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"Deep Isolation": The Solution to High Level Nuclear Waste?

David Middleton / November 12, 2018

Guest commentary by David Middleton

Hat tip to Dr. Willie Soon

The Deep Isolation concept is a proposal by Dr. Richard Muller (of BEST "fame") and his ~~wife~~ daughter, Elizabeth Muller. The team also includes our good friend Steve Mosher.

Steve Mosher, Director for Asia/Pacific

A scientist at Berkeley Earth, Moser has written and maintains several R-packages devoted to analyzing temperature and climate data with open source tools. He has recently transitioned to the consumer sector and specializes in bringing new technology to market.

Steve Mosher, Director for Asia/Pacific A scientist at Berkeley Earth, **Moser** has written and maintains

list Scott Tinker, Director of the Bureau of Economic Geology at the University of Texas as a member of their advisory board. The Texas BEG has in the past evaluated East Texas salt domes as potential nuclear repositories.

Right after reprocessing spent nuclear fuel, geologic sequestration is the second best solution for high level nuclear waste. This is from the Deep Isolation FAQ's page:

"

Deep Isolation Technology

What is the Deep Isolation concept, in simple terms?
Rather than use large tunnels, Deep Isolation will place nuclear waste in narrow (8 to 14 inch in diameter) horizontal drillholes in rock that has been stable for tens of millions of years. No humans need to go underground. The small diameter drillholes are markedly different than the 18 to 25-foot diameter tunnels of the planned Yucca Mountain repository.

Deep Isolation drillholes will go down about a mile vertically and then gently turn horizontal. The waste would be stored in the deep horizontal section. This approach has several key benefits. First, horizontal drillholes, especially with an upward tilt and a "plumber's trap" can prevent radioactive material from reaching the vertical portion of the borehole, and reduce dependency on man-made barriers. Second, placing the canisters in a long horizontal borehole increases the storage room without having to drill overly deep (at which point pressure can increase cost), or to have to worry about stacked canisters being crushed by their own weight.

The drilling industry has already perfected ways to place objects in deep boreholes, and retrieve them, all robotically.

For a visual summary of a Deep Isolation borehole, see Figure 3 at the end of this document.

Can you really put three miles of continuous steel liner (a "casing") down the drillhole (1 mile of vertical access and 2 miles of horizontal storage)? How does it get around the curved

hole. In the rig, 40-foot-long sections of casing are screwed together as they are lowered into the hole. The curved region that transitions from a vertical to a horizontal borehole has typically a 700-foot radius of curvature, and the steel casing flexes easily around this bend. This has been done in over 50,000 drillholes in the US in the last two decades.

Do you pick sites that are suitable for gas and oil recovery?
The ideal geology for waste isolation has no recoverable natural resources. We prefer rock that is ductile, so it is fracture resistant. Typically, this means clay-rich, and this feature makes the rock unsuitable for fracking.

Why didn't someone think of this before?
The Yucca Mountain tunnel repository was chosen by the US government in the 1980s, due for completion in 1998, before the new drilling technologies were highly developed. When the Yucca Mountain facility ran into physical and political problems, no alternatives could be considered because the Nuclear Waste Policy Act specified that they could not be licensed. Our solution provides an additional disposition pathway for commercial spent nuclear fuel and DOE nuclear waste inventories and should be considered as a second disposal option.

Can all that waste fit in narrow drillholes?
Spent nuclear fuel is compact, amounting to only 2 cubic meters per year for a gigawatt (thousand megawatt) reactor. Coal waste takes over a million times as much volume. One drill hole has 1000 cubic meters of space, enough for 20-reactor years of waste, assuming that we do no repackaging of the fuel assemblies. The assemblies that hold the waste fit in long narrow canisters that can be lowered into a drillhole.

What keeps the radioactivity from reaching the surface?
The Deep Isolation design relies on both engineered and geological barriers so there is built-in redundancy to the system.

The deep geology of the Deep Isolation design is a significant

themselves, the metal rods that contain them, the bentonite surrounding the rods, sealed steel canisters that hold the rod assemblies, steel casing that lines the drillhole, and the cement that fills the space between the casing and the drillhole.

For geologic times, the geology is a key barrier. The geologic formations that would be used have been stable for tens of millions of years.

Why a mile deep?
The waste is placed far below aquifers, in regions in which water has had no contact with the surface for a million years or more. We will dispose in or under geologic formations that have been stable for tens of millions of years. Typically, this means a depth of about a mile, but in some locations it could be as shallow as 3000 feet, or as deep as 10,000 feet. Drilling such holes is now routine, and the drilling industry has made over 50,000 of such horizontal drillholes over the last 20 years.

