



# “Then Bring the *Mountain to Mohammed!*”

## The **Only Immediate**, Safe, Spent-Fuel Fuku-Fix

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The risk of an unstoppable pyrophoric fire starting in the spent-fuel pools on Fukushima Daiichi Reactors 3 **and** 4 continues to alarm many scientists and government officials around the world. Why is this paper needed? Mr. Kitazawa, the chairman of the Fukushima Accident Council stated: “It takes a [long] while to remove all the spent fuel from the pool. *There is no appropriate solution for that.*” In other words, a whole World of “experts” *simply don't know what to do!* This is because **no experienced** experts yet exist since no one has, *ever before*, **needed** to stabilize a fuel pond that was precariously perched on a crumbling building under such daunting conditions, fully expecting a major earthquake at any time! Clearly, we must now consider unorthodox solutions. **This paper presents the first and only solution that is both thorough—AND (hopefully) will be done soon-enough:**

We cannot *immediately* bring the spent fuel rods safely down to the ground, therefore, we **must immediately** bring the ground *up* to directly support the Spent Fuel Pond itself.

Why consider the opinion of a Non-Nuclear expert? The inherent problem with expecting even the brightest experts in *any* profession to think *very far* “Outside the box” is that the peer-pressure, standards and expectations of their profession often chain them *very* closely to the inside of their *own* “Box.” For example TEPCO is *already* implementing the best solution that the nuclear industry can come up with—but this solution will not be ready anywhere near soon-enough, yet seemingly, they are sincerely *unable* to even *imagine* anything outside of their own “Box.” We must at *least* **consider** proposals from outside of the nuclear engineering professions since we are serious about finding a quick method to resolve this crisis.

For example, the present proposal is a civil engineering approach to what has previously been defined as a structural and *nuclear* engineering problem; thus, due to this cross-disciplinary overlap, nuclear engineers, structural engineers and civil engineers might *each* tend to be reluctant to *individually* endorse this plan, unless they are first coaxed into discussing the details of their concerns with each other.

Actually, it *appears* that structural engineering mistakes are already being made. (*Hopefully*, this is merely an artifact of bad-translation.) Engineers are reported to have installed 32 “pillars” to help support the Fuel Pond. If translated correctly, “pillars” implies mere vertical support. Presently, the biggest hazard to these reactor buildings is **not** from **vertical** forces, rather, it is from **horizontal** movements of the ground in an *Earthquake*. *Especially since the walls of the buildings are no longer providing diagonal support (to divide unstable square structures into stable triangular structures.) Additional diagonal supports would actually stabilize the building a great deal. Additional vertical supports, are helping a very small amount, if at all.*

We have been far luckier than we deserve, up to this point. The likelihood of the spent fuel ponds at Fukushima Daiichi Reactors 3 & 4 crashing to the ground or otherwise-losing their abilities to hold water in the very-near future is terrifyingly *probable*, especially if *this unique proposal* is not *immediately implemented*. Therefore, finding an *immediate* solution is so urgent, that this

unorthodox plan should be *immediately* implemented unless there is **already** a *quicker*, more effective proposal that is **already** prepared to roll out.

So far, the only competing idea is to form an international blue-ribbon committee to think of “*something* that is quicker than TEPCO's reliance on their own slow conservative plan!” This new proposal *is* as good a plan as anyone else is likely to both devise *and* to implement *soon-enough*.

Mitsuhei Murata, Former Japanese Ambassador to Switzerland and Former Japanese Prime Minister Naoto Kan and many technical experts have affirmed that, even in the early days of the nuclear disaster at Fukushima Daiichi (1) following the great Tsunami of 2011, it was *already* apparent that a horrifically dire, worst-case scenario could happen at any time. They *still affirm* that this likelihood *still* hangs over us; nonetheless, everything appears to be business as usual, as though none of this is still true. The former ambassador says that he has been advised by many qualified experts that the Fukushima Daiichi Reactor 4 Fuel Pond *still* endangers everyone on Earth. More recent analysis strongly suggests that the danger to the Fuel Pond on top of Reactor 3 is every bit as serious and perhaps more precarious.

