x9qggaz>

This gives a 'sound bite' sized summary of the situation.



99. **Concern continues after tsunami | Digging in the Clay**, on [14 March 2011 at 8:32 AM](#) said:

[...] to commenters on E.M.Smith's site I just found another summary "Fukushima a simple explanation", which is the best I've [...]



100. **R. L. Hails Sr. P. E.**, on [14 March 2011 at 8:39 AM](#) said:

I have engineered six BWRs, Mark I, Mark II, and Mark III containments. This is an early Mark I. I would quibble with some statements but consider this article infinitely better than the errors, both ignorant, and intentional, that have been reported. Japan is not

out of the woods yet, but we must acknowledge the skill and courage of their people, particularly those working the emergency. There are a lot of unknowns but this report, and time, indicates the good guys are winning, regaining total control, perhaps at the cost of a modest number of deaths, a statement which may have no scale of meaning.

There will be time for informed assessment, and perhaps malfeasance confronted, but now is the time for prayers and best wishes, to a grievously suffering nation.

IMHO, the next unknown to fear is another probably great quake, an aftershock, and possible tsunami over the next week.

101. [Getting Past The Headlines: What's Happening In Japan's Nuclear Power Plants? | The Moderate Voice](#), on [14 March 2011 at 8:40 AM](#) said:

[...] New Climate: Situation summary by Dr Josef Oehmen, MIT — detailed but [...]



102. [Kathy E. Gill](#), on [14 March 2011 at 8:41 AM](#) said:

Thanks – I have linked to this as a resource in this article: [Getting Past The Headlines: What's Happening In Japan's Nuclear Power Plants](#)



103. [Alastair Breingan](#), on [14 March 2011 at 8:43 AM](#) said:

Good post – thank you.

However I have to comment that the attempt to downplay the radiation risk is misguided and will do the nuclear cause no good.

You say:-

By “significant” I mean a level of radiation of more than what you would receive on – say – a long distance flight, or drinking a glass of beer that comes from certain areas with high levels of natural background radiation.

However Tepco (the operator) say

“The radiation exposure of 1 TEPCO employee, who was working inside the reactor building, exceeded 100mSv and was transported to the hospital.

<http://www.tepco.co.jp/en/press/corp-com/release/11031312-e.html>

Slightly more than you get from a glass of beer, especially as they do the “more than” bullshit.

The 40 year old plant took extraordinary damage and did most of its job, but the general opinion will further harden against nuclear – folk just don't like even a tiny chance of great risk.

Given that Spain's electricity is 35% renewables and Portugal 45% I know where I would put Australia's money. Build wind and solar as fast as possible and plan a few nuclear installations but don't start for 10 years. By the time you are ready to build we will know how the renewables are doing.



104. [JohnQPublic](#), on [14 March 2011 at 8:49 AM](#) said:

Nice summary. Thank you for the effort.

105. [Fukushima NUCLEAR ACCIDENT – a simple and accurate explanation « BraveNewClimate « Snow Report Blog](#), on [14 March 2011 at 8:54 AM](#) said:

[...] via Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate. [...]



106. [Gregory Meyerson](#), on [14 March 2011 at 9:02 AM](#) said:

barry: in that video, while you speak, the picture shows arrows pointing out of the nuclear plant with the words “cancer and genetic defects” underneath.

gm

In an earlier video, you mentioned that newer plants had no problems. could you elaborate? what sort of plants were these to which you refer?



107. [The Japanese Nuclear Reactor Problems « The Old Gray Cat, zoomin' along...](#), on [14 March 2011 at 9:06 AM](#) said:

[...] I was reading about the nuclear reactors that were affected by the Japanese earthquake and tsunami. I finally happened on a blog (!) that made sense of it all. I have a little understanding of how nuclear reactors work, especially older ones like these, but [...]



108. [Barry Brook](#), on [14 March 2011 at 9:12 AM](#) said:

Greg, plants like the AP1000 have passive cooling systems that work by convection and gravity feed, so don't depend on external power. Plants like EPR have fully isolated and sealed power units for the ECCS so would have not been damaged by the tsunami. Sorry for the short reply, being overwhelmed by media stuff right now.



109. [Bill Brown](#), on [14 March 2011 at 9:13 AM](#) said:

Much better analysis than the TV but Mr. Brooks curiously congratulates Japanese construction because the facility withstood more than the 8.4 or so that it was designed to take (failing then to criticize the forecasters). But the 9.0 earthquake was centered a couple of hundred miles away, so what was the intensity at Fukushima? I'd think it would be below the design limit. More to the point, what would have happened if the 9.0 earthquake had occurred closer to Fukushima, or if several large tremors had occurred back to back and the control rods or the battery somehow was disturbed?



110. [Hawkmon](#), on [14 March 2011 at 9:14 AM](#) said:

We all love to read something that confirms our opinions. Most people here seem quick to condemn any report that does not support the view that everything is fine, and then just to praise a report from an "MIT Research Scientist" who nuclear credentials seem to be that "his father has extensive experience in Germany's nuclear industry." My father was a lawyer, but that doesn't make my comments on the law automatically correct. I will take this report along with all the others claiming there is likely to be a big release of radioactivity with a huge grain of salt until this is all over in a few weeks/months time.

111. [unclear nuclear: getting the story right](#), on [14 March 2011 at 9:16 AM](#) said:

[...] understand the hype and FUD going on with the Japanese nuclear headlines, see Fukushima Nuclear Accident – a simple and accurate explanation. Along with reliable sources such as the IAEA and WNN updates, there is an incredible amount of [...]



112. [Bazza McKenzie](#), on [14 March 2011 at 9:17 AM](#) said:

Excellent, informative article.

Interesting perspective from Sonya terBorg, above about how great it is to be safe in a "nuclear free" New Zealand, given that 29 coal miners were recently killed in NZ's Pike River coal mine disaster, providing non nuclear fuel. So just how many people have been killed in Japan's nuclear industry?

For some people, fantasy will always triumph over reality.



113. [Barry Brook](#), on [14 March 2011 at 9:21 AM](#) said:

Bill Brown, hard to say at such energy levels, but it was telling that the critical damage was done by the tsunami, knocking out all of the backup generators and redundant generators in one fell swoop. The earthquake itself simply caused a SCRAM and doesn't seem to have damaged the reactors, which have some degree of seismic isolation. So an ocean-based incident may have made matters worse. But the time for such analysis will have to wait, too much speculation at this stage.



114. **Hawkmon**, on [14 March 2011 at 9:22 AM](#) said:

There is a huge difference Bazza, miners know the risks when they go down, while a full scale nuclear disaster will kill or injure innocent people kilometers away



115. **disdaniel**, on [14 March 2011 at 9:32 AM](#) said:

If the nuke plants are so bloody safe, then why is half the world on the edge of its seat, praying that nobody (else) dies as a result of “unplanned failures” at Fukushima?



116. **The Dread Pirate Neck Beard**, on [14 March 2011 at 9:44 AM](#) said:

Good, cogent analysis. Also, congrats on attracting the attention of the alex jones sorts, I guess.



117. **esquilax**, on [14 March 2011 at 9:53 AM](#) said:

“an ocean-based incident may have made matters worse. But the time for such analysis will have to wait”

.... because it's inconvenient to the “cause”?

It's clear that your followers Barry will offer excuses rather than the necessary realisation that the ultimate risk (economically too) can never be controlled.

World; the plane crashed! Followers; yeah, but the way it glided for hours is worth our admiration even before we know why that wing fell off!

Nuclear power is the Concorde or Shuttle of the power industry. Superficially viable, but ultimately a dead end.



118. **Barry Brook**, on [14 March 2011 at 9:53 AM](#) said:

Excellent FAQ by the NEI on the Japanese reactor situation at Fukushima:
http://www.nei.org/filefolder/Japanese_Nuclear_Situation_FAQs.pdf



119. **spark**, on [14 March 2011 at 9:54 AM](#) said:

I am still confused about the sea water injection. First of all, did they flood containment or only injected into the reactor vessel? Wouldn't flooding the containment have implications if a core meltdown can not be averted by injecting into the vessel (hydrogen/steam)? Also where exactly does the assertion that “core meltdown has been averted” made in the post stem from? Are we there yet?

Meanwhile, NHK reports that Tepco has informed the government radiation is again above legal limits at Daichi 1, but doesn't understand what is causing this .



120. **Ms Perps**, on [14 March 2011 at 9:55 AM](#) said:

disdaniel

“If the nuke plants are so bloody safe, then why is half the world on the edge of its seat, praying that nobody (else) dies as a result of “unplanned failures” at Fukushima?”

Why? because the media love to terrify the deliberately misinformed (by green groups) public by overstating any perceived problems with nuclear power. Most of the Australian press have been feeding hysterical misinformation to the general public BECAUSE IT

SELLS PAPERS AND BOOSTS RATINGS. Thank goodness for a rational explanation such as we have been supplied with on this blog. BTW who has died (from radiation – unfortunately someone has been killed by a crushing accident) as a result of the current situation at the power plants? Meanwhile thousands have been killed by the earthquake and tsunami and more in fires which have broken out in oil and gas plants. Let's get some rational perspective shall we!



121. **Ole Nordman**, on [14 March 2011 at 9:55 AM](#) said:

Dr. Oehmen complains about finding gross inaccuracies in press reports, some as many as an error in every paragraph. Oh my. But I found gross errors in Dr. Oehmen's article as well, including 1 in each of several paragraphs.

While Dr. Oehmen's article is generally accurate regarding general nuclear power physics, he is wrong, woefully ignorant and clearly way too optimistic and willing to believe atomic energy proponents (like Tepco).

Just for starters, he claims that dropping the control rods stops the entire fission process dead, except for the already-produced fission products, e.g. iodine and cesium. Maybe he should tell the uranium atoms in the fuel rods about his theories, since they are not likely to stop emitting neutrons which smash into other uranium atoms in the same fuel rod — without ever meeting the atoms of the control rod material.

Similarly, melting the fuel rod enclosure material, which Oehmen calls Zircaloy, does not merely let the water, steam and/or air (depending on the degree of lack of cooling) contact the fuel, but that liquified and perhaps vaporized Zircaloy gets loose as well. And if you think it is NOT radioactive after having spent the last 40 years in intimate proximity to fission, I've got a bridge in Brooklyn to sell you.

The situation is not nearly as dire as the extremists on the disaster end might imagine, but neither is it as safe and sanguine as Dr. Oehmen would have us believe. How many thousands of times have we heard "all is well" from politicians, experts and purported experts only to learn later that all was NOT well? Do you trust these people with vested interests in minimizing the damage and risk of this catastrophe? Of minimizing the risk of radioactive materials?

Remember Russian Alexander Litvinenko who was bumped off by some spy agency by a micro quantity of radioactive polonium? Do you think the minute quantities of radioactive materials that escaped and may escape in the future (even if just during the clean up process after a meltdown) are as completely safe as Dr. Oehmen claims? I don't claim to know, but when it comes to micrograms of some radioactive things able to kill you within weeks, I'd prefer to err on the safe side.

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



122. **DV82XL**, on [14 March 2011 at 9:57 AM](#) said:

"If the nuke plants are so bloody safe, then why is half the world on the edge of its seat, praying that nobody (else) dies as a result of "unplanned failures" at Fukushima?"

Because the media is churning this into a story when in fact there is really nothing there. There is much more damage in that country that is likely to impact more people than these reactors, but anything nuclear gets the fear factor higher than the possibly that an whole town has been swallowed up, which indeed might be the case.

123. **Fukushima summary: no danger | Eclipse Now**, on [14 March 2011 at 9:58 AM](#) said:

[...] via Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate. [...]



124. **Joffan**, on [14 March 2011 at 9:58 AM](#) said:

disdaniel, people's fears do not always correspond to reality. And while 4 people have been injured – last I heard – due to the various equipment failures and the explosion at Fukushima, the only fatality, of a crane operator, can reasonably be ascribed to the earthquake rather than the nuclear plant. Especially in the light of the huge numbers of casualties elsewhere which were also due to the earthquake, and will not be ascribed to inadequate building or poor road protection or failed moorings or a million other possible but faulty causes.



125.

Susanne, on [14 March 2011 at 10:00 AM](#) said:

Thank you for an excellent piece, Professor Brook. The news sources here in the States (CNN, ABC News, etc.) have been nothing short of frightening when reporting on this story, repeating the same video loop of the explosion over and over along with the dramatic music and blaring headlines. They've all but shouted "We're all gonna die!" to we the viewers and it really is quite upsetting. It is both refreshing and comforting to read something that takes a more level-headed, non-sensationalist, education slant to what is going on right now at these plants.



126.

Chris D, on [14 March 2011 at 10:13 AM](#) said:

The name 'Chernobyl' is sure getting a run in the world's media at the moment. It would be good to see a clear analysis of why these reactors have not catastrophically failed in a similar fashion.

Excellent blog and website Barry, and a great antidote to the rabid greens who both want to adhere to the science of AGW but at the same time distort the facts and science of nuclear power to suit their quasi-religious belief that one type of power is 'evil' while another 'good'.



127.

Sophie, on [14 March 2011 at 10:17 AM](#) said:

Very minor correction:

The factor is $10^{0.7} \sim 5$ instead of 7.

That is all.



128.

Ramon, on [14 March 2011 at 10:20 AM](#) said:

Hi,

Thanks for the great explanation. You said the plant is safe now and it will be safe, so, why I read a few minutes ago that the radiactivity is increasing again? So what happens if they do nothing now?

Thx.



129.

spark, on [14 March 2011 at 10:22 AM](#) said:

the media interest is in part because radioactive contamination is fucking creepy, but mainly because of the immense implications if those reactors really go belly up – lets pray they don't.

not sure what media you are watching though, here on german television we by far and large get "real" experts who have been working in the field, often for the government, but their assessments surely are a lot more worrying than the explanation presented here. still, attributing that to "feeding hysterical misinformation to the general public BECAUSE IT SELLS PAPERS AND BOOSTS RATINGS" seems a bit like stretch.



130.

disdaniel, on [14 March 2011 at 10:24 AM](#) said:

"Because the media is churning this into a story when in fact there is really nothing there"

"people's fears do not always correspond to reality"

Holy chit folks! There are at least two reactors (possibly a third) that are now destroyed beyond the point of salvage in a desperate attempt to prevent complete core meltdowns by flooding them with seawater.

Perhaps I'm just easily alarmed, but that seems newsworthy to me.

131.  **R. L. Citerley, P.E.**, on [14 March 2011 at 10:25 AM](#) said:
RE; R.Hails comment
I too examined the design of the containment building for Mark II and Mark III. Mark II is a little less sturdy than Mark III, but adequate for the design parameters set 40 years ago. Any engineering system needs to be upgraded as factual information becomes available. That is why we have Mark I, II and III. The present hysteria by the media does help our understanding of BWR systems, but only detracts.
132.  **David B. Benson**, on [14 March 2011 at 10:30 AM](#) said:
This is very good, but there is a correction required to the seismology bit. “As with the Richter scale, an increase of one step on this [moment magnitude] logarithmic scale corresponds to a $10^{1.5} \approx 32$ times increase in the amount of energy released, ...” from http://en.wikipedia.org/wiki/Moment_magnitude_scale so an increase from magnitude 8.2 to magnitude 8.9 is over 20 times as much strain energy released as the presumed design basis magnitude of 8.2.
However, this still does not give the accelerations at the reactors compared to the design basis, since the distance from the earthquake epicenter matters greatly.
133. [Top Posts — WordPress.com](#), on [14 March 2011 at 10:33 AM](#) said:
[...] Fukushima Nuclear Accident – a simple and accurate explanation Along with reliable sources such as the IAEA and WNN updates, there is an incredible amount of misinformation and [...] [...]
134.  **David B. Benson**, on [14 March 2011 at 10:37 AM](#) said:
Ole Nordman, on 14 March 2011 at 9:55 AM — Read about the neutron moderation requirement to sustain a chain reaction in uranium. Then you’ll understand that the main article is substantially correct.
135. [Why I am not worried about Japan’s nuclear reactors. | Morgsatlarge – blogorific.](#), on [14 March 2011 at 10:38 AM](#) said:
[...] Pingback: Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate [...]
136.  **TerjeP**, on [14 March 2011 at 10:47 AM](#) said:
Aussie economist, professor and blogger John Quiggin says he was thinking of supporting the idea of a nuclear Renaissance but following these events thinks nuclear should be off the agenda.
<http://johnquiggin.com/index.php/archives/2011/03/14/the-end-of-the-nuclear-renaissance/>
137.  **Finrod**, on [14 March 2011 at 10:53 AM](#) said:
Aussie economist, professor and blogger John Quiggin says he was thinking of supporting the idea of a nuclear Renaissance...
I find that a questionable claim.
138.  **So Cal Mike**, on [14 March 2011 at 10:54 AM](#) said:
Are you kidding me??
Brave New Climate??

Brainwashing knows no limits.

You clowns are probably comfortable using terms like “Climate Skeptic” and other Orwellian terms which is precisely what Huxley and Orwell warned us to be aware of.

139. [Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate « Netcrema – creme de la social news via digg + delicious + stumbleupon + reddit](#), on [14 March 2011 at 10:56 AM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimatebravenewclimate.com [...]

140. [Huge blast at Japan nuclear power plant - Page 3 - Christian Forums](#), on [14 March 2011 at 10:56 AM](#) said:

[...] [...]



141. **Shota Yamanaka**, on [14 March 2011 at 10:57 AM](#) said:

Thank you, this type of information is hard to be gotten in Japan. If you permit, I want to translate this article into Japanese and show it to my Japanese friends who are not good at English by the Internet.



142. **David B. Benson**, on [14 March 2011 at 11:14 AM](#) said:

Correcting a numerical error in my comment of 14 March 2011 at 10:30 AM, the increase in moment magnitude of 0.7 means 11.3 times as much energy was released as in the design basis. If the earthquake were actually moment magnitude 9.0 [as seems likely], then the increase in moment magnitude of 0.8 means 16 times as much energy.

Nonetheless, until the distance from epicenter is figured in, these calculations say little about the accelerations experienced by the nuclear power plants versus the design basis accelerations.



143. **Pradeep**, on [14 March 2011 at 11:16 AM](#) said:

Fantastic analysis. Learned alot. Thanks

144. [The Fairfacts Media Show » Blog Archive » Eco-fascists cash in on nuclear crisis](#), on [14 March 2011 at 11:30 AM](#) said:

[...] Indeed, in place of the media hyperbole, here is a detailed explanation of what is happening at the power plant. [...]



145. **Just the Facts**, on [14 March 2011 at 11:33 AM](#) said:

Opinions are one thing, but an expert on business supply chain management has no business whatsoever making irresponsible conclusive remarks such as “The plant is safe now and will stay safe.” It doesn’t matter who his relatives are.

“The main research interest of Dr. Josef Oehmen is risk management in the value chain, with a special focus on lean product development. Risk management allows companies to design and achieve the optimal risk-return balance in their portfolio of activities, successfully take entrepreneurial risks, increase their performance, and focus their attention on where it is needed most.”

http://lean.mit.edu/index.php?option=com_content&view=article&id=845&Itemid=816

146. [【原発問題】燃料棒の露出続く 福島第一原発3号機...燃料棒が損傷した可能性 | 2chまとめ速報-news](#), on [14 March 2011 at 11:33 AM](#) said:

[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]

147. [Japans Nuclear incident---not so bad. - Southern Maryland Community Forums](#), on [14 March 2011 at 11:35 AM](#) said:

[...] [...]



148. **curt mcgrath**, on [14 March 2011 at 11:36 AM](#) said:

I too had questions about the seawater angle – the article says they’re contaminating it somewhat so I guess that answers it.

149. [【原発問題】燃料棒の露出続く 福島第一原発3号機...燃料棒が損傷した可能性 | まとめ隊](#), on [14 March 2011 at 11:43 AM](#) said:

[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]



150. **Andrew Munro**, on [14 March 2011 at 11:54 AM](#) said:

Mr. Yamanaka,

When done could you send me your Japanese version to arm03@bigpond.com. I have friend who is panicking with all the rumours of the ‘rain’ to hit Tokyo. Cheers, Andrew



151. **James**, on [14 March 2011 at 12:02 PM](#) said:

This “feel good” post reminds me of the self-proclaimed petroleum expert who was putting out information during BP’s Gulf of Mexico rig disaster. He claimed it was only releasing a thin sheen of easily dispersible oil, and only in small quantity. We’ll know in a few days or weeks if this is yet more agenda-driven disinformation.

Let us revolt. The power industry is a huge, self-serving and entrenched model. Equivalent investment in point-of-use generation/energy efficiency/conservation solutions would substantially reduce the need for costly overbuilding of peaking capacity.