[…]

Can the waste be retrieved?
Yes. The drilling industry regularly retrieves objects and monitoring instruments from boreholes, and the process is standard. Once the vertical drillhole is sealed, an expert crew could still retrieve the waste, but it would take a week or possibly longer. Doing so is sufficiently complex to offer substantial security from a terrorist attempt

[…]

Deep Isolation FAQ’s

A few thoughts on this:

> *Can you really put three miles of continuous steel liner (a “casing”) down the drillhole (1 mile of vertical access and 2 miles of horizontal storage)?*

Typically, this means clay-rich, and this feature makes the rock unsuitable for fracking.

Shale is generally a clay-rich rock…

> “
> ***What is shale?***
> *A strict geological definition of shale is any “laminated, indurated (consolidated) rock with > 67% clay-sized materials” (Jackson, 1997). Approximately 50% of all sedimentary rocks are classified as shale. Shales are often deposited in low-energy depositional environments where the fine-grained clay particles fall out of suspension.*
>
> *Reference: Jackson, J.A. (1997). Glossary of Geology, 4th Ed. American Geological Institute*
>
> *Halliburton*

While “clay-sized materials” doesn’t necessarily require clay mineralogy, most of the shales that are frac’ed are fairly abundant in clay mineralogy.

M-I SWACO, a Schlumberger company.

Ductile shales tend to have low quartz and carbonate fractions and tend to plot more or less in the center of this ternary diagram:

“Fig. 1. Ternary diagram of all shales in database. The color represents the individual shale, and the size of the bubble represents the brittleness as determined from XRD data (computed by mineral composition).” Halliburton

If they’re planning on drilling these horizontal disposal wells in areas unsuitable for frac’ing… There’s not likely to be a lot of well data… So I’m not sure how they plan to identify ductile shale formations at depth. I suppose they could focus on failed shale plays, where the rocks were unsuitable for frac’ing.

The Texas BEG did take a serious look at using East Texas salt domes as waste

> *The waste is placed far below aquifers, in regions in which water has had no contact with the surface for a million years or more. We will dispose in or under geologic formations that have been stable for tens of millions of years. Typically, this means a depth of about a mile, but in some locations it could be as shallow as 3000 feet, or as deep as 10,000 feet. Drilling such holes is now routine, and the drilling industry has made over 50,000 of such horizontal drillholes over the last 20 years.*

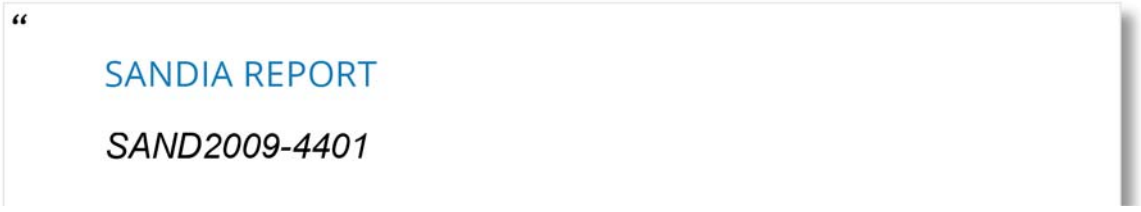
There's no "magic" depth. Each site would have to be evaluated in detail.

> *Can the waste be retrieved?*
> *Yes. The drilling industry regularly retrieves objects and monitoring instruments from boreholes, and the process is standard. Once the vertical drillhole is sealed, an expert crew could still retrieve the waste, but it would take a week or possibly longer. Doing so is sufficiently complex to offer substantial security from a terrorist attempt.*

"The drilling industry regularly retrieves objects and monitoring instruments from boreholes" that were designed to be retrieved: wireline logging instruments, drill strings, etc. "Once the vertical drillhole is sealed," the removal of objects designed to stay in the well are expensive and time-consuming to retrieve, if they are even retrievable. The one drawback to this sort of disposal system is that, unlike cavernous facilities, retrieval of disposed waste is extremely difficult. This sort of method is more suitable to permanent disposal.

> *Why didn't someone think of this before?*

Someone did think of it before…



Patrick V. Brady, Bill W. Arnold, Geoff A. Freeze, Peter N. Swift, Stephen J. Bauer, Joseph L. Kanney, Robert P. Rechard, Joshua S. Stein

Prepared by

Sandia National Laboratories Albuquerque, New Mexico 87185 and Livermore, California 94550

[…]

Preliminary evaluation of deep borehole disposal of high-level radioactive waste and spent nuclear fuel indicates the potential for excellent long-term safety performance at costs competitive with mined repositories. Significant fluid flow through basementrock is prevented, in part, by low permeabilities, poorly connected transport pathways, and overburden self-sealing. Deep fluids also resist vertical movement because they are density stratified. Thermal hydrologic calculations estimate the thermal pulse from emplaced waste to be small (less than 20° C at 10 meters from the borehole, for less than a few hundred years), and to result in maximum total vertical fluid movement of ~100 m. Reducing conditions will sharply limit solubilities of most dose-critical radionuclides at depth, and high ionic strengths of deep fluids will prevent colloidal transport.