Soon after the accident started, it was *initially* feared that one or more reactor containment vessels would explode, but this *in itself*, was **not** their greatest fear. It was recognized, even at that time, that such an explosion would leave the site so radioactive that it would have to be abandoned; consequently, without ongoing site maintenance, catastrophic amounts of radiation would be released, not so much from “*merely*” melting and exploding reactors but **mainly from the Spent Fuel Ponds**, each of which contain the volatile spent cores of **many years** of core replacements. Things were *already* looking so bad that TEPCO, the reactor owner was going to totally abandon the entire site until the Prime Minister Naoto Kan intervened, saving the day.

Even though, at this point, the containment vessels are unlikely to explode the same basic problem still hangs over us. Two Spent Fuel Ponds are precipitously perched on top of *two* crumbling

Reactor Buildings. The Reactor 3 Building and its Fuel Pond is probably in worse shape than the Reactor 4; the fact that it contains half as many fuel rods is totally irrelevant since its collapse would *still* be sufficient to cause *all* of the fuel ponds at the Fukushima Daiichi Reactor Complex *and the Daini* Reactor Complex, and the Tokai Reactor Complex to be abandoned and to run dry, dooming millions of people to early deaths, still births and birth defects Worldwide.

Another strong earthquake is expected to occur very soon; this will probably bring one or both of these two Fuel Ponds crashing to the ground unless *immediate* action is taken on *this* proposal *soon-enough*.

Soon after being exposed to the air, the Zirconium cladding on the fuel rods will ignite into a thermite-like Zirconium fire that may be impossible to extinguish under the incredibly difficult conditions that would then prevail. Strangely, most people seem to have simply breathed a sigh of relief that the reactor vessels will not explode, *even though the main problem is still present!*

This evacuation would **not** be confined to the Fukushima Daiichi (1) Reactor Complex, but was- and is still- expected to result in a domino effect of having to abandon the Fukushima Daini (2) Complex of reactors which is only seven miles away, as well as having to abandon the Tokai Complex of reactors which is only thirty-five miles from Tokyo. This will lead to a **total release of all possible radiation from those sites as well.**

Extrapolating from the evacuation deaths of people who turned out to be too fragile to move, in Fukushima Prefecture, an evacuation of Tokyo would extrapolate to tens of thousands of deaths of people who are too fragile to move from *there*. Former Ambassador Murata and Former Prime Minister *both* say that Tokyo would be abandoned for centuries. They *both* say that this would require an evacuation of fifty million people, an evacuation that would have to be completed in an impossible three-week time-span. *In contrast, the present proposal would prevent this; indeed, this "Stitch in time" could probably be implemented in less than three weeks, with no casualties.*

The Reactor 4 Fuel Pond is the one that is getting all of the bad press, but really, the Reactor 3 building is probably more structurally compromised than the Reactor 4 Building since at least one of its fuel pond explosions appears to have experienced a detonation---meaning that the explosion shockwave was supersonic. If so, it was a criticality event that forcefully blew itself apart, ending the reaction. (In contrast, nuclear bomb blasts must be deliberately designed so that the critical mass is positioned in the center of a chemical implosion that holds it together long enough for the chain reaction to *really* get going.)

The simplicity of this proposal lends itself to being implemented in a way that is a win-win solution between any and all concerned parties, including political, commercial and organized crime interests, the best interest of the Japanese people as well as of the rest of the World.

It is essential, at this point to avoid causing anyone to lose-face; and to also provide opportunities for the restoration of honor of people who have already lost-face, so they can redeem themselves by courageously doing the right thing now. It might even be wise to offer *generous* immunity to future prosecution in exchange for cooperation, in the interest of expediting this crucial plan.

This report, unlike earlier reports is not intended as a criticism of any current efforts to solve the profound problems at Fukushima Daiichi (number one) or anywhere else; instead, it seeks to supplement and to unify those important ongoing efforts. For example, the report is *not* alleging that there is anything wrong with TEPCO's current plans to continue building a proper crane that is in keeping with all the usual engineering practices of such a project. This report is merely arguing the obvious point that their plan *must* be supplemented with *this* plan which can be done right away. The emergency-plan outlined in this report can be inexpensively reversed at any time. If existing contracts are delayed, this can be remedied by adjusting their terms to reflect the time-value of *profit* that was to be paid to them, only for completed work.

It is *already* widely-known that *some sort of immediate* emergency steps *must* be *immediately* undertaken to *immediately* supplement all current efforts to prevent the collapse of the Fukushima Daiichi Reactors 3 and 4 Spent Fuel Ponds. Yet we have been told that we must wait for three or four years for this process to be completed, even though one of the worst disasters in human history could strike at any moment. (Unbelievably, TEPCO's newly "expedited" plan is to merely **start** removing fuel rod assemblies sometime in 2014!)