152. **Bill DeJager**, on [14 March 2011 at 12:03 PM](#) said:

“My question to those would be this: what would be a good enough design earthquake? Magnitude 10? 11? Nothing could be built economically if that is your criteria. That is pure wishful fantasy.”

Jeff in Iowa, that’s a straw man. No one here has suggested any such thing.

That said, the degree of earthquake and tsunami danger at the site may not have been adequately understood at the time that the first few units were designed and constructed. Nevertheless, the plant owner has had decades to study and reconsider these hazards in light of new geologic knowledge, and in response make appropriate adjustments to such things as emergency power supplies.

I stand by my previous post.

153. [jQ A330 on ground OOL - PPRuNe Forums](#), on [14 March 2011 at 12:15 PM](#) said:

[...] Brave if true. DFAT says Japan is OK but to defer non essential travel. QF says it's OK- and let's be honest, they've proven recently that they don't mind pulling the pin if they have doubts and given the recent loads they'd probably be thrilled to not have to fly a half full jumbo to/from Japan. There is no risk to anyone in Narita. The nuclear risk whilst real for those working at the power plants affected isn't really a big deal for the rest of Japan- unless you're a journo looking for a doomsday story. If you're after a more informed point of view, try here. [...]



154. **Nathanael**, on [14 March 2011 at 12:15 PM](#) said:

Barry, you’re wrong.

There will be a significant release of radioactive isotopes.

Cesium has already been detected outside the reactor, and radiation levels are going up again for unknown reasons; fuel rods from the storage pools may have been blown into the air and dumped randomly on site.

Reactor #3 is not effectively cooled even with the seawater being added. We'll see whether it explodes and whether the containment vessel works. Radioactive gases have to be vented repeatedly to prevent the containment vessel from failing due to excessive pressure, so either it blows up or stuff is dumped in the air nearby — the hope is that the gasses can be scrubbed before being vented, but who knows?

An informed public is essential to rejecting the chimera of nuclear fission steam engine plants in favor of renewables, which involve much less in the way of toxicity and are frankly cheaper per kilowatt-hour anyway.

155. 

Nathanael, on [14 March 2011 at 12:19 PM](#) said:

Barry, you're wrong.

There will be a significant release of radioactive isotopes.

Cesium has already been detected outside the reactor, and radiation levels are going up again for unknown reasons; fuel rods from the storage pools may have been blown into the air and dumped randomly on site.


Reactor #3 is not effectively cooled even with the seawater being added. We'll see whether it explodes and whether the containment vessel works. Radioactive gases have to be vented repeatedly to prevent the containment vessel from failing due to excessive pressure, so either it blows up or stuff is dumped in the air nearby — the hope is that the gasses can be scrubbed before being vented, but who knows?

All information from the IAEA.

An informed public is essential to rejecting the chimera of nuclear fission steam engine plants in favor of renewables, which involve much less in the way of toxicity and are frankly cheaper per kilowatt-hour anyway.

Of course I don't expect you to admit it, because this entire site is set up as a nuclear shilling site, complete with outright lies about the "limits" of solar power (hint: the limits of solar power are so large that they could supply the entire world's energy needs a million times over).

Jesus, this shilling is pathetic.

156. 

Steven, on [14 March 2011 at 12:25 PM](#) said:

Thanks fot the information.

I stopped watching news channels when they showed the Tsunami originating just above Fiji (obviously closer to the US).

I wish there was a short version. Then more people would read it.

Thanks again.

157. 

David B. Benson, on [14 March 2011 at 12:39 PM](#) said:

Nathanael, on 14 March 2011 at 12:19 PM — This thread has a highly specific purpose. Please stick to the topic here and take more general opinions or observations to Open Thread 9. Thank you.

158. 

Ricky, on [14 March 2011 at 12:43 PM](#) said:

Outstanding work, and highly reassuring.

It would be very helpful for lay readers like me if you might offer easily understood radiation exposure comparisons.

e.g – as a result of radionuclide emissions, persons within 1km of the reactor received exposure equivalent to a n hours airline flight at 35,000 ft.



159. **Tom Keen**, on [14 March 2011 at 12:52 PM](#) said:

fuel rods from the storage pools may have been blown into the air and dumped randomly on site.

Errr.....?



160. **Juanita Malley**, on [14 March 2011 at 12:56 PM](#) said:

thank you so much my grandson is in toyokyo and wants to stay



161. **Sidd**, on [14 March 2011 at 1:02 PM](#) said:

Dear god, they were hooking up fire pumps to the thing

“the Japanese have apparently tried used fire-fighting equipment”

<http://www.nytimes.com/2011/03/14/world/asia/japan-fukushima-nuclear-reactor.html>



162. **Jerry**, on [14 March 2011 at 1:15 PM](#) said:

Why were the back-up gen sets located in an area that could flood? Should they have not been located high up or in a sealed area? What did the think would happen after a big quake? A BIG wave perhaps? Sounds like a flaw to me!



163. **Barry Brook**, on [14 March 2011 at 1:16 PM](#) said:

I agree Jerry, although this is a beyond design basis accident, these backup units should have been better protected.



164. **Barry Brook**, on [14 March 2011 at 1:23 PM](#) said:

WNA: Yukio Edano says that water injection at Unit 3 is reported to be continuing, the indications are the containment vessel is still safe.

165. **Fukushima Nuclear Accident – a simple and accurate explanation | Digital Singularity's Blog**, on [14 March 2011 at 1:33 PM](#) said:

[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]

166. **links for 2011-03-13 « Marty Andrade**, on [14 March 2011 at 1:33 PM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate (tags: weekendreading tsunami japan Nukes nuclear science fukushima) [...]

167. **Japan - Old Hippiie's Forums**, on [14 March 2011 at 1:35 PM](#) said:

[...] [...]



168. **Jerry**, on [14 March 2011 at 1:43 PM](#) said:

Hi Barry. What does “design basis accident” mean? I think who ever designed the back-up systems should be held accountable for such a common sence mistake. (Bechtel, Parsons, B&R perhaps?) Nuke is the future and this just about killed it!



169. **Sean**, on [14 March 2011 at 1:51 PM](#) said:

Gather your thoughts before your fears

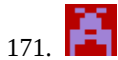


170. **quinn**, on [14 March 2011 at 2:01 PM](#) said:

'far right wing parties resort to when they try to tell you that all immigrants are lazy criminals.'

lol, this comment show the lack of intelligence on the part of the author. No one says that, that a straw man argument, so liberals have something to throw stones at.

I hope the rest of the analysis isnt such drivel, based in faulty logic....



171. **PQK**, on [14 March 2011 at 2:24 PM](#) said:

I'm in Japan and asked earlier if the analysis of the problems at Fukushima apply to just one reactor or to all the reactors at the facility. Perhaps, I missed the reply.

It would be extremely helpful to have a frank assessment of the risks of each individual reactor, if possible. I'm persuaded that the particular reactor in question is in no danger of exploding. I'm not all convinced that the threats from the other reactors have been explained clearly, at least here.

I appreciate the effort made here and remain pro-nuclear. Facts about the risks we face from other reactors are essential. Looking forward to an informed, well-supported update.

Cheers!



172. **David B. Benson**, on [14 March 2011 at 2:36 PM](#) said:

Jerry, on 14 March 2011 at 1:15 PM — A World Nuclear News report stated that the backup generators were protected against a 6.5 m tsunami, but that in the event it was at least 7 m of surge.



173. **bertgold**, on [14 March 2011 at 2:36 PM](#) said:

It is unclear to me why control room levels of radiation are so high. They are ~ 1000 mSv according to most reports. The US Air Force and Navy are now reporting radiation in an airstream in the Pacific Ocean near the accident. The NYTimes reports releases will continue for many months. Finally, I am a geneticist, not a physicist, and I am aware that many workers (~160 by most current counts) have been significantly exposed. My profession became expert at judging the effects of Radiation on people only after Hiroshima and Nagasaki. Jim Neel (James V. Neel), now deceased, whom I knew, went to Japan to assess the effects of radiation several times after the war and eventually wrote a report for the UN about it. That report did not make these kinds of situations appear very safe. The long term consequences of radiation exposure are not pretty. Herman Mueller got a Nobel Prize in great part because he noted that radiation shows zero-order kinetics in its ability to cause mutation. No dose is low enough so that it is completely safe.

I'm sorry the plugs didn't fit.



174. **andy**, on [14 March 2011 at 2:44 PM](#) said:

Good overview.

Some comments:

1. Metals which make up the primary loop piping, valves etc. can contain metals (such as Cobalt) which is often used as an alloy metal to control corrosion, and does have a more significant halflife than seconds (about 5 years). These particles can become entrained in a steam rupture etc, and pose a ingestion risk.

2. Iodine is often cited due to the fact it is a very abundant fission byproduct and that it is particularly nasty because the human body likes to use it in the thyroid. If there is a lot of radioactive Iodine floating around it and your body squirrels it away, that could be bad. That is why they hand out iodine tablets so you saturate your system with good iodine.

3. The most important take away is that just because one little bit of radiation makes it way out of the reactor, it is not necessarily dangerous. Scale must always be considered. For example, we all heard about the Tsunami heading for Los Angeles after this quake – when the scale of that Tsunami was realized (i.e. about one inch in height), it hardly warranted the name Tsunami. In this case particulate counts, and radiation monitoring need to be done to properly assess the magnitude of the situation. I believe, due to the fact that Nuclear Power and Nuclear Bomb share first names, there tends to be a much greater fear of Nuclear Power than is warranted, and as a result cleaner better ways of using and employing this technology are not chosen. I am not saying it is without risk, but the engineering risks are manageable – often more manageable than basic things, like the levees of New Orleans. For some reason as a society we decide to accept certain risk as ‘just the way things are’, and allow ourselves no tolerance for risks in other areas. Often these areas are where the consequence is not clearly understood due to the complexity of the science or an unwillingness for us to keep an open mind earns certain areas like Nuclear Power the ‘boogyman’ label. When someone says that ‘radiation has leaked’ or 22 Japanese have been contaminated, those statements have no meaning without scale. Once the official reports and studies come out, and the scale is understood, I am sure the big media rhetoric will die down with no apologies. The anti-nuclear zealots will claim that the reports were misleading and filled with lies. And nuclear power will receive another ‘false perception’ based black eye, and because of the aforementioned boogyman effect it will be hard pressed to redeem itself even if it is one of the most viable and greenest forms of energy currently widely available globally.



175. **CAPT Mike**, on [14 March 2011 at 2:45 PM](#) said:

Thanks Barry,
I qualified as a Navy Nuclear Engineer, and worked on secondary side maintenance for commercial nucs for several years.

Your article presents a pretty good layman summary of both the design and casualty situations for a BWR. While engineers can always fault you on some technical details, the thrust of your article is quite correct, in particular that the risk to people ought to remain low, Japanese society is typically opaque on issues that might embarrass, and that the utility will absorb a large loss on damaged equipment.

Best Regards,



176. **esquilax**, on [14 March 2011 at 2:56 PM](#) said:

“the backup generators were protected against a 6.5m tsunami”

...and the contingency for 7m appears to be;

177. [Quake Damage Before and After - American Police Beat Forums powered by OfficerResource | Law Enforcement Forums, Police Forums](#), on [14 March 2011 at 3:02 PM](#) said:

[...] [...]

178. [Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate : Popular Links : eConsultant](#), on [14 March 2011 at 3:06 PM](#) said:

[...] link: Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate 13 March 2011 | Uncategorized | Trackback | del.icio.us | Stumble it! | View Count : 0 Next [...]



179. **Alan**, on [14 March 2011 at 3:11 PM](#) said:

but the control rods are not fully inserted...



180. **ray**, on [14 March 2011 at 3:12 PM](#) said:

Thanks Brett, very informative

181. [Anonymous](#), on [14 March 2011 at 3:12 PM](#) said:

[...] [...]



182. [Heather Miller](#), on [14 March 2011 at 3:21 PM](#) said:

Looks like the author is lacking basic math skill too: An 8.9 earthquake is 5 times, not 7 times stronger than 8.2 on the logarithmic scale ...

183. [Japan before and after - Ford Mustang Forums : Corral.net Mustang Forum](#), on [14 March 2011 at 3:23 PM](#) said:

[...] [...]

184. [Earthquake Japan - Tsunami hits Japan and Pacific - Page 12 - Alien UFOs](#), on [14 March 2011 at 3:28 PM](#) said:

[...] [...]



185. [Ron](#), on [14 March 2011 at 3:29 PM](#) said:

Informative but clearly written by pro nuclear lobby – how is this guy supposed to make accurate claims about the situation when he is sitting in some office on the other side of the world???



186. [Chris Harries](#), on [14 March 2011 at 3:30 PM](#) said:

In a practical sense, it sorta doesn't matter what has precisely happened at Fukushima, the upshot is that this event is an unmitigated nightmare for the nuclear industry' – just as it appeared on the verge of a renaissance.

For nuclear devotees the aftermath will be a bitter pill to swallow, because unravelling what happened, and how close the nation came to disaster, will now preoccupy scientists and engineers for years to come.

The first 30 years of nuclear power took place in the aftermath of the WW11 bombings of Japanese cities and then the protracted cold war, when nuclear armaments kept the clock hovering around one minute to midnight.... and then the accidents at 3 Mile Island and Chernobyl locked in people's ingrained dread.

25 years of breathing space and the climate change agenda finally brought nuclear power back onto political and commercial agendas and the tide in public opinion had only just started to shift favourably towards nuclear power in the past 5 years. Now Fukushima is to become a household word.

Whether fear of nuclear power is justified or not, the industry is back to square one again. Well, almost. The majority of people out there aren't nuclear scientists, suspicion of the dangers of nuclear power stem from a history that was not imaginary, it was very real.



187. [Nervous](#), on [14 March 2011 at 3:30 PM](#) said:

To all the nuclear engineers: Why should anyone believe you? I know that sounds like a rhetorical question, but it isn't. One by one your assurances are shattered by events. So why should anyone believe you?

188. [Before You Give In To The Media's Nuclear Meltdown Stories... « PA Pundits – International](#), on [14 March 2011 at 3:32 PM](#) said:

[...] our friend Professor Barry Brook, comes this marvellously sane and cool explanation of the emergency at Japan's the Fukushima nuclear reactor by Dr Josef Oehmen, a research scientist [...]



189. [Nervous](#), on [14 March 2011 at 3:33 PM](#) said:

@bertgold, stop it. You are clearly an alarmist. Radiation is good for us, and scientists never lie. Haven't you gotten the message?



190. **anymouse**, on [14 March 2011 at 3:35 PM](#) said:

Please see this picture. (The exploded Fukushima-I-3 plant)

http://gigazine.jp/img/2011/03/14/fukushima_daiichi_3rd/Capture20110314-113641.jpg

(Original Article)

http://gigazine.net/news/20110314_fukushima_daiichi_3rd/

What this state is?



191. **spark**, on [14 March 2011 at 3:36 PM](#) said:

Some more comments/corrections on Josef Oehmen's piece:

<http://tinyurl.com/69bykgd>



192. **Tom Keen**, on [14 March 2011 at 3:44 PM](#) said:

@Heather Miller

While you are correct, i.e.

$(10^{**} 8.9) / (10^{**} 8.2) = 5.01187234$, there is no need to snipe at the author for a simple calculation error. This does not detract from the central argument in any way as far as I can see.



193. **Barry Brook**, on [14 March 2011 at 3:49 PM](#) said:

If we want to be pedantic, the earthquake is now rated 9.0, so between 7 and 5, let's split the difference.



194. **al-anon**, on [14 March 2011 at 3:52 PM](#) said:

I saw this blog and writeup referenced in several locations, so I thought I would check it out.

First, I see that you refer to the author as "a research scientist at MIT" and "a PhD Scientist", while somehow neglecting to mention that his expertise is in supply chain management and he has no relevant nuclear experience.



Second, the author states that the intent is to "give you some peace of mind regarding some of the troubles in Japan", which is, of course, quite a different intent than, say, providing a credible account of the situation.



Third, the author says "the situation is serious, but under control", which is, by now, manifestly false.

Fourth, the author contains the obligatory slam of journalists that is characteristic of pro-nuclear propagandists. You would actually know a lot more about what is going on if, for example, you had been reading Matthew Wald's articles in the New York Times.

Fifth, the author says, "there was and will *not* be any significant release of radioactivity", and clarifies that "[b]y 'significant' I mean a level of radiation of more than what you would receive on – say – a long distance flight, or drinking a glass of beer that comes from certain areas with high levels of natural background radiation." This too is manifestly false.

All this within the first couple of paragraphs. And this is the writeup I have seen widely touted by pro-nuclear propagandists. On the other hand, actual nuclear professionals who work with this stuff every day and, therefore, have some respect for the limitations of the technology, have been alarmed by the steadily deteriorating situation from the beginning.

195.  **Pablo**, on [14 March 2011 at 3:53 PM](#) said:
So articles like this of people passing through clouds of radiation are imaginary? Where would these clouds come from if there wasn't some kind of dangerous leak: http://www.nytimes.com/2011/03/14/world/asia/14plume.html?_r=3&src=tptw
196. [LINKS | OHIO GOZAIMASU](#), on [14 March 2011 at 3:53 PM](#) said:
[...] Explanation of Fukushima Nuclear Plant Explosion: <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]
197. [melting v meltdown - FlyerTalk Forums](#), on [14 March 2011 at 4:02 PM](#) said:
[...] Here is another explanation: <http://bravenewclimate.com/2011/03/1...e-explanation/> [...]
198.  **Ms Perps**, on [14 March 2011 at 4:08 PM](#) said:
These figures certainly put things in perspective don't they?

Energy Source Death Rate (deaths per TWh)
Coal – world average 161 (26% of world energy, 50% of electricity)
Coal – China 278
Coal – USA 15
Oil 36 (36% of world energy)
Natural Gas 4 (21% of world energy)
Biofuel/Biomass 12
Peat 12
Solar (rooftop) 0.44 (less than 0.1% of world energy)
Wind 0.15 (less than 1% of world energy)
Hydro 0.10 (europe death rate, 2.2% of world energy)
Hydro – world including Banqiao 1.4 (about 2500 TWh/yr and 171,000 Banqiao dead)
Nuclear 0.04 (5.9% of world energy)
199. [台灣派丫倫子 » 福島核電廠外建築物爆炸\(Fukushima Nuclear Accident\)](#), on [14 March 2011 at 4:08 PM](#) said:
[...] Fukushima Nuclear Accident – a simple and accurate explanation [...]
200.  **Claudiu**, on [14 March 2011 at 4:19 PM](#) said:
A Romanian version of this text is available here:
<http://www.parsec.ro/2011/03/ce-s-a-intamplat-la-fukushima/>
201. [Japan Hit By 8.9 Earthquake followed by sunami - Honda Civic Forum](#), on [14 March 2011 at 4:21 PM](#) said:
[...] Japan Hit By 8.9 Earthquake followed by sunami <http://bravenewclimate.com/2011/03/1...e-explanation/> GREAT read for anyone that wants to understand what's happening with the nuclear plants. It's [...]
202.  **esquilax**, on [14 March 2011 at 4:22 PM](#) said:

@ Ms Perps

Source? How are the Solar and Wind figures calculated?

Verging on the absurd isn't it?
203. [Nuclear Plant Updates | News for Tsukuba Residents](#), on [14 March 2011 at 4:28 PM](#) said:
[...] Consider forwarding it to your friends and family so they won't worry about you so much. (Here is another version of the same

article.) (Updated March 14, 2011 at [...])



204. **Robert Green**, on [14 March 2011 at 4:29 PM](#) said:

[deleted for violating commenting rules]



205. **Jokera**, on [14 March 2011 at 4:36 PM](#) said:

A simple and unrealistic explanation...

Anything can happen, there is already 2 explosions plus 2 more nuclear plants with problems, meanwhile radiation is being leaked to the atmosphere going to the air, earth and oceans...

This article could be good at explaining how nuclear plants work but nothing valuable regarding what can happen in accidents... because no one knows...



206. **bruce**, on [14 March 2011 at 4:39 PM](#) said:

Nathanael, what you wrote is incoherent compared to Barry's carefully detailed and informative piece. We certainly want an informed public, but what are we to make of statements like:

'There will be a significant release of radioactive isotopes.'

Our hospitals are full of radioactive isotopes. 'Significant'? Good grief the sentence is meaningless, like legal jargon, 'The party of the first part shall be known as the party of the first part'.

If you've got something to say, you need to learn how to express it.

BTW, you seem to be making a prediction, however ambiguously. So if you are wrong, will you recant?



207. **bruce**, on [14 March 2011 at 4:43 PM](#) said:

"On the other hand, actual nuclear professionals who work with this stuff every day and, therefore, have some respect for the limitations of the technology, have been alarmed by the steadily deteriorating situation from the beginning."