[…]

DOE estimates that 109,300 metric tons heavy metal (MTHM) of high-level waste and spent nuclear fuel – primarily commercial spent nuclear fuel (CSNF), but also DOE spent nuclear fuel (DSNF), and high-level waste glass (HLWG) – will need to be disposed of in the US (the projected US HLW and SNF inventory is summarized in Appendix A).,Deep borehole disposal, characterization and excavation costs should scale linearly with waste inventory: small inventories require fewer boreholes; large inventories require more boreholes. Not needing a specially engineered waste package would also lower overall borehole disposal costs. Both aspects might make

(assuming each deep borehole had a 2 km long waste disposal zone that contained approximately 400 vertically stacked fuel assemblies). The remainder of the projected inventory of 109,300 MTHM could be fit into an additional 350 or so boreholes.

Because crystalline basement rocks are relatively common at 2-5 km depth (See Figure 2; also see O'Brien et al. 1979; Heiken et al. 1996), the US waste disposal burden might be shared by shipping waste to regional borehole disposal facilities. If located near existing waste inventories and production, shipping would be minimized. A disposal length of ~2km, and holes spaced 0.2km apart suggests the total projected US inventory could be disposed in several borehole fields totaling ~30 square kilometers.

Petroleum drilling costs have decreased to the point where boreholes are now routinely drilled to multi-kilometer depths. Research boreholes in Russia and Germany have been drilled to 8-12 km. The drilling costs for 950 deep boreholes to dispose of the entire 109,300 MTHM inventory, assuming a cost of $20 million per borehole (see Section 3.1), would be ~ $19 billion. Very rough estimates of other costs are $10 billion for associated site characterization, performance assessment analysis, and license application, $20 billion for disposal operations, monitoring, and decommissioning, $12 billion for ancillary program activities, and $10 billion for transportation, resulting in a total life-cycle cost for a hypothetical deep borehole disposal program of $71 billion (in 2007 dollars). Although there are significant uncertainties in the cost estimates for deep borehole disposal presented here, the estimated total life-cycle cost may be significantly lower than the estimated total cost of Yucca Mountain. Note in particular the lower construction/operation and transportation outlays that borehole disposal would allow.

This document outlines a technical and performance assessment analysis of deep borehole disposal of US HLW and

Left: Deep Borehole Disposal Schematic. Right: Depth the Crystalline Basement Map

This is worth repeating:

> *The drilling costs for 950 deep boreholes to dispose of the entire 109,300 MTHM inventory, assuming a cost of $20 million per borehole (see Section 3.1), would be ~ $19 billion. Very rough estimates of other costs are $10 billion for associated site characterization, performance assessment analysis, and license application, $20 billion for disposal operations, monitoring, and decommissioning, $12 billion for ancillary program activities, and $10 billion for transportation, resulting in a total*

inventory of 109,300 metric tons heavy metal (MTHM) of high-level waste and spent nuclear fuel.

That would be $84 billion in 2017 USD.

According to BP’s Statistical Review of World Energy June 2017, from 1965-2016, US nuclear generating stations produced 26,386 TWh of electricity (26.4 trillion kWh).

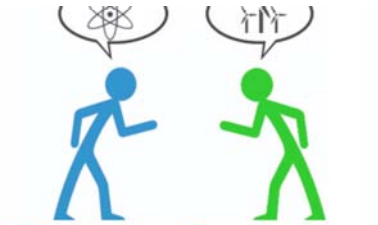
$84 billion divided by 26.4 trillion kWh is $0.0032/kWh… 1/3 of one penny per kWh to dispose of the entire inventory of high-level nuclear waste.

The geologic sequestration of high level nuclear waste is almost trivial.

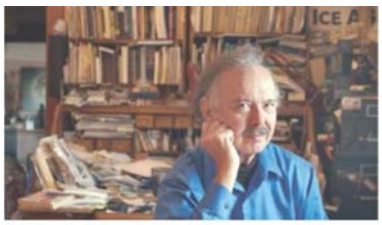
The main difference between the Sandia proposal and Deep Isolation is that the former would have permanently disposed of the waste in vertical wellbores drilled into crystalline basement rocks below sedimentary basins (~17,000′ below the surface); whereas Deep Isolation would dispose of the waste in “retrievable” horizontal boreholes in sedimentary rocks (~5,300′ below the surface).

Conclusion

It’s nice to see the BEST folks doing something useful. It’s an interesting concept. I just tend to think that it makes more sense to permanently dispose of the waste in deep wells, drilled into crystalline basement rocks, rather than shale formations in sedimentary basins.