As already noted, seemingly, no one has a better idea. The *only* competing proposal has been, in essence, to form an international blue ribbon committee to think of "*Something better!*" This report **is** what they *would be* searching for---let's get on with it!

- Experts are forecasting a magnitude 8 earthquake, yet even TEPCO, the owner, admits that the current Reactor 4 structure can only be safely relied upon for magnitude 7 earthquakes. Much less is known about the structural condition of Reactor 3. (It is extremely doubtful that any amount of structural reinforcement will be sufficient to keep these buildings from falling; this is because, although the site was originally excavated so the foundations would rest on bedrock, the 2011 quake nonetheless caused portions of the foundations to drop unevenly, up to thirty inches, unevenly shifting different parts of the foundations. It is exceedingly unlikely that the building could withstand any further changes in the underlying bedrock itself. (That bedrock itself has been moving is evident by the fact that land has changed elevation in many locations on the Northeast Coast of Honshu; this has even caused some land to sink into the Sea.
- Most independent experts strenuously dispute that it would even survive earthquakes that are considerably smaller than Magnitude 7; indeed, such still-deadly, smaller earthquakes are even far more likely to strike sooner and more often.
- It is frighteningly easy to draw a dangerously misleading conclusion from the fact that the reactor owner, TEPCO, successfully fought one *mere* hydrogen-gas fire in the miraculously still-intact fuel pond above Reactor 4; there is no reason to believe that a pyrophoric fire can actually be fought in the much-worse environment that would prevail after a pool-collapse; which would be *immensely* worse than the conditions at the time of the first fire:

- This would be a pyrophoric (metal-burning) fire, not a mere hydrogen fire, like the earlier fire; instead, the burning zirconium cladding would be more like an *enormous* thermite fire, one that could not be extinguished with water, even if fire-fighters could get close enough---which they *wouldn't* be able to do, anyway.
- Since the Spent Fuel Rods would no longer be *mostly*-covered with water, as before, they would be continuously broadcasting horrendous, unprecedented amounts of totally unshielded radiation that would instantly kill anyone getting close-enough to the reactor to actually fight the fire.
- Skyshine, (radiation that shines up into the air and reflects back down,) could be deadly for miles around the exposed fuel rods, even *before* there is a fire.
- Tons of highly radioactive particles would be carried high into the atmosphere by the tremendous updraft from this incredibly hot fire and would spread Worldwide, especially concentrating in the Northern Hemisphere.

A simple, emergency solution is proposed in this paper that can be *immediately* implemented.

- Access to critical areas of the plant and of the reactors would be preserved.
- It facilitates a diplomatically positive approach that helps all parties to save face or restore their already-lost honor, or to even make more money than they are already making.

Also:

- It enables all parties to make *more* money without interfering with existing agreements.
- It improves the currently-faltering public image of Tepco, and of the nuclear industry, by demonstrating that they can and will be flexible-enough to implement effective, timely solutions to protect the public safety.
- Amnesty from crimes against humanity should be *discreetly* worked into the agreement in exchange for cooperation with this plan.

It should not be our intention to disrupt existing contracts or agreements or to in any way impugn anybody; actually, this proposal represents an opportunity for additional profit for these same parties, if they will support it. The fact that this is a temporary solution also helps save-face since it lacks the formal elegance of more-permanent current efforts.

This win-win attitude is adopted because, due to the urgency of the problem, there is no time to play blame-games that, at this point, only impede progress. There will be plenty of time, in the future, to hold people responsible for their actions---hopefully those who have made mistakes will also be forgiven and even honored for finally doing the right things, (like promoting this plan,) in the eyes of courts and of history.