Rubbish. Completely contrary to the facts. actual nuclear professionals are at pains to explain that the situation is under control.

But for all you Henny Pennys:

"The sky is falling! The sky is falling!"

How do you even get through a day with such rabid paranoia? See a psychiatrist and get some treatment.



208. **Russell Langfield**, on [14 March 2011 at 4:43 PM](#) said:

I don't think any of you fools actually understood what you read. Go see my reading of it, in layman's terms here http://tasmaniantimes.com/index.php?weblog/article/japans-8.8-quake-6m-tsunami-waves/show_comments/



209. **Japan News (and "Lean" Misunderstood – Again) | theThinkShack**, on [14 March 2011 at 4:47 PM](#) said:

[...] Now...I read an interesting write-up by Dr Josef Oehmen, a research scientist at MIT, which details his take on the Fukushima nuclear reactor incident. [...]



210. **Jason**, on [14 March 2011 at 4:55 PM](#) said:

“Now, where does that leave us?
The plant is safe now and will stay safe.”

Interesting article but your conclusions have just been proven wrong as a second hydrogen explosion just killed 6 workers at the plant.
Interesting use of the word “safe”

211. [Why I am not worried about Japan's nuclear reactors. | Morgsatlargo – blogorific.](#) « 截图党, on [14 March 2011 at 4:56 PM](#) said:

[...] There exists a copy of this post on Barry Brooks excellent blog, where you can still use the discussion function: <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]

212. [福島第一・二原発事故 技術的考察スレ3 | 2chまとめ速報-社会](#), on [14 March 2011 at 5:04 PM](#) said:

[...] 掲載元 <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]



213. **Ms Perps**, on [14 March 2011 at 5:05 PM](#) said:

Robert Green

Do you understand the laws of libel?

Barry Brook receives no remuneration from anywhere or anyone associated with the nuclear industry. All of the work on this blog is done in his own free time, using his own money, because he cares and because it matters. You can easily check that out for yourself (and Barry has already answered this criticism elsewhere). His only motivation is to find an answer to the developing climate change catastrophe and thereby prevent species extinction and civilization breakdown. A rogue always accuses others of his own motives because his character cannot see that anyone else would act differently. I strongly suggest you apologise to Professor Brook immediately.



214. **Guy Armitage**, on [14 March 2011 at 5:09 PM](#) said:

Could you keep your pro/con nuclear power comments out of this post for now.

For all those in Japan (including myself), all we care about is our next move...and in order to be able to make it we need clear un-bias opinions.

You can argue about it all you want when the situation is under control again.



215. **Chris Harries**, on [14 March 2011 at 5:14 PM](#) said:

Death rates associated with various energy technologies do rate very positively for nuclear power, as reported by Ms Perps.

In fact, if risk of reactor accident was the only sword hanging over the industry's head then nuclear power could easily vie in popularity with other technologies (e.g. the motor car) that have an accident and death rate many hundreds of times higher.

The problem for the industry partly stems from the fact that the invisible nature of radiation tends to spook people (falling off a roof whilst installing solar panels is, by comparison, a very obvious and direct way to risk being maimed or killed).

Oddly there is an inordinate focus on the reactor safety issue, I guess because nuclear accidents are rather like planes falling out of the sky, in that they make for good dramatics. Per kilometre travelled, air travel is safer than car driving, bike riding or even walking, but the prospect of a plane crashing tends to spook people much more.

What sets the nuclear industry completely apart is that it has to contend with an array of other perceived high-level risks in parallel – that is, the historic connection between the nuclear fuel cycle and worldwide nuclear arms proliferation and the seemingly eternal problem of waste disposal. With all that other appeasement baggage to contend with the last thing the nuclear industry would want right now is a reactor meltdown, even if a partial one.



216. **Ms Perps**, on [14 March 2011 at 5:21 PM](#) said:

Esquilax (and others who are really interested) here is the source of the Energy Death Rates per KWhr

<http://nextbigfuture.com/2008/03/deaths-per-twh-for-all-energy-sources.html>



217. **Jack Nichols**, on [14 March 2011 at 5:26 PM](#) said:

Thanks for the article, it has cleared up how the system works, and the redundant backup systems. I am still going to keep a close eye on the information coming out. Your assessment is too clean, it is based on probabilities. No one has actually seen the entire damage yet. If I have learned anything in this life its "if something can go wrong it probably will". It is not over yet, until it is I will remain vigilant. respectfully jack



218. **Ms Perps**, on [14 March 2011 at 5:28 PM](#) said:

The figures from the report I have linked to "Energy Death Rates per KWhr" are gathered from reputable sources such as WHO and have been published throughout the literature. Attribution is given in the article. As I said Esquilax – it puts your unsubstantiated hysterical rants into perspective.



219. **Finrod**, on [14 March 2011 at 5:33 PM](#) said:

@ Chris Harries:

Comment 32 in the following thread explores the parallels with the aviation industry.

<http://depletedcranium.com/this-is-our-generations-three-mile-island-lets-not-screw-it-up/>



220. **esquilax**, on [14 March 2011 at 5:36 PM](#) said:

@ Ms Perps

File that one under sample bias and Fun-With-Stats-and-Dick-and-Jane.

To everyone else, the comments are HILARIOUS and worth a look. The author smacks of desperation for his headline; "Rooftop Solar More Dangerous Than Chernobyl"



221. **Ms Perps**, on [14 March 2011 at 5:40 PM](#) said:

Jason

You say:

"Interesting article but your conclusions have just been proven wrong as a second hydrogen explosion just killed 6 workers at the plant."

What is the source of your information? This is what the authorities say:

"Operator Tokyo Electric Power Co. confirmed that the 11:01 a.m. blast did not damage the container of the No. 3 reactor, allaying concerns that the explosion may have caused a massive release of radioactive substance.

TEPCO said three workers, including its employees, were injured by the blast. All of them suffered bruises.

<http://english.kyodonews.jp/news/2011/03/77627.htm>

222. [about the fukushima nuclear accident « sungazer](#), on [14 March 2011 at 5:41 PM](#) said:

[...] this helpful link on Twitter (with an update here). It's a long read, and includes an explanation of how [...]



223. **Preston Pannell**, on [14 March 2011 at 5:41 PM](#) said:

Great article, rather irritated at the people who didn't appreciate the innuendos about Iran or the Soviet. I am a nuclear operator for the Navy and find that people ignorance with Nuclear Power is rather astounding. You have summarized this "tragic nuclear accident" rather poetically. Thank you



224. **Ms Perps**, on [14 March 2011 at 5:51 PM](#) said:

Esquilax – stats with Dick and Jane – I don't think so. They come from a highly regarded report done for the EU. The summary:

"The risk comparisons are based on the results of the ExternE project (Ref. 1), which was financed by the EU Commission and carried out by research organisations in most EU states and in Norway. ExternE is one of the most extensive and scientifically most soundly based investigations within the field."

Here is the full scientific paper:

http://manhaz.cyf.gov.pl/manhaz/strona_konferencja_EAE-2001/15%20-%20Polenp~1.pdf



225. **esquilax**, on [14 March 2011 at 5:53 PM](#) said:

@ Finrod (@ DV82XL indirectly)

RE: Parallels with the aviation industry.

Concorde and the Shuttle are the comparisons. Built once, refined a little but ultimately flawed for what was perceived to be an acceptable risk. To reduce the risk further, the costs were enormous.

Nuclear power is now facing the same Waterloo on top of it's already woeful economics.



226. **Mitch in Toronto**, on [14 March 2011 at 5:58 PM](#) said:

In discussing intermediate radio-active elements the author states "The challenge is that after inserting the rods and stopping the chain reaction, the core still keeps producing heat. "The uranium "stopped" the chain reaction."

This is last sentence is less than optimally placed. It reads as though (the) uranium moderated itself. Assuredly not the case. Perhaps it should read "neutron-inspired uranium-decay ceased."

227. [Earthquake - AbuDhabist.com アブダビストコム](#), on [14 March 2011 at 5:59 PM](#) said:

[...] To know More about Nuclear Plant in Fukushima [...]



228. **Finrod**, on [14 March 2011 at 6:01 PM](#) said:

@ Esquilax:

Can you provide a reasoned supporting comment for your bare assertions?



229. [Second Explosion At Fukushima « An Internet Vagabond](#), on [14 March 2011 at 6:03 PM](#) said:

[...] For all those who want to know about Nuclear power plants and what happened at Fukushima, this article provides answers in a simple plain jargon free way. Amplify'd from bravenewclimate.com [...]



230. **esquilax**, on [14 March 2011 at 6:05 PM](#) said:

@ Ms Perps

No, they're correlating essentially construction deaths (questionable anyway) of solar PV installation before a TWh is produced.

Where is the number of construction deaths before any of the NPPs produced an electron?

On the mater of fossil fuels, obviously pollution there is causation. I have no problem with that.



231. **Ms Perps**, on [14 March 2011 at 6:10 PM](#) said:

Anyway – I agree with Finrod or was it DV8 -enough feeding of trolls like esquilax – this thread is being derailed and is not about pro or anti nuclear arguments but rather to give honest, up-front information to those people concerned about the situation in Japan often because they are worried about friends and relatives there. Let us return to that subject.



232. **esquilax**, on [14 March 2011 at 6:17 PM](#) said:

@ Ms Perps

You love your self congratulatory eco-chamber, I understand.

Let me distil the mood here; “the Japanese Nuclear Power industry is a TRIUMPH! It didn't fall over, yet, hopefully....oh, ooopps”.

The future reports will make very interesting and damning reading I am absolutely sure of it.

In the meantime, I hope everyone stays safe, including the unfortunate workers making it up on the spot.

233. [“Fukushima Nuclear Accident – a simple and accurate explanation” and related posts | The news blog](#), on [14 March 2011 at 6:24 PM](#) said:

[...] post by Top Stories – Google Blog Search and software by Elliott Back This entry was posted in Uncategorized. Bookmark the permalink. [...]



234. **my junks**, on [14 March 2011 at 6:34 PM](#) said:

Excellent summary, but I believe a couple of things could stand to be cleared up.

First, the term “meltdown” is thrown around the media pretty loosely but is not actually defined here, in the media, or in the nuclear industry. This presents a problem, so let's define “meltdown.”

In the past, before agenda-driven obfuscation became the norm in the media, a “meltdown” was understood to be when the uranium oxide fuel reached 3000 degrees and the separate pellets melted to form a single mass at the bottom of the reactor vessel. This mass would feed on itself to continue creating more heat, making it virtually uncontrollable. The popular theory went that this molten mass of fissionable material would melt its way through any material it came in contact with, including steel and/or concrete tertiary containment systems. This meant the mass could be neither controlled nor contained. Scary stuff indeed. The popular belief was that this mass of nuclear fuel would melt its way into the earth and melt a hole to China, hence the term “China Syndrome.” That's where that sappy Hanoi Jane movie got its title.

In any case, by this definition, melting at 2200 degrees of the Zircaloy tubes which contain the fuel pellets is not a “meltdown.” It's a very serious problem, and a hideously expensive one for the plant owner/operator, but it is not a meltdown.

This is an important distinction because of one technical point that was left out of this discussion. In the Three Mile Island (TMI)

accident, the direct cause of damage to the reactor was some of the Zircaloy fuel tubes melting, allowing the fuel pellets to drop to the bottom of the reactor vessel. On the face of it this would seem to be a precursor to a meltdown. But it wasn't.

It's important to understand that the fuel is uranium oxide, a ceramic, not uranium-235, a metal. Compared to metals, ceramics transfer heat very very poorly (that's why they use ceramic tiles on the outside of the space shuttle), and have a very high Young's modulus (i.e., let's just say they are very brittle). The result is that they easily crack and break apart when subject to uneven heating or cooling.

Most people have seen what happens when one pours a hot liquid over ice in a glass container (for example, making iced tea) – the glass cracks. This is precisely what the fuel pellets at TMI did – they broke apart when they hit the relatively cool water, or steam, or melted Zircaloy, or whatever “coolant” was present and significantly cooler than the uranium oxide. When the fuel pellets break apart, they reduce their criticality and increase their surface area, which improves cooling. The result is that a meltdown becomes very difficult, if not a practical impossibility, to achieve.

I used to work in the nuke industry. I worked with people who worked on the TMI cleanup. They showed me photos taken of the TV screens connected to their robotic cameras. One could see the remains of broken pellets sitting in a solidified mass of Zircaloy. They were surprised but relieved to see what had happened to the pellets. To them it meant that a meltdown would be very difficult to create. To me it means you would really have to work at creating a meltdown. I'm skeptical that a meltdown is even possible, but I could be wrong.

Of course, if you have an agenda, you could call melted fuel tubes a “meltdown” but molten metal is pretty easy to contain and isn't fissionable, meaning it can't feed on itself to create even more heat to create the imagined “China Syndrome”.

FYI: The TMI reactor was a pressurized water reactor (PWR), not a BWR like the Fukushima plant, but the PWR and BWR aren't all that different in operating concept. The Chernobyl-type plant was a whole different animal, nothing at all like either TMI or Fukushima. Those comparisons are simply idiotic.

I worked with a guy from Kiev before Chernobyl blew up. He used to tell me how dangerous Russian nukes were. After Chernobyl blew up I wondered if that was what he was talking about. I had lost track of him and couldn't ask.



235. **Catch**, on [14 March 2011 at 7:01 PM](#) said:

Thank you SO much. With misinformed rumors and over-dramatized reports flowing over local communications, your report not only gives us foreign residents here in Japan an understanding of the situation, it also gives us peace of mind.

With the continuing aftershocks and casualty discoveries, this is definitely a Godsend.



236. **tripledecimal**, on [14 March 2011 at 7:13 PM](#) said:

Good summary of what has happened. However, after a series of things going wrong, the conclusion “nothing can happen anymore” is naive. As with any nuclear catastrophe there is a whole chain of stuff going wrong at once, going through multiple layers of “depth of defense”. How e.g. can you be sure the core didn't get crack through the earthquake? Yes if nothing goes wrong anymore, the effects will result in only a few radioactive contained ruins, but that's no reason not to be careful and observant.



237. **dian**, on [14 March 2011 at 7:15 PM](#) said:

News are also circulating in the Philippines that radiation will most likely hit the country, mostly caused by Japan winds being blown off to it. Any news about that? The people are somewhat scared and we are all hoping and crossing our fingers that this really is just a hoax.

<http://randomthoughtsinabox.blogspot.com/2011/03/fukushima-nuclear-power-plant.html>



238. **tripledecimal**, on [14 March 2011 at 7:23 PM](#) said:

I ment, who can be sure the core *catcher* hasn't been cracket? Lets all hope it was the end of chain of events, but no reason to be deterministic about it.

239. [Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate « Bitácora de mí](#), on [14 March 2011 at 7:23 PM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation « BraveNewClimate. LikeBe the first to like this post. [...]



240. [Barry Brook](#), on [14 March 2011 at 7:24 PM](#) said:

dian, it is a (stupid and malicious) hoax. Look it up on Twitter.



241. [PQQ](#), on [14 March 2011 at 7:29 PM](#) said:

I'm still hoping for a detailed reply to my question about whether the very welcome post here applies to all the reactors at the facility. I have some very bad news, I'm afraid, for the fear-mongers who are trying to transform this crisis into a soap-box for their anti-nuclear hysterics. Kyodo is reporting that the state of emergency has been lifted for reactors 1 and 2 and that efforts are ongoing to keep the heat levels low at the remaining reactors. It appears that human error, a massive tsunami, and the most powerful earthquake in modern Japanese history combined could not damage a 40 year-old nuclear power plant built in one of the most unstable seismic regions on the planet. If that sounds like proof positive the technology is unsafe, you're living on a different planet. We live about 200 kilometers from Sendai and understand that the situation is fluid.



242. [Azrudi](#), on [14 March 2011 at 7:37 PM](#) said:

Jason; the 2nd explosion at Fukushima Unit 3 was planned. They didn't know exactly when it will happen, but the Japanese Government thru Mr Edano, Chief Cabinet Secretary has already announced this explosion yesterday to win public confidence. This is just a hydrogen detonation, an announcement was made yesterday so that the public does not speculate along the lines of that it could be a nuclear chain reaction explosion.

They announced that the explosion will happen today. But they didn't know exactly when.



243. [gsg](#), on [14 March 2011 at 7:37 PM](#) said:

so long !
where is the summary

the first picture "Boiling Water Reactor Design"
says:
Secondary containment : area of explosion
Primary containment : remains intact and safe

that enumeration differs from what he defines below

The Zircaloy casing is the first containment.
The pressure vessels is the second containment
The third containment is a hermetically (air tight) sealed, very thick bubble of the strongest steel.
This third containment is then surrounded by the reactor building.

, a large and thick concrete basin is cast under the pressure vessel , which is filled with graphite, all inside the third containment.

The reactor building is an outer shell that is supposed to keep the weather out, but nothing in. (this is the part that was damaged in the explosion, but more to that later).

how much do each of these parts weigh, how big are they, are the proportions correct ?

> the difference between the 8.2 that the plants were built for and
> the 8.9 that happened is 7 times, not 0.7). So the first hooray for

> Japanese engineering, everything held up.

but the 8.9 (now 9.0) did happen in 120km distance and 16 km beneath the sea-level
So, what happens when an 8.2 happens directly at the plants ? Still hooray ?

> The tsunami took out all multiple sets of backup Diesel generators.

would it have been so difficult/expensive to make them Tsunami-proof ?
Just put them underground

> So mobile diesel generators were trucked in.
> the plugs did not fit

ahh. Please say they were destroyed by the earthquake or such.
Not just an oversight !!?

> Because cooling the core is such a big deal, the reactor has a number of cooling systems,
> each in multiple versions

good.

> Which one failed when or did not fail is not clear at this point in time.

no problem, we have multiple versions.

> The temperature at this stage was about 550°C.
> This is when the reports about “radiation leakage” starting coming in.

> At some stage during this venting, the explosion occurred. The explosion took place
> outside of the third containment (our “last line of defense”), and the reactor building.

outside the reactor building ? Where then did it occur ?

> And it did explode, outside the third containment, damaging the reactor building around

OK, so apparently that was a typo above. Replace “and” by “in”

> The operators decided to vent the steam from the pressure vessel not directly
> into the environment, but into the space between the third containment and
> the reactor building (to give the radioactivity in the steam more time to subside).

maybe to filter it by these hepafilters, which I had read elsewhere ?

> The core is covered by several meters of water in order to allow for some time
> to pass (hours, days) before it gets exposed. Once the rods start to be exposed
> at the top, the exposed parts will reach the critical temperature of 2200 °C after
> about 45 minutes. This is when the first containment, the Zircaloy tube, would fail.

and that water level, is it known ? Is it being measured ? Did Tepco know about the
actual situation all along but didn't tell us (nor their injured workers) ?

> uranium, was still under control, because the uranium oxide rods were good until 3000 °C.
> ... very small amount of Cesium and Iodine escaped

> The water used in the cooling system is very clean, demineralized (like distilled) water.

> In order to prevent a core meltdown, the operators started to use sea water to cool the core.
> I am not quite sure if they flooded our pressure cooker with it (the second containment),
> or if they flooded the third containment, immersing the pressure cooker

> The plant came close to a core meltdown. Here is the worst-case scenario that
> was avoided: If the seawater could not have been used for treatment, the operators

...or, as was reported now (AFAIU) the whole plan had failed due to some leak ...

- > would have continued to vent the water steam to avoid pressure buildup. The third
- > containment would then have been completely sealed to allow the core meltdown
- > to happen without releasing radioactive material.

... and most importantly : without informing the public ...

- > After the meltdown, there would have been a waiting period for the intermediate radioactive
- > materials to decay inside the reactor, and all radioactive particles to settle on a surface
- > inside the containment. The cooling system would have been

...hopefully...

- > restored eventually, and the molten core cooled to a manageable temperature.
- > The containment would have been cleaned up on the inside. Then a messy job of
- > removing the molten core from the containment would have begun, packing the
- > (now solid again) fuel bit by bit into transportation containers to be shipped to
- > processing plants. Depending on the damage, the block of the plant would then
- > either be repaired or dismantled.

OK. So how much damage would (did?) that cause Tepco ? Does it compare to the scenario that the newspapers drew (due to lack of information like this)

- > Now, where does that leave us?
- > The plant is safe now and will stay safe.

...

but now we have problems with #3 which is another type and the cooling of #2 is reported to have failed too and possible problems in other plants too and aftershocks and injured workers, so we don't know whether there are still people left to do the job.