UCS Clarifies Stance on Nuclear Power
November 23, 2018
In "nuclear power"



Scientific American's interview with Dr. Richard Muller
May 23, 2011
In "Climate data"

A fascinating new interview with Prof Richard Muller, quote: On Climategate - "What they did was, I think, shameful. And it was scientific malpractice"
Guest Post by Barry Woods
The Progressive Radio Network website had a fascinating interview with Prof Richard Muller last week
August 9, 2012
In "Alarmism"

November 12, 2018 in nuclear power. Tags: nuclear waste disposal, Richard Muller, Steve Mosher

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Union of Concerned Scientists For Nukes!

“Russia will Shape the Future of Spaceflight”: Announces Nuclear Powered Reusable Rocket Programme

168 thoughts on ""Deep Isolation": The Solution to High Level Nuclear Waste?"

Donald Kasper November 12, 2018 at 3:59 pm

yucca Mountain to store nuclear waste is complete and ready to be used. Wait, to generate more money for Democrat bureaucrats, start another project instead.

Jim Moran November 12, 2018 at 4:08 pm

Mr. Kasper, you are on point. Yucca Mountain was stopped because of Harry Reid and political pressure. Another project would be a huge cost and probably would run into the same political pressure from the anti-nuke crowd. It would be worth it if the approval was obtained before the characterization but that is impossible. It may be best to stick with Yucca Mountain.

Ron Long November 12, 2018 at 4:29 pm

Donald/Jim, you are both right on. As a Geologist with 40 years experience in Nevada geology I can assure you that Yucca Mountain did not run into Political and Technical problems, only political problems. There are issues other than water tables and geologic stability in play here. For instance you need a security system to prevent the "dirty bomb" interests from stealing the radioactive waste, for another you need an already contaminated and off-limits area. Yucca Mountain is ready to go and fills the bill. Harry Reid is the guilty party here. This is not to denigrate current deep-drilling technology, it is amazing.

Ron,

Thinking about very long term possibilities, could earthquakes close fissures forcing water up to where the waste is stored? Or could changes to rainfall due to a future glacial cycle or other climate-change alter the equation making storage at Yucca risky for future generations?

Anonymoose November 13, 2018 at 10:27 am

About Yucca water issues: https://en.wikipedia.org/wiki/Yucca_Mountain_nuclear_waste_repository#Geology

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Walter Sobchak November 12, 2018 at 6:57 pm

There will never be nuclear waste storage as long as there federal judges, lawyers, and environmentalists.
They don’t want to solve problems. They want to be problems.

David Middleton November 13, 2018 at 2:53 am

Yucca Mountain was ideal… apart from NIMBY’ism. NIMBY’ism will always be the most formidable obstacle.

Samuel C Cogar November 13, 2018 at 8:30 am

> " *Right after reprocessing spent nuclear fuel,* ***geologic sequestration is the second best solution for high level nuclear waste****. "*

I agree, in that they refuse to reprocess the spent fuel rods, then "YES", ... "geologic sequestration" is the 2nd best solution for disposal of high level nuclear waste.

But why do so many brilliant people want to spend tens-of-million$ or tens-of-billion$ of taxpayer monies to get the job done, ... when there is, IMLO, a much, much easier, safer and cheaper way to dispose of "spent fuel waste" ..... that places them out of sight and out of mind .... FOREVER? And, IMO of course, ... the best "geologic sequestration" is the one that I have been advocating for the past 20+ years.

And HERE IS THE PROBLEM, to wit:

> " *To put the volume of the high level waste into perspective-****if all the current waste were stored as a single mass****, it would occupy a space* ***140 feet x 140 feet x 10 foot high****. Realistically, the actual space will be larger because the high level waste will be converted into a less dense vitrified (or glass form).*
> *There is another way of looking at the spent fuel waste – How much area would ALL of the fuel assemblies for the 110 nuclear power plants of 500 to 1100 MWe occupy if they were placed side by side? Based on DOE projections, there would ~232,000 fuel assemblies discharged through 2030.* ***These would occupy an area of ~100,000 ft2****, the area corresponding to about 1 city block -a very small area. "*
> *Read more @ http://www.nucleartourist.com/basics/hlwaste.htm*

And HERE IS THE CHEAP, EFFECTIVE SOLUTION, to wit:

Just package the nuclear waste in 50lb to 100lb (or whatever) oval (round) containers that are encased in a 6" thick flexible covering of highly non-reactive polymer, plastic or rubber-like compound .... and then transport them out to the western Pacific Ocean and dump them overboard and gravity will sequester them free of charge at the bottom of the Mariana Trench ..... where they will never be heard from again.