## ***How to Immediately Get the Fuel Rods Safely "On the Ground."***

*The main idea is to RAISE THE GROUND, to IMMEDIATELY support the floor directly beneath the pond. A specially-designed crushed rock aggregate will fill and surround the two Reactor Buildings. Sewer Pipes can be placed and buried to preserve access to critical parts of the Reactors.*

An aggregate will be prepared in which jagged rocks are mixed with smaller rocks that are about the right size for the smaller rocks to approximately fit inbetween the larger rocks to help them lock into place. Still-smaller-rocks will fill-in between *these* rocks, and so-on. (Ordinary smooth gravel, sand and dirt shift and settle too much. Concrete is not practical, such large blocks of concrete would take decades to set unless time-consuming plumbing ran through it to take away its heat of formation. )

- Precise mixtures of various grades of complementary sizes of *crushed* rocks that will interlock and sand of specific size distributions can be prepared that will easily flow into place, yet it will settle into an extremely stable-nonshifting platform without settling. (Not settling is very important since we need the aggregate that is poured between the different floors to continue supporting the level above it, to prevent loading of the next level to cause it to break through that level's floor which could compromise the unfilled part of the structure above that level.)
- This aggregate will both fill and surround the entire building.
- The only debris that should be removed from the interior of the building is anything that will interfere with completely filling the building with the crushed rock. Other rubble that consists compatible fill-solids such as concrete rubble or steel beams can be left.
- Likewise, the rising level of crushed rocks will first fill-in the basement until it is supporting the first floor. Then it will fill-in that level until it is supporting the second floor, and so on.
- Ultimately, it will directly support the floor that is supporting the Spent Fuel Pond.

## ***The Simultaneous Back-Up Plan***

A back-up plan must be simultaneously implemented since there is a strong possibility that Spent Fuel Pond will totally collapse or become otherwise unable to hold water *just before we have the plan fully implemented.*

- We must *end total reliance on the existing pool, while at the same time constructing the crushed rock pile, doing both simultaneously as soon as possible.*
- The existing pond can be encased in Submarine Steam Pipe Foam. (This stuff will even mend a cracked steam pipe.) Finally, the pond itself will be reinforced and surrounded by an outer pond and surrounded by more aggregate for additional support.

- *Spacers can be inserted inbetween the various fuel rod assemblies and the sides of the pond and between the fuel rod assemblies themselves to prevent further mispositioning and damage during any future earthquake.*

When the sides of the Reactor 4 building became unattached and later removed, this removed much of the diagonal support that is needed to keep the remaining vertical and horizontal frame from swaying and collapsing in the event of another serious earthquake. This is probably just as true of the Reactor 3 Building. The Reactor 3 building is far more covered in rubble than the Reactor 4 Building which has been cleared of rubble and of extraneous structures

- So far, TEPCO has only provided additional *vertical* support which may do little- or no- good in the event of an earthquake with large *horizontal* motions. *Diagonal* supports need to be added, *without delaying the work* of burying the lower levels.
- Making sure that the new construction is as earthquake proof as possible at every stage of construction so that it does not send debris crashing down onto the pond.

Large prefabbed Sewer Pipes can be placed near the fuel pond and other critical aspects of the site to provide safer shelters for fire fighting efforts, so workers and robots can minimize their exposure and still get close enough to a collapsed Reactor Four Building or closer to an otherwise drained pond, and to retain access to critical parts of the other reactors.

- The ground would be scraped then covered with a layer of zeolite, ordinary gravel, sand or dirt to provide a non-radioactive substrate for the Pipes.
- The pipes would then be covered by piles of of zeolite, ordinary gravel, sand or dirt.
- The piles of material that would be surrounding the pipes would be sprayed with a urethane roof coating on to the surface to keep out radioactive rainwater so water doesn't

carry radioactive substances and material through the sand to irradiate the interior of the pipes. (Perhaps a more radiation-resistant coating can be found.)

*These should also be done at the other reactor complexes at Fukushima Daiini (2) and at Tokai, to prevent the already-discribed domino effect of failing reactor complexes in the event that the Reactor 4 Fuel Pond loses its ability to hold water.*

These preparations should be also be used from the standpoint that the reactor cores may yet cause catastrophic steam explosions as they melt downward through the ground.

## **How to Accomplish the “Immediate-Part” of *Immediately!***

**Everyone involved in this should make this project their only current responsibility in life. Each part must begin as soon as it can be planned, staffed and supplied.**

**Each aspect of his work must take place as soon as is possible. In other words, as much as is possible, all work must be done at the same time, by different workers, except, that each part of this should be started as soon as possible, independently of the other parts-as much as is possible. This has the additional benefit of reducing the radiation exposure of individual workers.**

**Burying each level above the basement is a higher priority than any other aspect *except*, additional diagonal supports to each level, for the already-noted reasons.**

**The crushed rock pile should extend as far as possible above the top of the building and as far as possible to the side, to provide additional mass and pressure to stabilize the building**

*The Spent fuel rods will be moved once TEPCO'S existing crane project is completed.*