- > If you want to stay informed, please forget the usual media outlets and consult the following websites:

<http://www.world-nuclear-news.org/RS...1203111.html>

<http://bravenewclimate.com/2011/03/1...ar-earthquake/>

<http://ansnuclearcafe.org/2011/03/11...ions-in-japan/>

- > 233 Responses

I'm not going to read all these



244.

Edmond, on [14 March 2011 at 7:54 PM](#) said:

Thanks for putting this up..

I am in Japan at the moment and can't believe how the world media is sensationalizing this. Sure it is a serious problem, but nuclear physics is not something to be sensationalized.

I think people need to take a chill pill about the nuclear plants and think about the tens of thousands of people who are dead from the tsunami. The Japanese authorities are literally finding beaches with hundreds of bodies and people are worried about 3 people having mild radiation exposure.



245.

Ensiformis, on [14 March 2011 at 7:57 PM](#) said:

thanks,u information is very important. And useful for me. Because in indonesia will develop nuclear power.



246.

thevidwriter, on [14 March 2011 at 8:30 PM](#) said:

This is probably the most helpful information so far. Thank you for providing us with a proper insight.

247. 

[Andrew Jones](#), on [14 March 2011 at 8:31 PM](#) said:

Many thanks for the informative article.

I find it a really well thought out article at attempting to explain how nuclear reactors function.

Unfortunately I have the same questions as many other people here and I frankly find it very unsettling that despite going to such pains to write an easy to understand article in the attempt to set the record straight – you and many of the commentators (who purport to have some sort of qualification when it comes to nuclear energy) seem unable or unwilling to answer some basic questions regarding radiation leakage.

FACTS:

It has been reported that some 200 people are now being treated for radiation poisoning.

Low level radiation has been detected some 60 miles down the coast from Fukushima.

The US have withdrawn their fleet from the Fukushima area after detecting low level radiation.

For all these reports surely if the radiation only lasted for a few seconds then no-one would be suffering poisoning and radiation (even low level) would not be detected up to 60 miles away from the plant.

Finally – and this is a big one – I can't wait for someone to answer this one -

Why bother attempting to salvage the reactors if even a complete meltdown is completely safe and poses no risk to anyone ever? One of them was due to be shutdown forever anyway? Why bother attempting to cool it?

Reports are that now that they are using sea water to cool them – they are effectively useless and will be unable to be used again. So why bother?

Someone is not telling the full truth somewhere – if the reactors really were completely safe – just just the plant and walk away – as it is there have been numerous casualties now at the plant which going on your advice is a pointless exercise if there is no risk anyway.

248. 

[JL](#), on [14 March 2011 at 8:43 PM](#) said:

Nuclear power is like communism. In both cases the outcome is dependent on the quality of the people running it. And who IS running it? That is the question.






249. 

[meandjustmyself](#), on [14 March 2011 at 8:45 PM](#) said:

Sorry, but somebody complaining that much about misinformation and factual errors should care about facts a bit more himself:

1. The residual heat is not 3% but 7% (source: Tepco whom I trust to NOT try to create excessive panic)
2. The reactor does NOT have a core catcher. While core catchers are the latest and greatest in reactor safety AFAIK as of today there is NO operational reactor in the western world (Russia may have some) that does have a core catcher.
3. In case of a core meltdown, regular moderation is NOT guaranteed because the melting behavior of fuel and moderation rods is undefined.
4. In case of a core meltdown, the boron water doesn't help because it won't reach the molten core.
5. Injecting sea water does increase the chances of hydrogen buildup in the pressure vessel because sea water is more susceptible to splitup
6. They are injecting sea water into the core, not just flooding the containment (Source: Tepco).
7. People have: reportedly (source Japanese Gov.) been exposed to significant radiation levels as of your above definition, making your whole point moot.
8. Do you seriously believe they are evacuating more than 200,000 people just for the fun of it given the circumstances??? Face it: this evacuation will actually kill people, if not for the circumstances of the evacuation itself then for binding resources that would be desperately needed somewhere else.

No, as knowledgeable as this blog post sounds, it's deeply naive and in some crucial aspects just plain wrong.

250.  **REPOST: Why I Am Not Worried about Japan's Nuclear Reactors | Philosoposer's Lounge**, on [14 March 2011 at 8:46 PM](#) said:
[...] There exists a copy of this post on Barry Brooks excellent blog, where you can still use the discussion function: <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]
251.  **Barry Brook**, on [14 March 2011 at 8:47 PM](#) said:
Japanese translation of "Fukushima Nuclear Accident – a simple and accurate explanation" now available here: http://bravenewclimate.files.wordpress.com/2011/03/fukushim_explained_japanese_translation.pdf
Thanks to Shoto Yamanaka (Twitter @shotayam)
252.  **trippledecimal**, on [14 March 2011 at 8:48 PM](#) said:
Andrew Jones, what he said, there are multiple layers to hinder nuclear and toxic material to get into the environment. Some have failed, some are critical and another one (the core catcher) is still in place.
However the conclusion "it is 100% safe" is wrong. We can't be 100% certain the other layer will also fail out of this or that unforeseen event. And it is not futile to work on inner layers, as long they didn't fail completely. Also there is a difference in how big (and expensive) the radioactive ruin is going to be.
Contrary to this author a true expert will tell you there are different scenarios that can happen (where this one is merely the optimal case from this moment on.)
About the news of radiation poisoning I wonder as well. Fact is, news are contradictive and filtered. Nobody except the Japanese government and the company operating the plant do not know what is really, really, happening. And even those cannot look into the reactor cores.
253.  **Peter Simpson. (simmo)**, on [14 March 2011 at 8:49 PM](#) said:
I can not believe the television stations here in Australia, they have been sensationalising the reactor and explosion to the extent it is beyond belief.
Prime television which has national coverage here in Oz, announced this afternoon that there was a second explosion and in the same sentence said that 2,000 bodies were found on the beach, insinuating the explosion was the cause of these deaths, the disaster is bad enough and the suffering of the Japanese people, let alone all this rubbish being released by the media here in Oz my heart goes out to the people of Japan.
Simmo..
254. **【原発問題】福島第一原発3号機で爆発★2 | 2chまとめ速報-news**, on [14 March 2011 at 8:53 PM](#) said:
[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]
255. **【原発問題】福島第一原発3号機で爆発★2 | まとめ隊**, on [14 March 2011 at 8:54 PM](#) said:
[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]
256. **=== popurls.com === popular today**, on [14 March 2011 at 8:58 PM](#) said:
[...] ##### AT&T will cap DSL and U-Verse internet, impose overage fees ##### Fukushima Nuclear Accident a simple and accurate explanation ##### Lady Gaga Creates Prayer Bracelet to Benefit Disaster Relief in Japan ##### [...]
257.  **honeybose**, on [14 March 2011 at 9:13 PM](#) said:

Thank you very much for detail explanation. Please let me ask a couple of questions, and I would be thanking you very much if you would give a lecture.

I am familiar with neither nuclear technology nor quantum physiology. I wonder nuclear fission might be going on more or less, due to partly malfunction of control rods: which worked as they should at the first impact (ground shake), but during the Tsunami or second/third thrust, some of them may fall down (Japanese BWR designed to insert the rods from the bottom, not along gravity...my understanding). I would be very happy if you tell me your professional opinion on this possibility.

Second one, pure-water first, and now sea-water is pumped into the reactors (the reports do not tell which compartments, though) for long time: while the ECCS are designed to use a limited amount of reserved pure-water. Given the amounts of uranium/plutonium there and how long the fuel has been burned, it would be not difficult to calculate the expecting heat generation during shut-off. The amounts of water/sea-water putted in are then comparable what they should be ?



258. **Lorenzo**, on [14 March 2011 at 9:16 PM](#) said:

I found this post very informative, however biased...

There will still remain some misunderstanding between people considering a release of Cesium and radioactive Iodine as a success, and those seeing the failure and the lies.

You say "science", I see inconsistency.

Don't try to change people's vision, change what they see, act better!



259. **Gimp Hag**, on [14 March 2011 at 9:17 PM](#) said:

[deleted for violating commenting rules]

260. [Fukushima Nuclear Accident—An Accurate Explanation « The Man With Many Chins](#), on [14 March 2011 at 9:17 PM](#) said:

[...] 14, 2011 by The Man With Many Chins Below is an unashamedly cribbed article from [...]



261. **Eric Moore**, on [14 March 2011 at 9:19 PM](#) said:

I understand that the media is playing the sensationalist game, however it must also be pointed out that the nuclear industry is so important not only to Japan, but many other countries that all efforts would be made to cover up and downplay this disaster (like tobacco health effects cover-ups of the past). The world markets are so important that any indications of a complete disaster might signal the collapse of Japanese economy would collapse. Other countries would also have problems selling nuclear to their people so they are probably also wheeling out experts with vested interests to take part in TV interviews. Therefore although I hope that you are right but I tend to be as cautious about information coming out of people who have an interest in the nuclear power industry as I am about the media.



262. **Ergoshima**, on [14 March 2011 at 9:27 PM](#) said:

Why bother attempting to salvage the reactors if even a complete meltdown is completely safe and poses no risk to anyone ever? One of them was due to be shutdown forever anyway? Why bother attempting to cool it?

Because if a meltdown happens, Chernobyl 2 happens. They're not attempting to salvage it at all. Using seawater to cool the reactor spells the death knell for the reactor since the corrosion on the equipment will make the whole thing unuseable. It's not salvage, it's a desperate attempt to prevent a catastrophic explosion.

The US have withdrawn their fleet from the Fukushima area after detecting low level radiation.

—After detecting radiation 100 miles offshore! I'd call that a significant release of radiation.

They never tell the full truth in these matters. There's the wider issue of chaos and panic to consider in an already disaster zone. There

simply isn't the infrastructure to cope with every Japanese individual trying to escape a possible nuclear blast, whether or not they're at safe distance. So you never admit impending doom.



263. [krissi jones](#), on [14 March 2011 at 9:34 PM](#) said:

I pray for all of you, and i pray nothing else happens...
..god bless every one of you....your friend krissi



264. [Andrew Jones](#), on [14 March 2011 at 9:40 PM](#) said:

Thank you to those who have answered my questions – here are some more.

Why does the author (and some commentors) claim the half life of Iodine and Cesium to be so short that it will cause no problems to anyone – and yet the US EPA says that Cesium has a half life of 30 years and Iodine a half life of 8 days (but roughly 100 if it gets into the body)

Google “Cesium EPA”

Both of these timescales seem to be considerably more than “a few seconds” to me?



265. [DV82XL](#), on [14 March 2011 at 9:44 PM](#) said:

“They never tell the full truth in these matters. There’s the wider issue of chaos and panic to consider in an already disaster zone. There simply isn’t the infrastructure to cope with every Japanese individual trying to escape a possible nuclear blast, whether or not they’re at safe distance. So you never admit impending doom.”

If the facts don't fit your belief that something very bad is happening, it must be a cover-up.

Oh Eric Moore, tobacco health issues were well known and no one covered them up. The tobacco companies tried to claim they did not know about it, Please get your history straight.

266. [Best information sources...](#), on [14 March 2011 at 9:45 PM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation BraveNewClimate Useful information about the nuclear plant.
_____ Quote: [...]



267. [PQK](#), on [14 March 2011 at 9:47 PM](#) said:

Kyodo is now reporting that the fuel rods at the number 2 reactor are fully exposed. It is hard to see this development as good news.

268. [Fukushima Nuclear Accident – a simple and accurate explanation \(via BraveNewClimate\) | Top world news online](#), on [14 March 2011 at 9:49 PM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation (via BraveNewClimate) Japanese Translation here (thanks to Shota Yamanaka) New 14 March: Updates and additional Q&A information here and Technical details here _____ Along with reliable sources such as the IAEA and WNN updates, there is an incredible amount of misinformation and hyperbole flying around the internet and media right now about the Fukushima nuclear reactor situation. In the BNC post Discussion Thread – Japanese nuclear reactors and the ... Read More [...]



269. [Ergoshima](#), on [14 March 2011 at 9:49 PM](#) said:

Why does the author (and some commentors) claim the half life of Iodine and Cesium to be so short that it will cause no problems to anyone – and yet the US EPA says that Cesium has a half life of 30 years and Iodine a half life of 8 days (but roughly 100 if it gets into the body)

-Because some people will invariably talk out of their arse. But you're correction, the half-life is 30 years.

270. [8.8 quake - Tsunami - Sendai - Page 32](#), on [14 March 2011 at 9:49 PM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation BraveNewClimate This article may calm your concerns. Puma has been posting on Doug's fb that all of this is being put way out of proportion. He may be an asshole, but he does have an engineering background. _____ Quote: [...]



271. **Ergoshima**, on [14 March 2011 at 9:50 PM](#) said:

If the facts don't fit your belief that something very bad is happening, it must be a cover-up.

If you want to cause a giant panic in an already stricken country, then be my guest. But the result would not be pretty at all. And more people would die.



272. **Brian**, on [14 March 2011 at 10:07 PM](#) said:

[deleted: violates BNC commenting rules (no *ad hominem* attacks)]



273. **chris**, on [14 March 2011 at 10:20 PM](#) said:

I've heard that no graphite is used in the Fukushima nuclear plant... many sites state this... for example http://online.wsj.com/article/SB10001424052748704893604576198421680697248.html?mod=googlenews_wsj

or reuters etc...

274. [Atomkraft nein danke?](#), on [14 March 2011 at 10:21 PM](#) said:

[...] [...]



275. **Barry Brook**, on [14 March 2011 at 10:24 PM](#) said:

Correct, there is no graphite in the reactors. They (the Boiling Water Reactors) are (light) water moderated, not graphite moderated.

I am seeing no confirmation that the fuel rods in unit #2 were exposed, except for a 1-line excerpt from Kyodo News.

276. [Japan Nuclear Plant Meltdown? » Shocking Times](#), on [14 March 2011 at 10:25 PM](#) said:

[...] water are apparently failing and the core temperature continues to rise. This site offers perhaps the best detailed guide to the mechanisms that operate the power plant and the challenges faced by the [...]



277. **m**, on [14 March 2011 at 10:29 PM](#) said:

nobody believes in what the PRO-Lobbyists preach anymore.

in case you missed it: Fukushima Reactor 2 is dry. out of water. the trials to cool it down with seawater FAILED.

Switzerland decided not to build new nuclear power plants. more countries (with people who got some brains) will follow....



278. **bertgold**, on [14 March 2011 at 10:30 PM](#) said:

This blog is being cited because the public wants to believe that the engineers in charge have anticipated all the possibilities and are

properly managing the partial meltdowns. OTOH, it is clear that several unfortunate unanticipated events have occurred (diesel generator flooding, mismatched power source wiring, hydrogen explosions in or near the secondary containment). Now we are seeing some radiation danger to workers in the plants (can they not be remotely managed using PCanywhere or Remote Desktop Connection?), with significant consequences (just like 3-mile Island) because workers cannot risk exposure over long periods. We have also learned that there is no 'core catcher' as this blog suggests.

Japan is a physically small country with a huge population and cannot afford to give up any significant real estate for any significant period of time. Consequently, the rosy scenarios seen by many will not come to pass. The technology for clean up will have to progress and "safe" storage for all the waste will have to be found. This will not be quick or easy.

As a scientist I am hopeful that all the problems can be solved with a minimum loss of life. As a pragmatist, I am aware that there will clearly be (have already been) some casualties in this accident. My hope is that there will be as few as possible going forward and that 'normalcy' will return rapidly. That is certainly what the blogger that wrote the original comments intended.



279.

Scarface, on [14 March 2011 at 10:40 PM](#) said:

Hi Barry,

Could you give an update on the situation right now? The media are talking about cores without cooling and a possible meltdown. A far worse situation than described in your, by the way excellent, article. Is it really getting worse? I hope you can and will respond.

Thanks in advance!



280.

Luke Weston, on [14 March 2011 at 10:49 PM](#) said:

"Why does the author (and some commentators) claim the half life of Iodine and Cesium to be so short that it will cause no problems to anyone – and yet the US EPA says that Cesium has a half life of 30 years and Iodine a half life of 8 days (but roughly 100 if it gets into the body)

-Because some people will invariably talk out of their arse. But you're correction, the half-life is 30 years."

Well, it depends what isotopes you're talking about, of course.

Yes, the half-life of caesium-137 (which is a significant moderately long lived fission product, responsible for most of the radioactivity contained in used nuclear fuel) is 30 years.

But there's absolutely no reason to expect that anything but the tiniest little traces of radiocaesium will be released at Fukushima.

What is the natural background level of Cs-137 in the environment in Japan, due to things like the atomic bombs, anyway?

Some media outlets say radio-Cs has been detected... but nobody has ever said quantitatively how much (remember that measurement is extremely sensitive) nor have they said that it was actually above existing background.

The half-life of I-131 is not "100 days if it gets into the body". Maybe that's its biological half-life for excretion and turnover within the body, but its physical half-life for radioactive decay is still 8 days.

Many drugs and the like follow an exponential decay as they're eliminated from the body – so you talk about the biological half-life.

If you've got a radioactive chemical or radiopharmaceutical, with a certain physical (radioactive decay) half-life (which depends on the radionuclide) and a certain biological half-life (which depends on its chemical form), then to plot the decay of the amount of radioactivity in the person's body as a function of time then you need to add together the exponential decay constant for the physical decay and the decay constant for the biological decay.



281.

PQK, on [14 March 2011 at 10:52 PM](#) said:

Barry, Kyodo is now reporting that some of the rods in Number 2 may have already melted. The best case reporting for that reactor reported 30 centimeters of water in that reactor. That's about 10 inches, most of which must have been converted almost immediately into steam, if I understand the processes taking place. TEPCO is venting the steam as I tap. We need to get a clearer picture of what happens if these rods melt, please. I strongly suggest you address questions from pro-nuclear visitors and ignore the camp that has

already determined the outcome irrespective of the actual facts.



282. **Barry Brook**, on [14 March 2011 at 10:54 PM](#) said:

Still waiting for confirmation on the latest overall situation, Scarface. In my other thread (14 March updates) I just provided the latest WNN update (as of two minutes ago).



283. **Michelle T**, on [14 March 2011 at 10:59 PM](#) said:

The post made me feeling much better. I have been struggling with Leaving or Staying in Tokyo for 9 hours already, since the #3 was explored. Thank you very much. The best news since 3.11!!



284. **Sir rap165**, on [14 March 2011 at 11:01 PM](#) said:

seriously? external power generators could not be connected to the power plant because the plugs didn't fit ??



285. **PQQ**, on [14 March 2011 at 11:06 PM](#) said:

Fukushima No. 2 reactor's fuel rods fully exposed, melting feared

TOKYO, March 14, Kyodo

Fuel rods at the quake-hit Fukushima No. 1 nuclear power plant's No. 2 reactor were fully exposed at one point after its cooling functions failed, the plant operator said Monday, indicating the critical situation of the reactor's core beginning to melt due to overheating.

The rods were exposed as a fire pump to pour seawater into the reactor to cool it down ran out of fuel, Tokyo Electric Power Co. said. The firm had reported the loss of cooling functions as an emergency to the government.

TEPCO said water levels later recovered to cover 30 centimeters in the lower parts of the fuel rods.

The seawater injection operation started at 4:34 p.m., but water levels in the No. 2 reactor have since fallen sharply with only one out of five fire pumps working. The other four were feared to have been damaged by a blast that occurred in the morning at the nearby No. 3 reactor.

The utility firm said a hydrogen explosion at the nearby No. 3 reactor that occurred Monday morning may have caused a glitch in the cooling system of the No. 2 reactor.

Similar cooling down efforts have been taken at the plant's No. 1 and No. 3 reactors and explosions occurred at both reactors in the process, blowing away the roofs and walls of the buildings that house the reactors.

It is feared that the No. 2 reactor will follow the same path. To prevent a possible hydrogen explosion at the No. 2 reactor, TEPCO said it will look into opening a hole in the wall of the building that houses the reactor to release hydrogen.

The company has also begun work to depressurize the containment vessel of the No. 2 reactor by releasing radioactive steam, the government's Nuclear and Industrial Safety Agency said. Such a step is necessary to prevent the vessel from sustaining damage and losing its critical containment function.

With only one fire pump working, TEPCO is placing priority on injecting water into the No. 2 reactor, although both the No. 1 and No. 3 reactors still need coolant water injections, according to the agency.

The blast earlier in the day injured 11 people but the reactor's containment vessel was not damaged, with the government dismissing the possibility of a large amount of radioactive material being dispersed, as radiation levels did not jump after the explosion.

TEPCO said seven workers at the site and four members of the Self-Defense Forces were injured. Of the 11, two were found to have been exposed to radiation and are receiving treatment...

286. [terremoto in giappone.. - Pagina 11 - BaroneRosso.it - Forum Modellismo](#), on [14 March 2011 at 11:07 PM](#) said:

[...] [...]