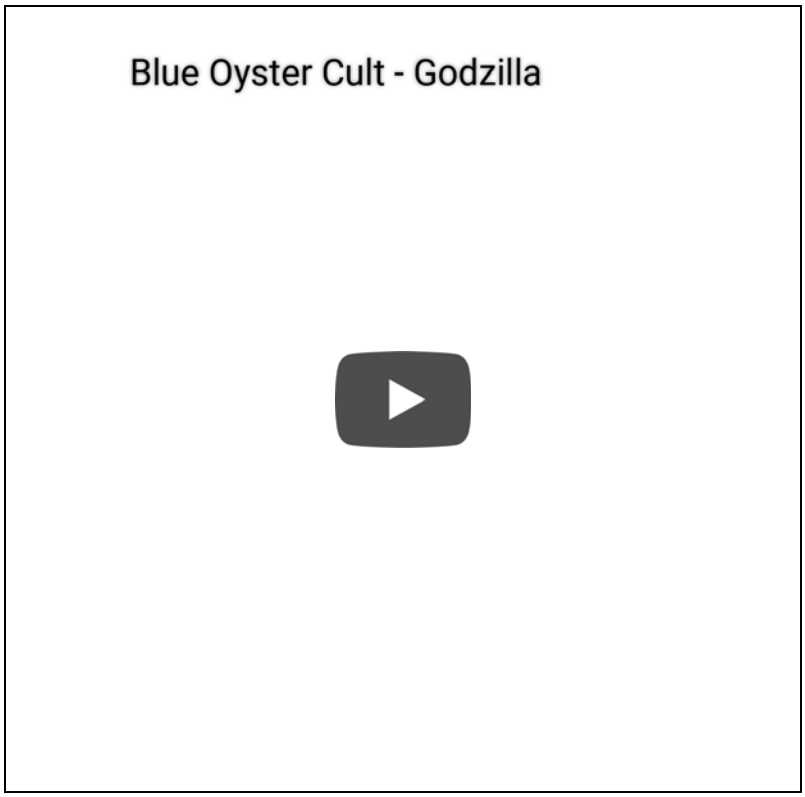
To wit:

southern end of a small slot-shaped valley in its floor known as the Challenger Deep.."
Read mote @ https://en.wikipedia.org/wiki/Mariana_Trench

"YUP", out of sight, out of mind, ... and 6.8 miles deep underwater, ... where the horrendous water pressure keeps "squeezing" those round containers tightly sealed.

David Middleton November 13, 2018 at 9:50 am

That's tempting... But there's always this hazard with dumping nuclear waste into ocean trenches...



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paul courtney November 13, 2018 at 11:53 am

the universe and everything is 11.
On an amplifier.

David Middleton November 13, 2018 at 12:47 pm

A classic from Deep Purple Made in Japan…

> *"The third gig at the Budokan in Tokyo on the 17th August went well with no significant problems, other than the acoustics of the hall could have been better. Possible because of this the subject of the monitors came up again and Ian Gillan asked over the mic before Strange Kind of Woman: "Yeah everything up here please. A bit more monitor if you've got it."* ***Then Ritchie asks "Can I have everything louder than everything else?" which Ian Gillan repeats "Yeah, can he have everything louder than everything else."*** *This remained on the final master.*

https://www.thehighwaystar.com/news/2014/05/28/everything-louder-than-everything-else/

Duane November 13, 2018 at 10:44 am

Any sealant material can degrade under environmental conditions, geochemical processes, and biological processes. Putting the most dangerous materials on earth in the middle of the world's largest reservoir of solvent is a very, very, very bad idea.

We used to use ocean dumping for rad waste – it was outlawed decades ago.

---

embed itself several feet into the mud. Nothing much could migrate out from that.

And seriously – just make the waste insoluble by mixing it with a ceramic. The worst effect might be a warm spot in the ocean about the size of a football field. It really isn’t that difficult, and the volume isn’t that great.

Samuel C Cogar November 14, 2018 at 3:47 am

I am firmly convinced that government “troughfeeders” literally hate and detest the solving of any and all problems via the expenditure of the least amount of time, energy or money.

Whatever they do, ….. they always try to make sure there is something left for them to do next month.

D. Anderson November 13, 2018 at 4:53 am

Harry Reed had no objection until the project was finished and the money stopped flowing into his state. Then he objected.

Retired_Engineer_Jim November 13, 2018 at 9:39 am

Wasn’t there also the problem of various States threatening to refuse to permit transportation of nuclear waste through their States to get to Yucca Mountain?

States do not have authority to restrict interstate commerce, nor to regulate the transportation of nuclear materials or waste products. They can act as commenters and intervenors in Federal decision making processes under NEPA and various nuclear materials regulations administered by the NRC and the DOT.

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paul courtney November 13, 2018 at 12:04 pm

Jim and Duane: I think you’re both right, Jim correctly recalls the threats and Duane correctly analyzes the law. If only federal judges would reliably apply it. My guess is, if it came to that, and Yucca opened for business, injunctions would stop shipments for a few decades because enviros would know where to file.

Sunsettommy November 13, 2018 at 9:38 am

Why can’t they process high level waste into low level waste?

DD More November 13, 2018 at 10:40 am

Tom – “process high level waste into low level waste?”

Man has learned to generate Fission without the radioactive waste, but Carter killed it.
Start with this story.

http://www.jimstonefreelance.com/busted.html –
Jim Stone, Updated on July 22, 2013 – “During my journey

when conducting an investigation into such a disaster a journalist would want that type of reference.
When I started to think I was going to walk away with nothing new, he began to talk about an entirely different subject. He began his new direction in the discussion with the phrase "My team succeeded in closing the nuclear loop, and Carter banned our miracle with an executive order.
We perfected the second reactor design which used liquid sodium as a coolant and the reactor ran much hotter – 1100 farenheit as opposed to 550 in a boiling water reactor. The liquid sodium circulated inside the reactor instead of water, with the heat of the reaction being removed from the system by a heat exchanger which produced steam outside the reactor for use in producing electricity. The temperature difference and coolant characteristics in the complimentary reactor facilitated the burning of the isotopes, and you got to use both sides of the reaction – the boiling water reactor produced electricity while producing unwanted isotopes, and the sodium cooled reactor produced electricity while burning the unwanted isotopes out. This process could be repeated 20 times, and when it was finished the fuel was DEAD and no longer hazardous because all of it's radiological potential was used up. It was a clean energy dream come true, and Carter banned it by executive order!" [Executive Order 12193]
He specifically stated that the burn down was so complete that the spent fuel was safe to handle directly with bare hands, and needed no special care or maintenance at all, and after I questioned him about exactly how safe, said you could safely sleep on it. I questioned him several times, saying he must be exaggerating, but he said ALL radiological potential was used, and the fuel was completely inert at the end of the final cycle.

Now Russia has it. – http://theunhivedmind.com/wordpress3/russia-proceeds-with-closed-loop-nuclear-technology-carter-banned-russia-now-has-a-free-energy-future/

20 cycles of power generation and no radioactive waste at the end.

Tommy, They can, and into No Level Waste.

Start with this story.
http://www.jimstonefreelance.com/busted.html –
Jim Stone, Updated on July 22, 2013 – "During my journey of discovery in my investigation into the Fukushima disaster, I interviewed an 85 year old nuclear engineer who worked in the nuclear industry during America's glory days, an engineer who earned GE over 100 patents. He was one of the engineers who designed Fukushima, so naturally when conducting an investigation into such a disaster a journalist would want that type of reference.
When I started to think I was going to walk away with nothing new, he began to talk about an entirely different subject. He began his new direction in the discussion with the phrase "My team succeeded in closing the nuclear loop, and Carter banned our miracle with an executive order.
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20 cycles of power generation and no radioactive waste at the end, means we can produce 19 times all the nuclear power until they need more fresh stuff.

As to Yucca, the final Kill Shot argument was, "You Cannot confirm a 'Warning Sign' can be made that someone 10,000 years in the future will be able to Read.

PlainBill November 13, 2018 at 4:25 pm

DD More,
Care to explain how EO 12193, which deals with continued co-operation with the European Atomic Energy Community has anything to do with banning results of research?
https://en.wikisource.org/wiki/Executive_Order_12193

Also, the link purporting to show that Russia has the technology up and running is a 404.

Michael Jankowski November 12, 2018 at 4:03 pm

https://www.e-sciencecentral.org/articles/SC000027905

"...The concept of deep borehole disposal (DBD) for high-level nuclear wastes has been around for about 40 years..."

Alastair Brickell November 12, 2018 at 8:44 pm

Michael Jankowski
November 12, 2018 at 4:03 pm

Actually Mike a far better version of deep disposal called

and added a pinch of high level nasties to the mix. These were encapsulated in the perovskite mineral's crystal lattice as the new rock solidified. Perovskite is a relatively common mineral in some granitic rocks that have stayed solid for billions of years. This gave the major layer of protection…solid disposal rather than liquid and not susceptible to the heat and radiation induced crazing that can affect and compromise some of borosilicate glasses that are used (mainly in Europe) for solid waste disposal.

However, the truly brilliant part of his proposal was that the cannisters had black carbonaceous shale packed all around them. This is a kind of rock where any groundwater carrying uranium, etc. gets precipitated out…this is how many uranium orebodies are formed. Thus any leakage would be immobilised forever (over vast geological timescales) by the shale packing. A somewhat similar effect could I guess be obtained by the present system if the horizontal storage holes were drilled into a thick black shale bed. Of course horizontal drilling was virtually unknown back in his time and is a plus and possibly a game changer.