287. **m**, on [14 March 2011 at 11:07 PM](#) said:

TEPCO reports the cores are without water and partially melting.



288. **spark**, on [14 March 2011 at 11:13 PM](#) said:

Fear not, as we already know by this simple and accurate explanation what happens next:

“Here is the worst-case scenario that was avoided: If the seawater could not have been used for treatment, the operators would have continued to vent the water steam to avoid pressure buildup. The third containment would then have been completely sealed to allow the core meltdown to happen without releasing radioactive material. After the meltdown, there would have been a waiting period for the intermediate radioactive materials to decay inside the reactor, and all radioactive particles to settle on a surface inside the containment. The cooling system would have been restored eventually, and the molten core cooled to a manageable temperature.”

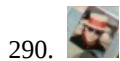
By the book, that is.



289. **bzb**, on [14 March 2011 at 11:24 PM](#) said:

Great text, Barry. Finally some serious info...

[Removed OT link]



290. [Hur det egentligen ligger till | Jordens Herrar](#), on [14 March 2011 at 11:26 PM](#) said:

[...] längsta och mest informativa text. Lite rädslor kan ju nu anses [...]



291. **m**, on [14 March 2011 at 11:28 PM](#) said:

[deleted for violation of BNC rules policy]

292. [How did the nuclear accident get this bad? - Page 3 - INGunOwners](#), on [14 March 2011 at 11:31 PM](#) said:

[...] I think the media is doing what it does best- blowing this out of all proportion. This is not another Chernobyl. Fukushima Nuclear Accident – a simple and accurate explanation BraveNewClimate [...]



293. **Retsopotua**, on [14 March 2011 at 11:34 PM](#) said:

[deleted for violation of BNC commenting policy: no *ad hominem* attacks]

294. [Poster's Paradise » Before anyone panics over the Japanese Nuke situation](#), on [14 March 2011 at 11:35 PM](#) said:

[...] bravenewclimate.com/2011/03/13/fukushima-simple-explanation/ Posted by Maddog @ 8:05 am :: Uncategorized Comment RSS :: Trackback URI [...]



295. **cj**, on [14 March 2011 at 11:36 PM](#) said:

The easiest fact for the layman to understand is wrong. "So the first hooray for Japanese engineering, everything held up." General Electric designed this plant.

What is the Author's degree? No where in his extensive bio is this info listed. Best I can estimate, he has a degree in Ecology.
<http://www.adelaide.edu.au/directory/barry.brook>

Any Nuclear Physicists/Engineers care to comment?

These two items create doubts for me.



296. **m**, on [14 March 2011 at 11:36 PM](#) said:

My last comment got deleted for some kind of violation. I am just wondering why the link bzb posted has a right to stay as he calls this 'information'. A link to a site where Chernobyl is called a bluff. If you want to keep your article at least a bit credible, you should get rid of this link, too, as you did get rid of my comment to it. it is kind of off-topic anyway.



297. **Dan Meneley**, on [14 March 2011 at 11:36 PM](#) said:

"m" proves to me once again that insult is the last refuge of the incoherent.

The Japanese recovery workers are doing the very best with what they have. Reactor decay heat is decreasing steadily, as it always does after shutdown.

The situation is improving, not degrading. A large release is becoming less and less likely as time goes on,



298. **Jace**, on [14 March 2011 at 11:37 PM](#) said:

Your synopsis implies that the pumping of sea water into the cores has cooled them. This isn't precisely the case. The pressure inside the chamber is so great that they are having a hard time getting the water in with the firefighting equipment (yes, fire hoses) they're using. On top of that, their instruments are likely not giving accurate readings, so they're working somewhat blind. While they are able to keep the reactor from going into total meltdown, they aren't able to get it sufficiently cooled to have it "off".



299. **Eric Moore**, on [14 March 2011 at 11:39 PM](#) said:

I hope you guys are right, however you seem to be very self righteous which makes me worry. I am not sure if nuclear is good or bad for the long term in our world, but one thing is sure I don't think I can trust people with commercial or political interest in nuclear power. Humans are naturally only concerned with short term interests. Money is the biggest driver both for individuals and governments. I get very annoyed that so little is spent in research to do with renewable and, even more importantly, energy efficiency projects are too slow and again not funded properly as far as I can see.

300. [Japan Indies » Blog Archive » Japan Now and How to Help](#), on [14 March 2011 at 11:43 PM](#) said:

[...] Dr. Josef Oehmen-Research scientist in mechanical engineering and engineering systems at MIT: Not ex... [...]

301. [Fukushima: Reactors and the Public](#), on [14 March 2011 at 11:49 PM](#) said:

[...] here, but instead will send you directly to Oehmen's essay, which was also reproduced on the BraveNewClimate site with a series of illustrations. But a few salient points: When the earthquake hit, the nuclear [...]



302. **Mattb**, on [14 March 2011 at 11:49 PM](#) said:

Eric – this is a 40 year old reactor surviving with only minimal low level radiation releases what was one of the largest earthquakes recorded and a 10m Tsunami to boot! 10,000+ people are dead, pretty much everything in the path of the Tsunami was wiped off the face of the planet, and yet these reactors are holding together. Sure there are issues, and no one is denying that something else COULD

go wrong even if highly unlikely, but right now the media should be calling a spade a spade and celebrating that these reactors are intact, in spite of commercial or political interests.

Media is reacting as though this is already Chernobyl, or will almost definitely be Chernobyl, but it's not. It's a goddam celebration of engineering safety!

303. 

m, on [14 March 2011 at 11:51 PM](#) said:

I am not doubting that anyone is doing their best.
Doing the best just doesn't always mean, someone's doing the right thing...

And reactor heat is increasing steadily after an explosion occurred.I am correcting myself: there have been two detonations this morning.

304. 

meandjustmyself, on [14 March 2011 at 11:53 PM](#) said:

Err. No. It's not, it's actually quite the opposite.

305. 

PQK, on [14 March 2011 at 11:54 PM](#) said:

Kyodo:

BREAKING NEWS: Fukushima's 3 reactors highly likely facing melting: Edano 9:41 Tokyo time.

It is quite possible that the engineers will be able to pump enough sea water into the three reactors over the next 48 hours to prevent a major disaster. But the best case scenario seems to call for the venting of a lot of radioactive steam. I'm still unclear what the worst case scenarios look like. Mr. Edano states that a worst case scenario like Chernobyl is highly unlikely. So, what are some of the likely worst case scenarios?

306. 

Eric Moore, on [14 March 2011 at 11:58 PM](#) said:

Matt – I do hope you are right and I am following all commentators on this, because I know there is media hype, self interests and ignorance (I am sure I probably fit into that label). As long as in the long run there is total openness and lessons learnt, I will be happy. I hope Japan gets back on it's feet and that the people immediate requirements are put before big financial interests.

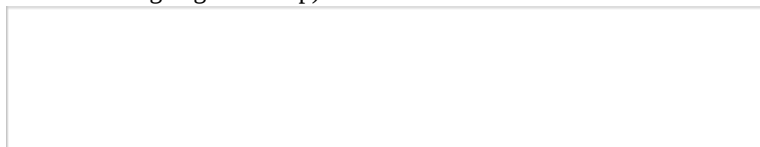
307. [E L S U A ~ A KM Blog Thinking Outside The Inbox by Luis Suarez » Social Networking Gets Serious – #prayforjapan](#), on [15 March 2011 at 12:03 AM](#) said:

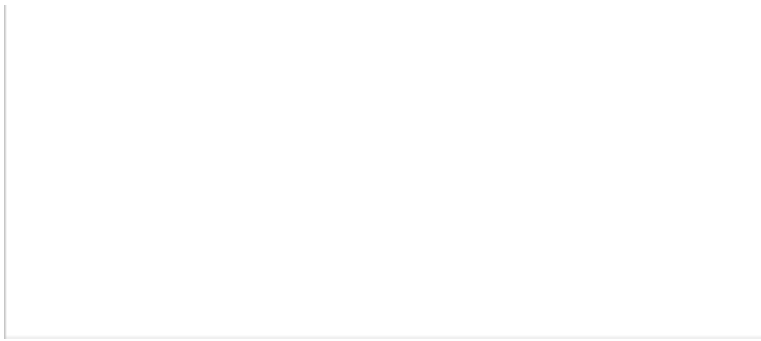
[...] happening in Japan have proved, with both the earthquake and the follow-up tsunami and over the last couple of days the nuclear threat, is that realistic fact, now more than ever!, that Social Networking can be [...]

308. 

meandjustmyself, on [15 March 2011 at 12:03 AM](#) said:

All of what we actually _see_ here in the reports doesn't fit the "good news" presented here.
This is just a personnel, unqualified judgment but I'd bet that at least for reactor #1 the containment vessel is _not_ intact (or at least the cover is not) while the reactor pressure vessel still is. You just don't get the kind of explosion we've seen at #1 from hydrogen burning in an unpressurized environment without high levels of oxygen.
This is how high levels of hydrogen burning with atmospheric oxygen under perfect conditions look like (lots of excess hydrogen is released during engine startup):





309. **m**, on [15 March 2011 at 12:04 AM](#) said:

the media is not reacting as this is another Chernobyl. actually everyone hopes it will be not. and it is not about comparing one disaster with another anyway. the politicians and people are reacting! they simply see that nuclear power has risks which we should think about if we are willing to take them. that is what is happening.

and it is no celebration of engineering safety. those guys were lucky (lucky?! what the head i am saying...) ...well, lucky not more has happened yet....or lucky, that nobody really knows what actually happened.

it is legitimate to observe a happening and make one's own conclusion. if some people decide that there are alternatives....why is it so hard for you respect this?

310. [Japan Nuclear Accident « Where we are now](#), on [15 March 2011 at 12:10 AM](#) said:

[...] the meantime, here is a long, detailed — but accurate and easy to understand — explanation of what happened, what has been done, and why everyone will most likely be safe from the big scary [...]



311. **Dan Meneley**, on [15 March 2011 at 12:17 AM](#) said:

Once again “m” has it wrong. The Japanese responders are doing just fine, thank you. They are doing the right things.

And reactor heat production is NOT increasing. Read the recent statement by the Japanese Atomic Industrial Forum. Good news all around — and true.

Every time the pressure of the primary containment is relieved we can expect a hydrogen explosion. Even at atmospheric pressure, hydrogen is combustible above about 4 percent concentration. The secondary containment atmosphere is air, after all, especially after the roof has been blown off.



312. **m**, on [15 March 2011 at 12:29 AM](#) said:

I totally understand that people who own their bread in the nuclear biz stand in for it. I respect that. I probably would do the same. It is like a discussion between mac-users and the rest of the PC-world. Everyone believes what is already closest to their believes. Before those incidents I must admit I hadn't any clear opinion concerning nuclear power plants, though I remember how frightened I was as a kid when Chernobyl happened. It didn't make me an active anti-nuclear-person. I was still open and observing. But after all this I cannot stay neutral anymore. I am not doubting the know-how of people who work in the business, BUT it is frivolous to claim to exactly know what is going on inside this reactor (just as frivolous as shouting: Chernobyl, Chernobyl!). And exactly this is why I decided not to be pro. We just cannot foresee anything. And with this knowledge nuclear power plants are like an army of Pandora's Boxes. It is just about measuring the risks. If there is no better alternative than living with this fear than – I am sorry – we haven't thought about it hard enough. Nuclear Power seemed to be a short-cut when mankind came up with, but we may not survive it...



313. **Frank Paolino**, on [15 March 2011 at 12:30 AM](#) said:

Barry,

I have been looking for a post like this to counterbalance the mindless, sound-bite reports that don't care to tackle any of the science.

Thanks for taking the time to explain what is going on in rational terms. Even though the situation is changing and not all information is known, at least you try to go through what you know in a rational fashion.

Whether one likes nuclear power or not, an attempt to get to the facts is necessary, and this is one of those efforts. Thanks!



314. [A Little Less Hysteria With My Meltdown, Please? « SOYLENT GREEN](#), on [15 March 2011 at 12:32 AM](#) said:

[...] Here's a slightly less hyperbolic evaluation from someone who knows whereof he speaks: [...]



315. **Peter**, on [15 March 2011 at 12:39 AM](#) said:

I am a health physicist (radiation safety expert) with advanced degrees and 30 years experience in US nuclear power and USDOE experience. I have been reading this and the comments, but alas hesitate to express my opinions due to the nasty attacks of the anti-nuke trolls. The article is mostly correct in the technical details albeit a few minor errors about the accident(s). It is hard not to be seen as self-righteous when accosted with emotional attacks that do not have any scientific basis. That said, it is not the time now to sit back and say everything is fine, as the situation is still serious for the site.

For those who are reading this in Japan, the event is not over yet and the findings of airborne radioactivity plumes 100 mi. from shore and 30 km down from Fukushima are alarming – however they are not an emergency, especially if they are only the short-lived I-129 and 131, and other radionuclides from the decay neutron activation of air, water, and sea water. Tritium is especially weak as a hazard, even with its' long half-life, due to the very weak radiation emissions. The cesium-137 and Sr-90 (if indeed these are the isotopes detected) are another matter, but as previous bloggers have stated they should likely be in much smaller quantities – and I understand the prevailing winds normally blow from E or SE so the plume is going offshore. Also, neither explosion was large enough (in my opinion) to eject particulates high into the atmosphere, nor has there been any report of fire, so comparisons with Chernobyl are ridiculous. However, listen to, and follow any of the guidance being given by authorities. They are using protection guidelines that are extremely conservative and will keep you safe.

Finding any hard numbers for the extent of the exposure or release has been extremely frustrating, and I have not found one single use of the correct terminology in the media yet for radiation dose or dose rate. It has been stated that the radiation level in the control room of unit one is 1000 mSv. That is meaningless with out the RATE – per hour ??? per day? Converting to US units (sigh...) and wildly guessing it means 10 rem/hr, then the control room is uninhabitable. I doubt that is the case unless the spent fuel pool really has been drained of cooling water and there is spent fuel in there. Another report from TEPCO stated one employee has received a radiation dose of over 10 rem. How much over? Radiation non-stochastic effects (prompt effects) start at about 50 rem absorbed dose.

The US Navy report from the USS Eisenhower stated that the radioactive plume the sailors were exposed to “was only exposing the personnel to the same dose from natural background they would receive in one month”. A little radCon math tells me that exposure was ~30-40 mrem. If they received this in an hour, and this was in fact 100 mi. from shore, than this is a significant plume from the accident and is not a short-term ‘puff’ release. Of course it also means the reactor containments are not effective, which is to be expected when venting off steam from the PV. However, I doubt very much this is correct, because site boundary instruments are not reading above 5 mrem/hr from my reading, and even Chernobyl did not approach such doses at that distance.

One comment on the original article I disagree with is the results of the full melt-down of the fuel, whether it is the Low-Enriched U fuel of Unit 1 or the MOX (mixed Pu-U) fuel of unit 3. There is no possibility the reactor containment will seal in a melt-down. If the water completely boils off in the vessel and cannot be replaced – unlikely, but if it is really true that the only emergency pumps are fire pumps and they are running out of fuel, possible – and the fuel/zirconium mixture melts and begins burning, and there is now no reactor building left over each unit.....well, it will be a ‘mini-Chernobyl’, for lack of a better laymans’ term. Lets all hope and pray they can restore power, and decay-heat removal cooling continues as the workers are valiantly trying to ensure. It could have been MUCH worse.

316. [Media Sensationalizing Japan's Nuclear Plant Situations | City-County Observer](#), on [15 March 2011 at 12:45 AM](#) said:

[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]



317. **Dan Meneley**, on [15 March 2011 at 12:46 AM](#) said:

Sad that “m” feels he must discredit the professional ethics of all the expert and well-meaning people who work in the nuclear industry around the world, in order to support his own point of view.

As a professor almost ten years past retirement, I am quite independent in both my finances and profession. I am more that a little offended by this attitude.



318. **m**, on [15 March 2011 at 12:47 AM](#) said:

From the Guardian:

2.13pm: Justin McCurry, the Guardian's Tokyo correspondent, emails to say the water level inside the No. 2 reactor at Fukushima Daiichi nuclear power plant has recovered to a level of about two metres, according to Kyodo News. The rods were fully exposed for about two and a half hours, according to Japan's Nuclear and Industrial Safety Agency.



319. **CoalBurner**, on [15 March 2011 at 12:49 AM](#) said:

I'm assuming that some people are giving their lives (or many years of their lives) to prevent a worse catastrophe. I would probably refuse to continue working there even if I was one of the critical engineers needed to save the situation. Also, there is no "celebration of engineering" element in allowing any of these 40 year old reactors to keep working. It sounds like massive bad luck that at least one reactor was supposed to shut down permanently just about the time the tsunami happened. We will see the public shut down many Mark I's around the world soon. Smart people will be saying "if it doesn't have a core catcher" it isn't going into my backyard."

I mean, after all, with a "core catcher", it won't hurt anyone's real estate value to be located 5km from a nuclear power plant, right?

I'm sure the pro-nuclear people will volunteer to have at least a PRISM reactor located 5 km from their real estate.

Right?

Why am I hearing crickets chirping?

By the way, are their advantages to a PRISM reactor?



320. **Barry Brook**, on [15 March 2011 at 12:49 AM](#) said:

Okay, I'm off to catch some sleep — those on comment moderation will just have to be patient until I wake up.

321. [Japan Nuclear Power Station- Scientist Claims No Significant Release of Radioactivity Likely | TrueblueNZ](#), on [15 March 2011 at 12:53 AM](#) said:

[...] Full report here. Very clear simple and easy to understand. If you're worried, I advise a read. (Click on image for enlarged view.)
[...]

322. [Nuklearunfall Fukushima – einfach und genau erklärt! « Der Honigmann sagt...](#), on [15 March 2011 at 12:55 AM](#) said:

[...] Den Originalartikel finden Sie hier [...]

323. [Reflections » Nuclear Meltdown, or hype?](#), on [15 March 2011 at 12:57 AM](#) said:

[...] Fukushima Nuclear Accident – a simple and accurate explanation [...]



324. **CoalBurner**, on [15 March 2011 at 12:59 AM](#) said:

Everyone with political or economic decision making power regarding nuclear plants, should be required to put a significant amount of their personal fortune into local real estate.

Here is important info on the Mark I from GE that was noted for its "cost-saving" inadequacies compared to competitors 40 years ago:

However, as early as 1972, Dr. Stephen Hanauer, an Atomic Energy Commission safety official, recommended that the pressure suppression system be discontinued and any further designs not be accepted for construction permits. Shortly

thereafter, three General Electric nuclear engineers publicly resigned their prestigious positions citing dangerous shortcomings in the GE design.

An NRC analysis of the potential failure of the Mark I under accident conditions concluded in a 1985 report that Mark I failure within the first few hours following core melt would appear rather likely.”



325. [@DatisKevin](#), on [15 March 2011 at 1:04 AM](#) said:

Thanks for writing this great post!



326. [CoalBurner](#), on [15 March 2011 at 1:07 AM](#) said:

In the [Hazards of Boiling Water Reactors in the United States](#) one sees that venting was expected for Mark I's in 1986, which means it's been considered an “acceptable risk” by governments and industry people since then.

You can't fault GE because they would have gladly had their old systems replaced with new ones. It sounds like, just as many first world dentists have more dangerous x-ray and other equipment than third world dentists, there's been a lot of greed going on where companies were trying to get for their shareholders immense profits based on the idea that their capital expense was realized 40 years ago or 25 years ago.

It is unconscionable that, at the time of Chernobyl, these Mark I's were known to be at high risk for “venting events” but this was considered “acceptable”. Politicians have been getting lobby money for sure.

Real estate values around all Mark I BWR reactors should be plummeting about now, as people learn what they are = dangerous cash cows.



327. [G.R.L. Cowan, hydrogen](#), on [15 March 2011 at 1:07 AM](#) said:

Dr. Meneley says,

Sad that “m” feels he must discredit ...

Or anyway he feels it's clever to try — under a pseudonym!

It was good to hear you talking to Wei Chen on the CBC. They've been doing some things right. Another is to talk about the radiation levels at the afflicted plants in terms of transpacific airline flight exposure.



328. [Héctor](#), on [15 March 2011 at 1:07 AM](#) said:

I have made a translation into Spanish here:

<http://filemon.dyndns.org/~hector/dokuwiki/doku.php?id=fukushima>

Thanks!



329. [Joffan](#), on [15 March 2011 at 1:08 AM](#) said:

Peter, I think that Chernobyl is an entirely inappropriate point of reference to use in any context, no matter how you qualify it.

If there is a full core melt, and **if** somehow (despite our knowledge of what happens from Three-mile island) the melt penetrates the reactor vessel, there is **still** the next layer of containment for the melt, much of which will not leave the reactor vessel anyway (3MI again), diluted with steel. Your assertion that “there is no possibility that the reactor containment will seal in a melt-down” seems without ground.