Two problems are the extra cost to make the Synrock and the dilute nature of the waste meaning hugely increased volumes to be disposed of. However the extra immobility and inherent safety of the system wins out in my opinion and the dilute nature of the waste means reduced thermal problems.
I believe the US military looked at Synrock and a demonstration plant was built to form the Synrock (but without the pinch of waste). Not sure why it was never commercialised. My guess is the usual greenie objection to actually solving any problem that they need to continue to use to scare the masses so they can endlessly to raise funds from the gullible. A bit like AGW really.

Tom Halla November 12, 2018 at 4:04 pm

I still regard Jimmy Carter's insistence on a once-through fuel cycle to be one of his bad ideas (and he had many). Reprocessing the spent fuel, or using it in a reactor type tolerant of the fission

Clyde Spencer November 12, 2018 at 5:26 pm

Tom Halla,
If it hadn’t been for Carter’s ban on re-processing spent fuel, there wouldn’t be an urgency to dispose of it. The long-lived isotopes are the ones that can be recycled. While Carterwas concerned about nuclear proliferation, or terrorists making dirty bombs, history has shown that the French have had not difficulty securing their reprocessing facilities. It was a decision that created a crisis in disposal of ‘spent’ nuclear fuel, and should be reversed.

PRDJ November 13, 2018 at 2:41 pm

So why don’t we make a citizens lobby to our newly elected Republican senators and President Trump to rescind President Carters ridiculous EO?

Slywolfe November 13, 2018 at 3:39 pm

I think Carter was a Nuclear Engineer…

Tom Halla November 13, 2018 at 5:30 pm

James Earl Carter, jr, went through a reactor officer’s program, not “nuclear engineering”. He had a qualification that he could supervise the operation of a shipboard reactor, not the design of reactors per se.

I still regard Jimmy Carter’s insistence on a once-through fuel cycle to be one of his bad ideas (and he had many). Reprocessing the spent fuel, or using it in a reactor type tolerant of the fission products, would be better.
Carter was supposedly worried about proliferation, and had the virtue signalling notion that we could serve as a “good example”.
And the duplicate comment filter is on the fritz again

Mike Borgelt November 12, 2018 at 4:17 pm

> Halla, they reprocessed the fuel rods from reactors at the Hanford Washington site to obtain plutonium for making nuclear weapons.
> ..
> They are still trying to clean up the mess they made:
> https://en.wikipedia.org/wiki/Hanford_Site

Chad Irby November 12, 2018 at 4:27 pm

> They did that decades ago, when “nuclear safety procedures” meant “try not to drop it on your foot.”

HotScot November 12, 2018 at 4:48 pm

> Mike Borgelt
>
> Wow…..Wikipdia. I wish I had thought of that publicly accessible and editable font of knowledge for reliable scientific information. Almost as good as the guardian.
>
> On the other hand, there’s always Dave Middleton. I’ll stick with Dave.

LOL @ HotScot.....if you don't like wikipedia, hows this?
..
https://www.energy.gov/ea/hanford
...
Or this?
..
https://www.scientificamerican.com/article/hanford-nuclear-cleanup-problems/
...
Your rejection of wikipedia is funny
Want more?

Mike Borgelt November 12, 2018 at 5:49 pm

HotScot, your rejection of wikipedia is laughable. It goes to show you how ignorant you are of what is happening at the Hanford Site. Did you know that the seepage is about to hit the Columbia River aquifier?....
...
Nope...
...
Grasping at straws.
..
You need to learn about what is going on, instead of making a fool of yourself.

Tom Halla November 12, 2018 at 6:05 pm

Wikipedia is selectively unreliable. On some subjects, it is fairly accurate. On others, have you ever heard of William Conolly?

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reliable?

Tom Halla November 12, 2018 at 6:23 pm

I didn’t do any research on that topic. But Wikipedia is a mix of accurate information and dezinformatiya, so any result from it must be checked from another source.
For whatever reason, their definitions of some fallacies are totally new age, as an example. Similarly, any discussion of politically fraught subjects is particularly treacherous.

Mike Borgelt November 12, 2018 at 6:32 pm

‘I didn’t do any research on that topic.”
…
Then keep your mouth shut until you do.
…
Once you’ve researched the topic, come back here and tell us if wikipedia’s entry is valid.

Tom Halla November 12, 2018 at 6:37 pm

I gave you a reason citing Wankerpedia was inadequate in general.

MarkW November 12, 2018 at 7:21 pm

totally escaped your notice. Then again, you do have a tendency to ignore anything that doesn't fit your agenda.

MarkW November 12, 2018 at 7:22 pm

Poor Mike, he actually seems to believe that since he agrees with what Wiki says, then everyone else is obligated to as well.