330. **Michael**, on [15 March 2011 at 1:08 AM](#) said:

Two questions:

You say: “The intermediate radioactive materials (Cesium and Iodine) are also almost gone at this stage, because the Uranium decay was stopped a long time ago. This further reduces the activation.” ¹³⁷Cs has a half-life of over 30 years, the Chernobyl cesium is still around all over Europe. Iodine has several isotopes with half-lives of a few days, implying a high intensity in the next couple of weeks. How do you arrive at your conclusion that the “activation” – whatever you mean with this imprecise term – is reduced?

“The reactor core will then be dismantled and transported to a processing facility, just like during a regular fuel change.” Do you seriously think it will be easy to dismantle a (partly) destroyed, highly active reactor core?



331. **McMike**, on [15 March 2011 at 1:14 AM](#) said:

Aha, so since it was *only* a close call, and it failed to become a major tragedy due to the availability of sea water, then that proves nuclear power is *safe*.

Russian Roulette is safe too, all that worry about bullets to the head is overblown silliness, five out of six times.



332. **ADB**, on [15 March 2011 at 1:15 AM](#) said:

Thanks a lot for this. Very informative. I gave up on the MSM for accurate info a long time ago.

It's probably too late, but I was wondering if you could explain one or two points. If (as I understand it) the Cesium and Iodine naturally breaks down into non-radioactive elements, why does some Cesium or Iodine have to be removed from the cooling/ sea water as radioactive waste?



333. **Chili**, on [15 March 2011 at 1:19 AM](#) said:

‘The radioactive nitrogen as well as the noble gases do not pose a threat to human health.’

does this mean to living creatures (fish, squid...) as well? So we still can eat sushi?



334. **G.R.L. Cowan, hydrogen**, on [15 March 2011 at 1:19 AM](#) said:

Eric Moore, on 14 March 2011 at 11:39 PM said:

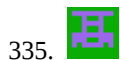
I hope you guys are right, however you seem to be very self righteous which makes me worry. I am not sure if nuclear is good or bad for the long term in our world, but one thing is sure I don't think I can trust people with commercial or political interest in nuclear power.

Look at it this way: both before and after the tsunami, Japan was full of fuel burners and fuel that routinely killed people. The fuel was heavily taxed. So you could say that for each \$billion government got, someone had to die.

And not only could you say it, it's the whole truth, up to perhaps some inaccuracy in the \$1 billion figure. But obviously it doesn't make much difference if it's ten billion or 100 million.

And the (Teller-approved) nuclear power deal was always, give up that billion, Mr. Tax Man. You don't need it, and you'll save the victim that it requires. And the answer has always come, “Oh, goody. Excellent. just excellent. Um ... with due deliberation, and if we can get it by the public, of course.”

And the deal hasn't changed. Teller-approved reactors still haven't harmed their first neighbour. But notice how enthusiastically public money takers have been grinding their axes in the hope that it might!



335. **CoalBurner**, on [15 March 2011 at 1:19 AM](#) said:

Let me repeat myself:

High level Atomic Energy officials wanted Mark 1 reactors banned 40 years ago. See <http://www.nirs.org/home.htm>

This was entirely preventable even if one wasn't stupid enough not to build for the most powerful earthquake and tsunami effect theoretically possible (rather than the most powerful experienced in the mere 100 years before). One has to read "The Black Swan" and prepare for the worst case theoretically possible and not the worst case ever before seen. You have to prepare as if you own the real estate immediately downwind.



336. **ADB**, on [15 March 2011 at 1:20 AM](#) said:

McMike at 1:14AM, 15 March.

You do understand, don't you, that even if there had been a core meltdown, it would have been held within the containment vessel, and not entered the environment? Did you actually bother to read the article?



337. **meandjustmyself**, on [15 March 2011 at 1:25 AM](#) said:

"You do understand, don't you, that even if there had been a core meltdown, it would have been held within the containment vessel, and not entered the environment? Did you actually bother to read the article?"

Yes, we read the article and it's just plain wrong in this point.

The article also states that the reactor had a core catcher which is also just plain wrong.



338. **Mark**, on [15 March 2011 at 1:31 AM](#) said:

I think the big problem here was the following: The Fukushima plant uses seawater drawn in to condense the steam after it exits the power turbines. You can look at Google Maps and see the seawater inlets behind the seawall, and see the seawater outlet as well. This is a normal method for cooling a power plant.

When the tsunami hit, it likely dredged up massive amounts of silt (just look at the after photos of all of the mud and silt in the towns), overflowed the seawall, and deposited that silt into the seawater inlets, clogging them.

So even with backup power, seawater could not be drawn in to condense the steam back to liquid water.



339. **Harm de Coninck**, on [15 March 2011 at 1:31 AM](#) said:

Although I appreciate this technical explanation of what went wrong in this nuclear plant, I do not like the way these facts are used to 'promote' nuclear power.

I find this quite 'uncivilized', knowing that 200.000 people are evacuated, one person is dead and several are wounded (as mentioned before). And the article also states that the Japanese people are going to have to pay more money for their electricity bill in the coming months.

Knowing all this, I can not imagine that the Japanese are prepared to take more risks related to nuclear power plants in the future, just to prevent global warming. After all, why should they be scared of slightly higher sea levels after the events of the last four days?

340. [Centrali di Fukushima: come funzionano e cosa non ha funzionato | Lega Nerd](#), on [15 March 2011 at 1:31 AM](#) said:

[...] Wikipedia (un sacco di articoli, impossibile citarli tutti) bravenewclimate.com (ottimo articolo, ma attenzione che questo sito è fortemente [...])



341. **CoalBurner**, on [15 March 2011 at 1:31 AM](#) said:

One point for the pro-nukes is that, if left wing groups have been preventing the building of safer nuclear plants that would have already replaced the older ones, then they've been part of the problem and the reason why so many Mark I's are still operating around the world.



342. **JD noland**, on [15 March 2011 at 1:35 AM](#) said:

So this all comes down to Plugs not fitting together to be able to use the portable generators!
A multi million dollar complex and not one Electrician around to wire these cables together!
You do not have to have a plug in to conduct electricity
!!!!!!!
Just a conductor!

343. **Japan Tsunami, before and afters - Retro-Renault**, on [15 March 2011 at 1:39 AM](#) said:

[...] [...]



344. **Atkins**, on [15 March 2011 at 1:41 AM](#) said:

Here's an interview with a japanese containment vessel designer, which makes much more sense:

<http://www.ustream.tv/recorded/13320522>



345. **sanjay kumar vatsa**, on [15 March 2011 at 1:43 AM](#) said:

KIndly read it



346. **gsgs**, on [15 March 2011 at 1:46 AM](#) said:

1422: Japanese engineer Masashi Goto, who helped design the containment vessel for Fukushima's reactor core, says the design was not enough to withstand earthquakes or tsunamis and the plant's builders, Toshiba, knew this.

1426: Mr Goto says his greatest fear is that blasts at number 3 and number 1 reactors may have damaged the steel casing of the containment vessel designed to stop radioactive material escaping into the atmosphere.

Should a meltdown and an explosion occur,...The next 24 hours are critical, he says.



347. **Kuba**, on [15 March 2011 at 1:47 AM](#) said:

Frank said: "The plugs on trucked in temporary diesel generators did not fit? Did anyone in Japan ever heard of temporary connection rigging. Or is the status quo in Japan entrenched like here in US where electrical inspectors will threaten you with multi million dollar fine if you don't comply with polished electrical code so the guys who try to help in emergency will spit in disgust and walk away? 8 hours is very long time in which temporary electric power should be connected by any means or batteries should be charged with temporary hook-up to prolong the time. Most electrical engineers will be scratching their heads why this was not done in 8 hours time."

Frank, I think that we're talking 100s of KVA needed to run the coolant pumps. You can't exactly splice those wires without dedicated tools. You need a hydraulic ram with correct die to do attach lugs to the wire. You can't do temporary insulation using electrical tape either. It just takes ONE missing piece for the job to be stopped. You don't have the right die for the size of the wire available, or you don't have the lugs, or, or, or. It's very easy NOT to be able to do such a job when it's unplanned for.



348. [Razwiedka Izraela i Koszer Nostra « Grypa666's Blog](#), on [15 March 2011 at 1:48 AM](#) said:

[...] myślicie, zbrodniarze! W Fukuszima, wtyczki mobilnych generatorów sprowadzonych na miejsce awarii NIEPASOWALY do kontaktu, więc nie można było na czas schłodzić reaktora! Opamiętajcie się, Polscy (?) entuzjaści [...]

349. [La centrale di Fukushima: spiegazione semplice e chiara](#), on [15 March 2011 at 1:48 AM](#) said:

[...] del MIT, riguardo la centrale di Fukushima. L'articolo originale (in inglese) lo trovate qua, qua sotto invece il link per la traduzione in italiano. [...]



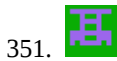
350. [jonny English](#), on [15 March 2011 at 1:53 AM](#) said:

To "prepare for the worst case theoretically possible". An interesting concept.... Before leaving home tomorrow morning, think what is the "worst case theoretically possible" and then think again about going out.

Designs need reduce the risks so that they as low as reasonably practicable.

Now, however, is not the time for additional speculation by those who have limited information and have a wish to exaggerate. Leave that to the journalists and politicians in countries such as Switzerland...

But seriously, truly sincere wishes to all our peers and all other caught up in the evnts in Japan. Particularly those on the NPP site who are working to make the plants safe and minimise radiological releases. Heroes one and all.



351. [CoalBurner](#), on [15 March 2011 at 2:01 AM](#) said:

Question: Fukushima differs from Chernobyl mainly in that the control rods never got back into the core at Chernobyl. Correct? The Soviet plant remained critical as it burned, right?

If that is the case, then can a misshapen, melted core in Japan go back to criticality?

Is boron being flown in? How much boron does a plant keep on hand?

Would Mark I reactors not located next to lots of sea water be more dangerous?



352. [Andreas Krey](#), on [15 March 2011 at 2:02 AM](#) said:

It is indeed paradoxical to conclude from the current situation that nuclear energy is safe and controllable.

It is laudable to what extent the reactors held up to an earthquake that they were not designed for, but then, the reactors were – in hindsight – obviously deployed in a place they were not designed for.

And that's the problem. You can't sell nuclear reactors as 'safe' as there always will be unexpected events or chains of events which were not included in the design, and will lead to violation of safety, in the form of unplanned release of radioactive materials.

Keep in mind that while this looks like a proof of robustness of those reactors how lucky we are that the winds don't blow towards tokyo right now. While the 'just an X-ray' is true, it still means that the downwind regions are uninhabitable as long as the reactor cooling doesn't become a lot less haphazard.

So 'nuclear power is safe, except when something unexpected happens, then better be prepared to evacuate large swaths of the country' may be closer to the truth, and one that isn't exactly likely to win the population.

353. [8.8 earthquake hits Japan - Page 5 - HEXUS.community discussion forums](#), on [15 March 2011 at 2:02 AM](#) said:

[...] 8.8 earthquake hits Japan Best Article so far. <http://bravenewclimate.com/2011/03/1...e-explanation/> Society's to blame, Or possibly [...]



354. **No Meltdown Here « Shiny Book**, on [15 March 2011 at 2:09 AM](#) said:

[...] instead I'm posting a link to a site with very good information about the Fukushima Nuclear Plant and what is going on at the [...]



355. **CoalBurner**, on [15 March 2011 at 2:09 AM](#) said:

Designs need reduce the risks so that they as low as reasonably practicable.

No, no and no. This is wrong.

Read "The Black Swan" to understand that, with nuclear power, you don't prepare for the practical, you prepare for the 2000 year event, because a 2000 year event can occur at any time.

If you are from the Depleted Uranium site, believe me, there attitude of hubris will not play. They say there that "pro-nukes should not apologize" and use other arguing techniques that just aren't going to fly with intelligent people nor the general public. Those Mark I's should have been taken offline 40 years ago.

Those of us with conservative politics need to be very careful of pretending that only liberals (left wingers) care about their real estate and the milk supply and the food supply in terms of possible contamination in the interest of corporations they do not personally own shares in.

Scenario: Obama campaigns for 2012 that all Mark I's need to be decommissioned fast. Republicans say this is hype. Several politicians are caught taking money from GE. Landslide victory for the Dems. All because of a misguided concept that only left wingers can get ticked off by the stupidity and greed that led to this Mark I problem.



356. **CoalBurner**, on [15 March 2011 at 2:11 AM](#) said:

Quoting Patrick Niessen:

- A reactor is build on a coast with a large and well documented Tsunami Risk
- Reactors all over Japan are built on or near active Earth Quake fault lines
- They are operated by a company well known for falsifying safety reports, circumventing regulations and building codes, engaging in suicidal processing techniques and intentionally hiding facts or lying
- The plants are supervised by an agency that fully relies on the operator to take measurements, fix faults, etc
- All things that were earlier said cannot happen actually did occur
- International experts are flabbergasted by the official statements coming from Japan

Engineering Hubris – I recommend reading Homo Faber to remind people the role of chance (or even fate), if this is required after the financial crisis and the Oil Disaster in the Gulf of Mexico.



357. **CoalBurner**, on [15 March 2011 at 2:15 AM](#) said:

Here is a list of Mark I reactors still operating in the US:

<http://www.nirs.org/reactorwatch/accidents/gemk1reactorsinus.pdf>

The same hubris that caused the Gulf Oil Spill was operating here.

Consider that both of these "impossible" events happened within one year.



358. **albert**, on [15 March 2011 at 2:19 AM](#) said:

With the last news, I think Mr Brook loose all credibly when saying:
”

Now, where does that leave us?

* The plant is safe now and will stay safe.
”

Shame on you and on your uncontrollable tech



359. **Richard**, on [15 March 2011 at 2:25 AM](#) said:

This is not directly tied to the event in Japan or any other reactor “accidents” but could anyone tell me how we store nuclear waste or the containment vessels of a reactor after decommissioning? What has the cost of this issue been to date? This is never added to or discussed when considering the building of a new reactor. Reactor construction has always cost two to three times as much as the estimate so I feel sometimes the people promoting nuclear have more important issues of profit than civic responsibility. As far as accidents go there have been far more than the A.E.C. or its’ replacements would like for one to believe. While these accidents are not directly involved with the operation of power plants it does involve nuclear research and testing*. The designs are old and the repeated “it won’t happen again” always comes into play. If a coal mine is hit by a quake the loss of human life and economy could be great but it doesn’t carry on for 300 plus years or possibly a millennium of dead land. People say solar can’t support the all planets energy needs. I believe this, but can’t, never could. If you don’t believe technology can bring solar on line then you can’t convince me that nuclear power from its beginning refinement to deposal is a safe and economical endeavor.

*Excluding the man’s body pulled off the ceiling of the containment unit after an explosion due a stupid human error. My point exactly.



360. **spark**, on [15 March 2011 at 2:25 AM](#) said:

albert, that post is not from Mr Brook but from a Josef Oehmen (read the beginning). A lot of the information and assessments it provides are incorrect or have been superceded by events happened in the meantime.



361. **Jonny English**, on [15 March 2011 at 2:28 AM](#) said:

Dear Coalburner. Two comments

1) There is a risk to everything we do, of course. Everything has a finite likelihood and consequence. (You wear a seatbelt for safety in the car as you chose to drive, but if you wanted people to drive slower and with more care you would put a spike in the centre of the steering wheel, but I digress) We do not build ships with 10+ hulls to protect against icebergs, we do not wear body armour when going to the store etc. This is because we make a judgement between the liklihood of something happening and the cost (money, time, other inconveniences). Simply being deterministic in your approach to avoid a theoretical worst case scenario, would mean nothing ever was done, anywhere. Of course, where you “draw the line” is often subjective and based on experts decision (who we hope are impartial and well informed, of course). Where this line is drawn is something to discuss, but it must be drawn somewhere

2) Whether these particular plant designs should have been operating is a question for the Japanese nuclear regulator autorites who gave the site a license – and, despite the low risk of a Tsunami in Switzerland, ENSI who license the similar plant at Leibstadt and other such bodies elsewhere.

Some really smart comments on this site, thank BNC.



362. **como**, on [15 March 2011 at 2:29 AM](#) said:

word up!



363.

como, on [15 March 2011 at 2:30 AM](#) said:

exactly, coal burner. they where built by people who want to make money. and surely they need scientists on their side who want to make money, too, and talk their talk.

364. [What Next? « The Dame Truth](#), on [15 March 2011 at 2:31 AM](#) said:

[...] further information, see BraveNewClimate , Sam Sewell's The Steady Drip and, of course, first, last and always, Logistics [...]



365. **como**, on [15 March 2011 at 2:34 AM](#) said:

A quote from the article, just to show the kind of racist of it:

“The problem of hydrogen-oxygen formation is one of the biggies when you design a power plant (if you are not Soviet, that is), so the reactor is build and operated in a way it cannot happen inside the containment.”

...”if you are not Soviet”...??!?

It is not exactly ‘scientific’ to talk or write like that. I’m sorry...

366. [Japan gettin' pwned - Page 3 - Mazdaspeed Forums](#), on [15 March 2011 at 2:35 AM](#) said:

[...] [...]



367. **albert**, on [15 March 2011 at 2:35 AM](#) said:

Hey I'm okay with progress, really. But Just go playing with your deadly toys elsewhere (away from our planet), you obviously cant face the consequence when something goes wrong megamind.



368. **albert**, on [15 March 2011 at 2:39 AM](#) said:

“We do not build ships with 10+ hulls to protect against icebergs,”. Of course the consequences are equivalent between a boat meeting an iceberg and a nuclear disaster. Damn..



369. **CoalBurner**, on [15 March 2011 at 2:40 AM](#) said:

Johnny English,

No. In this case. No. And where so many lives are at stake, you can't compare it to one person's assessment of risk when driving.

It's this attitude that gives us these preventable catastrophes (Gulf Oil Spill, etc).

There was no excuse for not being prepared for a 9.0 in that region and no excuse for having the pumps in an area that could get swamped. Keeping a Mark I going so long except as a cash cow for shareholders to see more profit in 2010. Reactor 1 was supposed to go offline permanently on March 25th. For the rest of the world's Mark I's you will now see retirement a lot sooner.

That depleted uranium site is so badly wrong in its attitude by the way. If you are here from there, note that it is NOT a good idea to take a no prisoners, non apologetic approach such as never admitting that nuclear energy isn't dangerous, etc.

The best argument for the pro-nuke crowd is that the left wingers have prevented the replacement of the old Mark I's with newer plants. That argument will fly, possibly.



370. **como**, on [15 March 2011 at 2:41 AM](#) said:

If you want to write scientific (even if your approach is to keep it simple...for us 'not so clever' people) you are walking on a fine line. And it is better not step over it and put some 'funny' stuff into it, which people could get wrong (like the Soviet-joke for example). It will harm the credibility of the rest of your words, scientist.

371. 

albert, on [15 March 2011 at 2:43 AM](#) said:

Okay at this precise time, Japanese (and us alike, earth inhabitants) have 3 reactor in a meltdown state. You should delete this article and close this website. Kiss your kids and tell them daddy was wrong and is sorry for this.

372. 

J Edwards, on [15 March 2011 at 2:46 AM](#) said:

Thanks very much for this.

I currently reside in Chiba and I am in a very lightly but still affected area of the quake/tsunamis.

I am essentially fluent in Japanese having lived here 4 years and studied vigorously, and I can tell you that there have been many contradictory reports on TV indeed. Also, a severe lack of practical information such as you have kindly provided above. It has been said that:

- a melted core could in fact break through all containment barriers and burn itself into the Earth's crust like an ember through paper. (My own analogy but, you get the picture)

No mention of:

- the strength of the 3rd containment vessel or composition of the 2ndary vessel has been made. The working assumption here is that the fuel inside can just burn its way through anything indefinitely and also do so very quickly, again like an ember sitting on paper.

- (brief) mention only, and only in the very initial news pieces not at all anymore, of the control rods and main nuclear reaction having been stopped. It is most likely a working assumption in most people's minds that the main nuclear reaction, the 'main oven fires' are still burning away in there, or something.

- there has been sufficient mention of how low radiation levels actually are, but nothing about half-lives. Knowing most of the radioactive material which is being released dies within seconds would be of great relief to many people (if they'd just friggin report it!)

Add to this cultural aspects such as

- The Japanese hate saying the wrong thing and rather than say something that's 99% true they prefer to wait till it's proven 100% true, have a meeting about it and so on. This leads to

- a lot of use of the volitional form, the 'most likely's, the 'maybe's and 'mights' and 'one could possibly say' etc, to the point where you really feel you can't trust the info.

Take all of the above and you have a really well controlled but bitterly panic-inducing situation.

Thanks again for the post, good to know Chernobyl is impossible in Fukushima and that even a slow meltdown is of no immediate risk.

373. 

como, on [15 March 2011 at 2:53 AM](#) said:

yes...this whole situation was 'impossible' before it happened and now it happened and it seems pretty possible. who knows which other impossibilities come possible in no time.

it is good that other countries (especially in the EU) think over their nuclear-concepts.

i am sorry for all the Japanese people. i am a big fan of many things their culture brought to us. it is hurting me that they to go through all this...at the same time.

374. [Radioactive « Robomonkey's Blog](#), on [15 March 2011 at 2:57 AM](#) said:

[...] Given all the panic and hyperbole in the media about the nuclear plants in Japan (I'm expecting CNN to report, with a straight face,

the increased likelihood of Godzilla attacks caused by the radiation), here's an explanation from someone who knows whereof he speaks: I have been reading every news release on the incident since the earthquake. There has not been one single (!) report that was accurate and free of errors (and part of that problem is also a weakness in the Japanese crisis communication). By "not free of errors" I do not refer to tendentious anti-nuclear journalism – that is quite normal these days. By "not free of errors" I mean blatant errors regarding physics and natural law, as well as gross misinterpretation of facts, due to an obvious lack of fundamental and basic understanding of the way nuclear reactors are build and operated. I have read a 3 page report on CNN where every single paragraph contained an error. ...— Josef Oehmen PhD., MIT [...]



375. **como**, on [15 March 2011 at 2:59 AM](#) said:

in other countries the people just raise their voice right now! when if not now?

i am pretty sure that if the people of japan would have been told clearly ...listen, we build nuke plants which are technically not perfect and they will be in an area where we should actually not build them.... maybe i am wrong, but i bet they would have tried to avoid that.

and if not, it is still absolutely legitimate for the rest of the world to raise their voice now and try to stop this nuclear insanity.

why are we not allowed to learn a lesson?

who wants us not to learn?

this is the question.



376. **lshubert**, on [15 March 2011 at 3:01 AM](#) said:

The key sentence in that article is "The third containment is designed, built and tested for one single purpose: To contain, indefinitely, a complete core meltdown".

Two problems with that:

1) As we know, not everything is "working as designed" here, so that would be a huge bet to take.

2) It's not even true... This has never, EVER been "tested" for a true meltdown. There have been computer simulations, and some small-scale regressions tests... but this was never tested for a full meltdown.



377. **como**, on [15 March 2011 at 3:05 AM](#) said:

exactly. the problem with this article is that the writer describes this particular power plant as if he has been in there.

as we know now:

some of the parts are even missing in the plant built by Toshiba.



378. **Lisa Boucher**, on [15 March 2011 at 3:07 AM](#) said:

There's a small error in your Richter Scale calculation. The difference in energy between a 8.9 earthquake and a 8.2 earthquake is not 7; it's 11. Each number on the scale indicates 31 times more energy (logarithmically, as you indicated). So $31^{0.7} = 11$

379. [Why I am not worried about Japan's nuclear reactors. | Morgsatlarge – blogorific.](#), on [15 March 2011 at 3:07 AM](#) said:

[...] same article appears here <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> and includes [...]



380. **S Bundy**, on [15 March 2011 at 3:11 AM](#) said:

Ironically, the backup diesels were the weakest link in the chain, and the ones that could have been the easiest to retrofit to prevent.

Since the facility was built, much has been learned about the science of tsunami waves, such as that earthquake-spawned tsunami top

out around 10-12 meters. Similar limits also tend to apply to typhoon storm surges (another sea phenomenon that has been researched much better since 1970).

There were probably 6 or more chances (the refueling maintenance periods) where someone could (and probably should) have looked at the elevation of the generators, and relocated them to a purpose-built mound to raise them to 15-20 meters above the surrounding landscape, and into an armored, sealed building protected by berms and battery-powered pumps.

It's probable that the control rooms had similar protection, from their heights in the surrounding buildings – why the equipment meant to be used from the control rooms in a reactor emergency was not given similar protection will probably result in a lot of finger-pointing and plant modifications.

When it comes to safety, it's better to overengineer because nature (and the occasional terrorist) have repeatedly proven that “worst-case scenarios” typically aren't.

381. [Japan nuclear power stations - Page 2 - PPRuNe Forums](#), on [15 March 2011 at 3:13 AM](#) said:

[...] It would have been useful for the hysterically-inclined media (in Australia anyway) to have read this piece before running around like Chicken Little about the Japanese nuclear power stations. Fukushima Nuclear Accident – a simple and accurate explanation BraveNewClimate [...]



382. **Jerry**, on [15 March 2011 at 3:16 AM](#) said:

They should have had power switchover boxes rigged with the correct male and female plugs for any needed aux gen sets with the proper attachment tools at the ready...even Homer Simpson could figure this one. Doh!



383. **Lisa Boucher**, on [15 March 2011 at 3:20 AM](#) said:

Mr. Brook, you also seem to assume that the control rods were successfully inserted immediately after the earthquake began. How do you know this?

If the rods were not inserted all the way, then (of course) there *is* an issue with continuing criticality, and your analysis is fatally flawed.



384. **Lisa Boucher**, on [15 March 2011 at 3:22 AM](#) said:

I misspoke ... I meant there would be an issue of continuing FISSION.



385. **McMike**, on [15 March 2011 at 3:24 AM](#) said:

It was nice of you to declare the crisis over and everything is safe. Unfortunately for you and for all of us, events continue to overtake your effort at spin.

The false equivalences presented here by boosters such as between driving and nuclear power, or ocean shipping and nuclear power makes quite clear that the advocates for nuclear power really ought not be trusted with grown-up decision-making.

386. [Japan is not Chernobyl | Steward Financial Group](#), on [15 March 2011 at 3:30 AM](#) said:

[...] a more detailed analysis of the Nuclear Accident, this article provides a very scientific look at the Fukushima Reactor print a copy email to a friend [...]



387. **Juha**, on [15 March 2011 at 3:38 AM](#) said:

Lisa, continued criticality is impossible even if control rods were not inserted, due to the boric acid in the coolant water. And since these are water moderated reactors, criticality is ALSO impossible if they dry out and there is no water at all.

The only time a reactor design like this can be critical is when control rods are out, AND it's swimming in water that hasn't been treated with neutron poison.



388. **Mike Bird**, on [15 March 2011 at 3:44 AM](#) said:

According to wikipedia the No.1 reactor was commissioned in 1971 with construction starting in 1966. Does anyone know how old the DESIGN of this reactor is? I don't know how the permitting process worked in Japan in the '60s, but here in the U.S. the lengthy process would seem to indicate a design dating to the mid '50s. Are the failures of such outdated technology really pertinent to the discussion of the safety of current designs? A second thought: It seems to me that the failure was not of the reactor design (outdated as it was), rather the failure was in the backup emergency power supply provisions. This is a separate issue from the safety of the reactor itself.



389. **Tatu**, on [15 March 2011 at 3:45 AM](#) said:

Barry, you are probably right in most of your analysis (leaving logarithmic scales aside ;p). But your suggested conclusion is awfully wrong.

Would you like to be one of the guys there at the reactor, trying to manage the contingency, risking – no, sacrificing! – their healths? Would you? "Nuclear Power – Yes please!"?



390. **Masuo Nakajima**, on [15 March 2011 at 3:52 AM](#) said:

Fukushima Daiichi Plant Unit 3 was running with MOX Fuel. This does not change your scenario at all??
oh and $(10^{0.7})^{(3/2)}=11.2$ not 7.0... :)



391. **Wakeup**, on [15 March 2011 at 3:53 AM](#) said:

Someone sitting on top of the containment vessel would get the same radiation exposure as a cross country flight? Someone on the aircraft carrier 100 miles out to sea that they just moved because of radiation detection would get that exposure. Someone on top of the containment vessel would be dead. The hydrogen explosions means the cores are at least partially melted. The very best case scenario is the containment vessel holds and they spend years cleaning up a highly contaminated sight with no good place to put the shit the clean up. That's the BEST that can happen. If one of the containment vessels rupture it will be Chernobyl times 10.

And what's this about it will be dissipated at sea. If it goes in the ocean it just magically disappears and everything is ok. Just like the oil from the BP spill magically disappeared. It certainly seems to work for France. They get most of their power from nuclear and have decided the best place to dispose of the waste is off the coast of Somalia (no messy governments to deal with there). Put it in the Ocean and it dissipates. It's magic.

There is no safe technology. It all fails. If you run the timeline out far enough it becomes a mathematical certainty. But on a much shorter scale you can be certain humans will screw up. Constantly. And do things like build nuclear power plants on a subduction zone – with small containment vessels – and then put the power hookups for the cooling system in the basement. The cooling system which is the only thing that stands between them and a meltdown. It's cheaper. Or extend the operating licenses of dozens of plants here and in Europe even though they are past their design lifetimes (and some like Vermont Yankee are leaking radioactivity into the the ground water). It's cheaper. Or the contractors that cut this and that corner.

Three mile island. Vermont Yankee. Chernobyl. Waste dumped off Somalia? Oh and Japan says everything is perfectly fine and no significant radiation has escaped. And the US says all the oil from the BP spill has magically been eaten. And now facebook tells me everything is perfectly fine. Well I'll just go crank up the thermostat and turn up the lights then.

There is no safe technology. Our lifestyle is completely unsustainable especially in the US. I really can't even imagine what will be left of the world in 100 years. I guess I won't be around to see it anyway.

392. **Japan Tsunami - Spearfishing Planet**, on [15 March 2011 at 3:56 AM](#) said:

[...] [...]

393. [Donate for Japan - help japanese people in need](#), on [15 March 2011 at 3:59 AM](#) said:

[...] Fukushima nuklear plant in Japan after it was rocked by an 8.9 earthquake can be found over there at brave new climate. Worth a [...]



394. **carme**, on [15 March 2011 at 4:08 AM](#) said:

Thanks for sharing.

Catalan translation of Dr. Oehmen here: claricatala.com/2011/03/14/no-em-preocupen-els-reactors-nuclears-japonesos/

With respect from Barcelona, Spain!

395. [Second Follow-Up Interview with my Dad, a Nuclear Engineer, about the Fukushima Daiichi Nuclear Power Plant Disaster in Japan | Global Posts](#), on [15 March 2011 at 4:10 AM](#) said:

[...] My dad refers to this article in today's interview: Fukushima Nuclear Accident- a simple and accurate explanation [...]



396. **giomakyo**, on [15 March 2011 at 4:15 AM](#) said:

They have partial meltdown in reactor 2, possibly in 1 and 3 as well. They have only one functional pump and three reactors with broken cooling systems, so they have to choose which is the most dangerous at any given point in time, when really all three need to be cooled constantly. They need to keep pumping in sea water, which keeps running the risk of hydrogen explosions, any one of which could compromise the core, which would be bad news. If it was the #3 reactor, that would mean plutonium being released. I'm basing this entirely on govt. and industry statements. So you can see how far off base Dr. Oehmen is.



397. **backflash**, on [15 March 2011 at 4:18 AM](#) said:

My question may sound stupid but why cant they use liquid nitrogen to cool it down?



398. **tomw**, on [15 March 2011 at 4:19 AM](#) said:

To those who are ignorant of the Russian designed unit at Chernobyl:

There was NO containment vessel constructed around the reactor. The Russians did not believe them necessary. Thus the problem with magma-like radioactive material spewing forth from the bowels of the reactor.

The only option after the failure was the construction of a concrete 'sarcophagus' poured over the reactor in a huge pile. Said covering is deteriorating rapidly and a more permanent solution is supposedly under study.

tom



399. **Jeffrey**, on [15 March 2011 at 4:22 AM](#) said:

I'd like to be as sanguine as all the experts, but all that's been documented here is a brave prognostication in a "if everything works as designed" sense. However, since no one posting here is actually there, and because the IAEA has just dispatched a team to Japan, I don't think anyone here posting knows anything more than what you are hearing or reading in the press.

TEPCO has an abysmal safety record and you can't trust Japanese officials as far as you can throw them. Since the second day after the quake/tsunami, the official version of things has been that they are getting everything under control. I guess that's why the outer containment building for another reactor blew its roof off today.

I've got a vested interest in this having a happy ending. The last thing we need right now are pro-nuclear experts explaining how what's happened to date is nothing to worry about and that three reactors reaching critical state isn't anything to worry about.



400. **KK**, on [15 March 2011 at 4:26 AM](#) said:

An 8.9 earthquake is 5 times more powerful than 8.2, not 7. It is a log scale, not linear.

$$(10^{8.9}) / (10^{8.2}) = 5.01$$



401. **como**, on [15 March 2011 at 4:38 AM](#) said:

YEAH, all you logarhythimical percussionists... we know it! 78 people have pointed that already out. if this would be the only problem with this article...

and don't waste your time with translating that pro-nuke propaganda into your mothertongue.



402. **wonderer**, on [15 March 2011 at 4:40 AM](#) said:

Hello I have read the article carefully but have some (sorry if naive) questions:

- "The third containment is a hermetically (air tight) sealed, very thick bubble of the strongest steel" so how is the pressure released from that? Are the valves that you mention installed on the third containment?

- What about the people who were found to be infected by radioactivity? From your article I would expect that nobody is harmed.

Thanks in advance



403. **Greg Brede**, on [15 March 2011 at 4:42 AM](#) said:

You mention that the H2 accumulation was the result of venting primary containment (Drywell) to secondary containment (Rx Bld). Why not go to the Stack using Stand By Gas Treatment (SBGT). Was this out of service due to loss of Safety Related electrical from EDG?

Perhaps change to MARK 1 Containment with a manual vent to atmosphere on the refuel floor to vent H2 on station blackout.



404. **Emery**, on [15 March 2011 at 4:43 AM](#) said:

Very informative but it also appears that because of your involvement, hence your understanding, your sound more like an information officer for the industry and to be frank a little cavalier. Glad to know there is nothing to worry about???? There is a lot to worry about. Perhaps its no Chernobyl but there is still a lot of danger to the people in Japan and perhaps others. You also did not mention the MOX fuel used in reactor #3 and the dangers it presents to those of us who don't need to worry.



405. **dandelion**, on [15 March 2011 at 4:51 AM](#) said:

it is like someone posting the user manual for a car which has been already driven against the wall and manual mentioned airbags, but they sparsed out the airbags because....well, stuff like this is so expensive..

406. **[Nuclear meltdown likely underway in Japan!](#)**, on [15 March 2011 at 4:51 AM](#) said:

[...] [...]

407. **[Traduzione finita! Report della CNN pieno di imprecisioni!!](#)**, on [15 March 2011 at 4:52 AM](#) said:

[...] del MIT, riguardo la centrale di Fukushima. L'articolo originale (in inglese) lo trovate qua, qua sotto invece il link per la traduzione in italiano. Josef Oehmen nella sua introduzione (in [...])

408. **[7.9 earthquake hits Japan! - Page 13 - Zilvia.net Forums | Nissan 240SX \(Silvia\) and Z \(Fairlady\) Car Forum](#)**, on [15 March 2011 at 4:52 AM](#) said:

[...] [...]



409. **Robert Ahlskog**, on [15 March 2011 at 4:56 AM](#) said:

This event worries me in the sense that it will be a roadblock in the research and development of better nuclear reactors. I am a layman but I realize the importance of nuclear reactors to sustain our way of living, our energy needs seem to have an exponential growth and there is no way we can achieve this using wind and solar.

I am not against wind, solar and hydro-electric power; I just don't see a way we can maintain the necessary energy output without having nuclear power to provide a solid base that we can complement with renewable sources.

The biggest threat as I see it today is our coal/oil plants that directly contribute to greenhouse gases and frankly should be scrapped a.s.a.p.

As for all you pro-wind people, why is it that we can't build wind power? There is always harsh resistance, mostly from the green-people, citing destruction of nature, killing of birds, reflections causing epilepsy, horrible sound and em-radiation. Now these are things that are preventing the construction of wind power in my home country Finland, I find most of them bogus, but somehow they have effectively halted the development.

I support all additional power sources as I think that humanity needs endless power to achieve our potential.



410. **Marco Togni**, on [15 March 2011 at 4:59 AM](#) said:

You can find the italian translation on my website:
<http://www.marcotogni.it/articoli/centrale-fukushima>

I think a link to this article would be great for all italian people that can't understand what is happening.
Best Regards,
Marco



411. **Esther**, on [15 March 2011 at 5:05 AM](#) said:

Thankyou for all your clarifying explanations.



412. **ObserverofScience**, on [15 March 2011 at 5:07 AM](#) said:

Something that has been forgotten in this is that even though Caesium 137 DOES react with water in a harmless way (besides the exploding part.)...

They are radioactive! It doesn't matter what reaction occurs the half-life of 30 years still stands. Radioactive elements remain radioactive and carry radioactivity beyond any normal reaction with an element like water.

Caesium 135 will stay radioactive for millions of years.

It isn't the isotopes reaction to outside elements that matters, it is the radioactivity. This radioactivity was detected on American Fighter Jet pilots hundreds of kilometers away when they returned to aircraft carriers. The original 12 mile zone was really a hundred kilometers plus.

Although Dr Josef Oehmen gives a good analysis, it isn't complete and the facts are only given on information that has been released. We always find out later that things aren't often as they first appeared and the truth is somewhere in the middle.

Many scientists other than Dr Josef Oehmen are expressing great worry, he is saying don't worry.

We DO KNOW Caesium HAS been released.

That leaves the truth to be something to take note of.



413. **Eric Gisin**, on [15 March 2011 at 5:10 AM](#) said:

“uranium stopped decaying” should be “uranium fission stopped (or slowed to a trickle)”



414. **ObserverofScience**, on [15 March 2011 at 5:18 AM](#) said:

<http://www.lenntech.com/periodic/elements/cs.htm>

Something of interest.

415. **Some links | mischkulanz**, on [15 March 2011 at 5:24 AM](#) said:

[...] <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> This entry was posted in The Net. Bookmark the permalink. ← Meltdown reported in Fukushima 3 LikeBe the first to like this post. [...]

416. **keikosan.com | Keiko Ichiguchi's blog from Bologna – 市口桂子のポーロニャな日々**, on [15 March 2011 at 5:25 AM](#) said:

[...] trovato un sito curioso sull'incidente nucleare di Fukushima. Spero tanto che abbia ragione questo [...]



417. **Nuclear researcher - Reactor design and radiation effects are my forte**, on [15 March 2011 at 5:28 AM](#) said:

Some help;

Ischubert – The containment may not have been tested but similar ones have such as 3 mile island. It is also HUGELY over engineered. They work out how big it has to be to contain the fuel in this situation (using simulations) then they make it MUCH bigger and stronger than it needs to be.

armchairpilot – Cesium isn't the real issue iodine is. Because such small amounts have been released the only danger is if the material is ingested or inhaled and accumulates. Cesium will not accumulate, but spread out. Iodine will accumulate in parts of the body so it is an issue. However the iodine half life is very short so will almost be gone!

Emery – MOX fuel is only different as it contains 3% Plutonium. The other cores at this stage in their lives will have ~1% Pu due to neutron capture in uranium (called breeding). So they all contain Plutonium, which isn't any worse. If anything Plutonium is more mechanically and thermally stable.

I have missed a lot of other questions but please feel free to email me about anything you're interested in. The media has oversaturated a lot, and paraphrased very inappropriately:
the.smeghead@gmail.com



418. **Ben**, on [15 March 2011 at 5:32 AM](#) said:

It will be fascinating to find out which side is right in this argument. Two quite opposite opinions battling over what is really the situation. We should find out soon enough.

419. **Why I am not worried about Japan's nuclear reactors.**, on [15 March 2011 at 5:44 AM](#) said:

[...] There exists a copy of this post on Barry Brooks excellent blog, where you can still use the discussion function: <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]

420. **Security Musings » Blog Archive » Lessons from the Fukushima Nuclear Accident**, on [15 March 2011 at 5:46 AM](#) said:

[...] a great, detailed description of the entire incident, check out Barry Brook's post “Fukushima Nuclear Accident – a simple and accurate explanation”... over on the Brave New Climate blog. It's an excellent discussion of the accident, which [...]



421.

Paul, on [15 March 2011 at 5:52 AM](#) said:

So buildings blowing up is all part of the plan. Nice plan.



422.

TinHat, on [15 March 2011 at 5:54 AM](#) said:

Thanks for the enlightening article.

I am sure there were good reasons to do so, but I am puzzled why a BWR which doesn't need seawater to run, is built so close to the ocean, facing a known subduction zone.

As a layman, I would recommend NOT building any future BWRs on the coast, but inland, just a few tens of Km. And implement a minimum height above mean sea level (say 30-40m). I noted other suggestions that they be moved to the West coast, but that is far from the centres of population. I think there is a happy compromise which, yes, may require extending the high tension power lines to the new area in the foothills, but certainly seems like a safer option going forward.

And the story about the power plugs not fitting? You can't be serious! Any competent electrical engineer could resolve this issue. I'm going to spend the rest of the day trawling through the news reports to try to get a better understanding of the precise issue. It just can't be as simple as stated.

I am a nuclear, wind and solar proponent.



423.

Dick Mays, on [15 March 2011 at 5:56 AM](#) said:

Imminent thermonuclear meltdown is a better news story. Fair and Balanced news require reporting the other, non scientific side of the story too...



424.

Paul, on [15 March 2011 at 5:56 AM](#) said:

You see, buildings blowing up are no reason to be concerned. Trust us, we have this completely under control. Thank you Bill Wattenburg.

425. [.jpg Blog» Blog Archive » Nuclear Safety – Fukushima](#), on [15 March 2011 at 6:01 AM](#) said:

[...] Second, The Register links to this article with great technical detail: <http://bravenewclimate.com/2011/03/13/fukushima-simple-explanation/> [...]



426.

Mike, on [15 March 2011 at 6:06 AM](#) said:

After working in the media myself and being a bit educated about the distance to which some (all?) media trusts would go to sell their material and drive the general attention upon it, I have to say that I trust this article to be a lot more accurate and transparent than the general mambo jumbo you've been seeing on the news lately. Why I choose to believe this? Because i've spent the last 10 minutes reading hard facts as opposed to the televisions that have been feeding one overexaggerated scenario after the other to the general (sorry to say this but it's true) uneducated population – I mean c'mon, how many of us are actually nuclear scientists and can pick the truth apart from the little white lies? Thank you for a great and educated explanation Mr. Brook.



427.

liggamite, on [15 March 2011 at 6:09 AM](#) said:

@m from previous discussion: i would like to remind you that your "clear, brutal facts" come from biased sources as well. You have no idea if its actually 200,000 people. Every source is biased. There's no point in arguing until whatever happen's happens.



428.

liggamite, on [15 March 2011 at 6:11 AM](#) said:

however i understand your criticism



429. **Lisa Boucher**, on [15 March 2011 at 6:13 AM](#) said:

KK — Your calculation is incorrect, because the base of the exponent is 31, not 10.

Source: <http://earthquake.usgs.gov/learn/topics/richter.php>

“each whole number step in the magnitude scale corresponds to the release of about 31 times more energy”



430. **D R Lunsford**, on [15 March 2011 at 6:15 AM](#) said:

liggamite,

Because people no longer trust the usefulness of reality, it does not matter what the facts are at all, before of after, whatever the source. Humans are determined to enter a new dark age, and nothing can prevent them from having their way, except perhaps a well-aimed asteroid. Shoot straight, God.



431. **G.R.L. Cowan, hydrogen energy fan until ~1996**, on [15 March 2011 at 6:16 AM](#) said:

TinHat writes,

but I am puzzled why a BWR which doesn't need seawater to run ...

It needs freshwater inside, and any kind of water outside, in large amounts, to cool the freshwater — actually to condense it from steam, but this is still something cool water can do — nearby outside.



432. **Key**, on [15 March 2011 at 6:28 AM](#) said:

What I don't get is this – and it's probably simple to some people, but I'm no nuclear engineer. If the rods can't be cooled and continue to heat, and they melt, what happens next?

These fuel pellets have a high melting point of 2200 degrees. Steel melts at approx 1370 degrees. The base of the containment is concrete and might well have been subject to damage from the earthquake. Zircaloy melts at 1850 degrees, which will not contain the fuel or the melting rods.

I can't see how this can be contained unless they can be cooled properly. if the fuel and the rods melt. I think we're heading for a disaster much bigger than Chernobyl.

Nuclear energy is not safe, produces dangerous waste, and incidents are played down by so-called experts. People are still suffering from the effects of Chernobyl now. My heart goes out to all the people of Japan – especially those sacrificing their lives to avoid major catastrophe in the nuclear power plant.



433. **Jesse Josserand**, on [15 March 2011 at 6:39 AM](#) said:

This report by this PhD is already wrong. More radiation than should ever have been released ALREADY HAS!!!



434. **a tree branch**, on [15 March 2011 at 6:41 AM](#) said:

You make an error in math. An 8.9 is only about 5 times larger than an 8.2 in log scale.

$$10^{(8.9)}/10^{(8.2)}=5.01$$

...anyways...

The zirconium melting disassociates the water into H and O so that would imply temps above 2200 celsius.

If, as you say, the uranium oxide is in pellet form, wouldn't they fall to the bottom of the second containment. Because the first containment has melted away. If they get clumped up at the bottom pressure cooker aren't they more likely to go supercrit, runaway on the engineer so adding water instantly boils off?

435. 

Chris Harries, on [15 March 2011 at 6:45 AM](#) said:


We can be thankful that public concern over reactor safety is actually a very positive thing in that over the years it has required the nuclear industry to implement stringent safeguards and (as is now being demonstrated) these safeguards are indeed warranted.

So a heartfelt thanks to all those who have been a part of these advances, pro and anti nuclear folk alike.

Some within the nuclear industry have no doubt resented such safety advances because they have contributed to a prohibitive cost of nuclear power construction rendering that technology less cost competitive than other energy sources. But just imagine for a moment if those standards had not been developed as they have.

Actually, we don't have to imagine, we know what happened with BPs rig in the Gulf of Mexico – deep sea drilling for oil had no rigorous safety regulations in place and in the aftermath of that debacle the nuclear industry was cited as a prime example where regulations had been forced on an industry as a result of public concern.

The Fukushima incident will be very helpful in the research and development of safer nuclear reactor technology. It was fortuitous in a way that this incident happened within a jurisdiction that has the technical capacity and resources to handle the emergency, just imagine if this same event was occurring right now in earthquake-prone Indonesia.

436. 

G.R.L. Cowan, hydrogen energy fan until ~1996, on [15 March 2011 at 6:50 AM](#) said:

If they get clumped up at the bottom pressure cooker aren't they more likely to go supercrit

No, subcritical. Criticality or supercriticality, with low-enriched or unenriched fuel, requires that the neutrons leave the fuel for a while, and travel through a moderator, e.g. water, and then return to fuel.

So fuel lumps spread out through moderator can be going along in that state, and then, if they fall together, they are extinguished by the absence of moderator in between.

437. 

chiyuki, on [15 March 2011 at 6:53 AM](#) said:

I thank you for posting it and Yamanaka, translating in Japanese.

438. 

Richard Snow, on [15 March 2011 at 7:07 AM](#) said:

The plugs didn't fit? That's why they make hacksaws and electrical tape. Sometimes you have to bend the rules.

439. 

anime superpowers, on [15 March 2011 at 7:13 AM](#) said:

errors and errors too by the end not limited to:
“because the Uranium decay was stopped a long time ago”

wording denies law of physics if I understand the translation correctly. half-life of the the active isotopes. the decay is still present at some levels due to half-life but there is high chance all the particles that can activate another uranium atom are trapped by the control rod. so the ratio of decaying:newly activated is

if the “likely to happen” condition far above in the text is true then probably the more correct wording should be: stopped the excessive activation among different fuel rods (continues in the rod itself ? lot less heat produced but still some? slowing down the decay of

uranium closer to the levels of extremely small quantities in ratio to the mass in the reactor.

i'm no hightech. but that last part sounded ridiculous. so did I got at least a closer to the perfection this part?



440. [Kaj Luukko](#), on [15 March 2011 at 7:13 AM](#) said:

Chris:

The Fukushima incident will be very helpful in the research and development of safer nuclear reactor technology.

AFAIK, there was nothing wrong with the reactors in Fukushima. The one and only cause for troubles seems to be the diesel generators that couldn't withstand the tsunami.

That's obviously a design failure, or risk management failure or something. And it's a shame, a VERY BIG SHAME, and I'm sure we will hear more about this in near future.



441. [Fukushima und die Entdeckung der Langsamkeit | Christian Buggischs Blog](#), on [15 March 2011 at 7:14 AM](#) said:

[...] den Fernsehleuten das Leben damit auch nicht leichter. (Wen's interessiert: Hier gibt es in Englisch oder Deutsch den Versuch einer seriösen Einordnung der Ereignisse in Fukushima – [...])



442. [John Lindsay](#), on [15 March 2011 at 7:15 AM](#) said:

Amateur idea: Could a number of pressure vessels in series with a reserve of stored water be used to recycle steam like a massive distillation apparatus until such time as the core residual heat begins to fall? I suppose that redundancy would be too expensive even if it was theoretically possible.



443. [Edgardo](#), on [15 March 2011 at 7:21 AM](#) said:

Nothing to see here folks but last ditch efforts, buildings blowing up, partial meltdowns, cesium poisoning our food chain, move along now.

444. [Massive Earthquake Hits Japan *Merged*](#), on [15 March 2011 at 7:22 AM](#) said:

[...] [...]



445. [John](#), on [15 March 2011 at 7:22 AM](#) said:

It is nothing new that the media targets the "mass" or "corporate slaves" or the "unfortunates" to cause panic, fear, anxiety and curiosity as well as "the lust to see some action". I particularly enjoy the facial expressions some journalists are required to have and use while recounting certain events (which is the reason you always see the same people telling the news). People are being influenced to watch more, to keep the channel on, all to benefit the news broadcaster, or at least, the owner of it. Unfortunately the wrong people like Murdoch and Co will now become richer, due to the already general mass population watching this now for hours a day.

I totally agree with person that wrote this article with how a nuclear powerplant functions and that it cannot explode and that it cannot turn into a next Chernobyl. I do not comment on the calculations as I am ignorant in regards to advanced mathematics and physics, but the fact is, it will not turn into a dirty nuclear bomb and spray around crop, farm animals, people which then pass the radiation on to anyone else they just get close to.

I would also like to add that now is no time for a mathematics competition nor a who is wiser than the author. I am sure that the author of this needed to write something as fast as possible since every second counts before more people become infected from the news virus, so therefore errors in any regards such as calculations or exact decaying times, even if it takes 30 years instead of 30 seconds for now are tolerated. Because much worse is people being infected by the news virus that go around spread their ignorant viewpoints as recalled from Fox News and CNN.

Propaganda and news broadcasts are after all a weapon of mass destruction much greater than what is happening in that plant right now so I thank the author for his time in diverting people off those horrible news virus producers that are cashing in big time by the second.



446. **Pragmatist**, on [15 March 2011 at 7:29 AM](#) said:

It's interesting that Dr Josef Oehmen is introduced as a "Phd Scientist" when he seems to be an economist.
http://lean.mit.edu/index.php?option=com_content&view=article&id=845&Itemid=816
I'd have an easier time believing this report if he had any publications that had anything to do with nuclear power.



447. **refields**, on [15 March 2011 at 7:35 AM](#) said:

In his summary Josef says

"A very small amount of Cesium was released, as well as Iodine. The Cesium and Iodine isotopes were carried out to the sea and will never be seen again."

This is a highly inaccurate and misleading description. Radioactive Iodine -131, after it is breathed or injected, immediately accumulates in the thyroid gland. Its radioactivity decreases about 8% per day, so that after 2 weeks there is still 31% of the radioactivity present. If the initial level were one million times the safe amount, 2 weeks later there would still be 300 thousands times the safe amount.

Cesium-137 has a half life of 30 years which means that its radioactivity decreases only by about 2% per year. It is water soluble and is absorbed by vapor in rain clouds from where it can be blown anywhere and deposited on large areas of vegetables and on grass which animals eat. This leads to the supply of radioactively contaminated food and especially milk and meat products.

Josef's post is an insidious example of deliberate disinformation used in "crisis management", which as it happens, is an area in which Josef is an expert, as shown by his publication list at

<http://web.mit.edu/oehmen/www/>



448. **Joffan**, on [15 March 2011 at 7:50 AM](#) said:

Pragmatist, your own link describes him as a Research Scientist and he certainly has a PhD. Rather than an economist, I'd say he is a business systems engineer. Still not a nuclear scientist of course, but a technical background and interest in the area is often a better precursor for a popular article than a deep technical knowledge.



449. **Douglas Warne**, on [15 March 2011 at 7:52 AM](#) said:

I only hope the assertions of the author of the article (a research scientist at MIT Boston whose father has extensive experience with the German nuclear industry), are correct and that the 'final-line-of-defense containment' in these reactors has remained uncompromised as intended.

Its fair to say that (at least in my opinion) when we get to the 'final line of defense' in a nuclear accident with six, possible more individual reactors in full crisis mode simultaneously, that there is reason to be concerned whether that 'final-line-of-defense' in each of those reactors will hold up as intended. Each Japanese nuclear 'plant' has as many as 5-6 'reactors' in each plant.

It would appear that no less than 'four more reactors' in various plants will be allowed to reach 'the final line of defense' in full fail mode — because of inoperative primary cooling systems, secondary cooling systems, emergency diesel back-up cooling systems, and, last but not least — hastily installed (but inadequate) mobile diesel cooling systems.

At this point they are resorting to pumping in sea water (the cooling measure of absolutely last resort...it has never been done before) to prevent the core getting so hot it could possibly compromise the final containment tomb. That seems like it would work so I'm somewhat comforted. That's what the explosions are you see on television — when sea water meets near molten reactor core the hydrogen and oxygen in water separate. The pressure has to go somewhere. The so called hydrogen explosion. A giant pressure release. They claim they are controlling that. I'll play along. I want to believe. But my skeptic keeps poking me. I wish he would stop.

Seawater however destroys the reactor as an asset. It can never be used to generate power again. In other words they are flirting with meltdown up to the very last minute in an attempt to salvage an asset (admittedly a needed public utility too. Its freezing in Japan right now on top of everything else they've endured. It's a full blown apocalypse for the fine people of Japan.) We must trust that they know best when to start pumping in seawater and abandon trying to save a capital asset. Nuclear brinkmanship of a different order. They are balancing on the head of a pin. A lot of Japanese national pride hangs in the balance. Wish them good luck and pass it on. They could use some good luck right now.

In other words we need to have faith that highly unstable and dangerous near molten radioactive material in borderline meltdown mode will be 'contained' by the final line of defense — basically a very large concrete tomb and that the operators will know the precise moment when to give up on saving the reactor and throw the seawater in there to slow old Nuclear Nelly down. I won't even tell you about the failed gauge at Reactor #1 that prevented them from knowing the actual core temp — so I'm assuming they used their best guessimate when to start pumping in the seawater. Pray for the integrity of that concrete tomb. Four more containment tombs have to survive their first (and only) test too in the coming days. Again I am only assuming that the first two have. Pray that I am right. Prayer actually could make a difference now.



450. **8Dm**, on [15 March 2011 at 8:02 AM](#) said:

Very good and informative article.

As an Iranian, with all my peace and love please accept my excuse if I couldn't answer the question regarding the difficulty of building a nuclear bomb.



451. **KG**, on [15 March 2011 at 8:06 AM](#) said:

Tsk, tsk. If only the Japanese government had read this, they wouldn't have evacuated 180,000 people from a 20km zone around Fukushima 1, in the middle of a huge natural disaster. Nor would they have asked for international experts to help them deal with the problems at the site. And if only Tepco had consulted Barry, and discovered that "The plant is safe now and will stay safe.", they wouldn't have left workers on site so that several were injured, one seriously, in the second explosion.



452. **Keith**, on [15 March 2011 at 8:07 AM](#) said:

The cold, hard, inescapable fact remains: THERE WAS NO CATASTROPHE. Those powerplants were hit by one of the most powerful earthquakes in human history (an earthquake several times more powerful than they were built to withstand), AND they were hit within an hour by one of the most powerful tsunamis ever seen. They were clobbered by a one-two combination of historic proportions, and despite that, THERE WAS NO MELTDOWN. Those of you were hoping and praying for a disaster that would fuel your anti-nuke hysterical propaganda reactor, sorry about that.



453. **Douglas Warne**, on [15 March 2011 at 8:08 AM](#) said:

High res. satellite pic of Fukushima Daiichi plant with Reactor #1 to the bottom and reactor #3 to the top. Photo taken 3 minutes after the explosion. Email me for pic if Flickr is down.

<http://www.flickr.com/photos/digitalglobe-imagery/5525887859/sizes/o/>

Similar photo of Chernobyl reactor block after explosion. I'm sorry but Reactor #3 looks to be in much worse shape than Reactor #1 after their respective explosions. Secondary containment is visible above Reactor #1. Not so clear if it is above Reactor #3.

http://electrodes.files.wordpress.com/2009/07/chernobyl_reactor4_disaster_03_05_86_1.jpg

if you have trouble accessing email me and I will forward both pics for you.



454. **KG**, on [15 March 2011 at 8:10 AM](#) said:

Now that idiot Japanese PM Kan is saying:

‘A worrisome situation remains but I hope to take the lead in overcoming this crisis. I will take all measures so that damage will not expand.’

I’m sure he’s just grandstanding, and really, it’s all completely under control as Barry assures us.



455.

Atkins, on [15 March 2011 at 8:11 AM](#) said:

I am sure Dr Josef Oehmen had the best intentions while writing this, but it clearly doesn’t stand. Too many assumptions are made. That the government actually reveals all information in a correct manner. That operators are performing correctly (meaning following the book). That the construction of the reactor is as described.

Any of those assumptions might be easily ill-founded. Clearly there is not enough information as to what is happening at the site. Different sources give different information, France even put the incident higher on the scale. While the western media certainly goes over the top, in Japan not much is said by the government. As an example, the Toshiba containment vessel designer said that they have no idea if the containment vessels are completely intact for sure, that some of the monitors might not display correct information etc.

Also, many points of the article are already disproved. The author clearly stated that there is no danger even if one must sit on top of the reactor. That doesn’t fit with evacuating 200 000 people (evacuation which in itself is dangerous and may cost lives) and screening some for radiation. Or US troops measuring elevated levels kilometers away from the site. Or Japan calling for help from US.

The article also doesn’t take in account what aftershocks can do to that situation (there’s still one 7 forecasted with 70% chance), tired operators and whatnot.

This surely isn’t going to be a Chernobyl, no doubt about that. But it is also only 270km away from 12 million people.



456.

spark, on [15 March 2011 at 8:12 AM](#) said:

@Greg Brede

In the original Mark-I design, the suppression pool was believed to sufficiently relieve steam pressure. But:

“In 1986, Harold Denton, then the NRC’s top safety official, told an industry trade group that the “Mark I containment, especially being smaller with lower design pressure, in spite of the suppression pool, [...] you’ll find something like a 90% probability of that containment failing.” In order to protect the Mark I containment from a total rupture it was determined necessary to vent any high pressure buildup. As a result, an industry workgroup designed and installed the “direct torus vent system” at all Mark I reactors. [...] the vent is a reinforced pipe installed in the torus and designed to release radioactive high pressure steam generated in a severe accident by allowing the unfiltered release directly to the atmosphere through the 300 foot vent stack.”

<http://www.nirs.org/factsheets/bwrfact.htm>

Filtering should be of minor priority under accident conditions. Either the steam was already in the containment, the venting system failed, or it was never retrofitted to the reactor in question at all. Also see this 1987 article I have linked to repeatedly over the last days, that describes what happens after containment venting (release into reactor building) and seems to have been written before the “direct torus vent system” was developed:

CONTAINMENT

VENTING AS A MITIGATION

FOR BWR MARK I PLANT

<http://linkinghub.elsevier.com/retrieve/pii/0029549388900568>



457.

KG, on [15 March 2011 at 8:14 AM](#) said:

“an earthquake several times more powerful than they were built to withstand” – Keith

Which raises the question: why were they not built to withstand more powerful quakes and larger tsunamis? This was a large earthquake, but far from unprecedented: the Chilean quake of 22 May 1960 was a 9.5.

BTW, Keith, the earthquake and the tsunami were not unconnected, so to call this a “one-two” as if they were two independent events is daft.

“Those of you were hoping and praying for a disaster that would fuel your anti-nuke hysterical propaganda reactor, sorry about that.”

I think this sort of comment says more about you than about anyone else.

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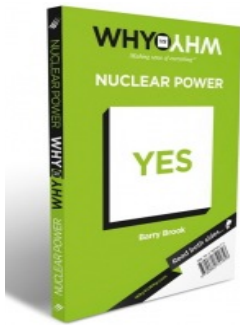


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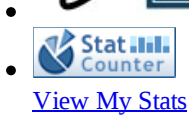
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- The fuel, be it uranium or U-Pu MOX, is irrelevant unless containment is breached. No indication that this has occurred, just as in Unit #1. 18 hours ago



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