Farmer Ch E retired November 12, 2018 at 9:07 pm

Mike,

"Did you know that the seepage is about to reach the Columbia River aquifer?"

It's been awhile since I worked at Hanford so pardon these questions. I recall there being an issue w/ carbon tetrachloride migrating towards the aquifer. Is the seepage of radionuclides reaching the aquifer or is it a chlorinated solvent from processing? Which radionuclides are migrating, how fast are they moving, what type of radiation do they produce, and how active are they? If they were to reach the aquifer, how long before they reach the river? If they reach the river, would the radiation be detectable do to dilution. Would they pose any type of risk to the environment or humans similar to indoor radon risks or increased radiation risks at altitude on a commercial airliner? I'm sure these questions have been studied by experts and I pose them only to illustrate the complexity.

During the late '70s I did engeneering

John Endicott November 13, 2018 at 5:45 am

Mike Borgelt, he doesn’t have to do his own research in one specific subject to know that Wikipedia is a notoriously unreliable site (particularly in regards to any controversial subject). And if/when he ever does want to do his own research to any particular topic, he’ll likely do what any intelligent person would do by starting at someplace other than a notoriously unreliable site like Wikipedia.

Retired_Engineer_Jim November 13, 2018 at 9:50 am

While a few of you are harassing Mr Borgelt over his use of Wikipedia as a source, please read the comment from Farmer CH E retired and realize that, regardless of your faith in Wikipedia, the Hanford site may well be a mess. About 20 years ago, I enjoyed a luncheon speech from one of the folks at the US Department of Energy who was charged with cleaning up Hanford. He was decidedly unoptimistic, as, at that time, they had some confidence that they understood the problems, and had no solutions. He discussed the stored materials getting to the ground water and thence into the Columbia River system as a seriosu problem which, at that time, had no solution. Let’s hope they’ve made good progress in 20 years.

KaliforniaKook November 13, 2018 at 10:39 am

problems with citing the NYT or the LAT as references, and they're pretty bad!
If a bunch of liberal professors acknowledge that about Wikipedia, then "reader beware" should be the order of the day.

D. J. Hawkins November 12, 2018 at 5:19 pm

Most of the "mess" is the result of the failure to open up a final repository site so that the liquid waste could be solidified, containerized, and buried. Those tanks were never intended to be in use so long.

MarkW November 12, 2018 at 7:19 pm

So Mike, what you are saying is that if one group bungles nuclear reprocessing this proves that every group will bungle re-processing?
Why don't you try thinking for once.

Steven Piet November 12, 2018 at 6:05 pm

No sane country would put valuable material down a borehole. After we separate the 95% good stuff from 5% useless stuff, sure, put the 5% down boreholes, or Yucca, or anywhere. With the good stuff removed, the rest is less dangerous than the original natural uranium ore in under 1000 years – humans can and have engineered things that have lasted that long. Hanford wasn't designed to current standards nor designed for permanent storage. Other countries can separate and recycle used nuclear material, we can too.

"There's not likely to be a lot of well data… So I'm not sure how they plan to identify ductile shale formations at depth."

Many, not all, formations found at depth are also exposed on the surface somewhere where they are easy to look at. e.g. The Marcellus Shale is widely exposed in roadcuts South and West of Albany. The Eagle Ford is a surface rock in a strip along the Balcones escarpment for hundreds of miles North and South of Austin. Of course, there's no absolute guarantee that the nature of the rock (facies change) won't be a problem. But that just means that maybe a well or two will have to be written off when things underground don't turn out as expected. So what?

I never thought the objection to Yucca Mountain was anything but political. Water Table is 2400 feet down — 1400 feet below the storage area. No people near the site. No people to speak of in the drainage area which is into unpopulated interior basins. Rainfall less than 8 inches a year and unlikely to change much.

But this sounds OK.

And anything is probably better than storing high level waste at dozens of sites — many with dubious geology — and some upstream of major population centers.

David Middleton November 12, 2018 at 6:23 pm

> If there's little or no well control, how do you even locate the formations at depth? Shoot seismic? Run 3-point problems on surface outcrops? Deep Isolation assumes that ductile shale formations can be mapped at depth sufficiently to support lateral well completions. This requires extensive subsurface data.
>
> This is not the sort of project that can economically sustain any exploration costs.

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formation — and look at the stuff in the well cores. For example the early drillers in NorthWest Pennsylvania expected to drill through a bit of shale, maybe with some coal, then a Conglomerate (Orleans) then more shale, then another thinner conglomerate with smaller cobbles(Wolf Creek) then alternating shales and sandstones. If they were lucky, they’d find oil in the third sandstone.

“This is not the sort of project that can economically sustain any exploration costs.”

I should think the opposite. They can drill on land — maybe on the Colorado Plateau or Great Basin where no one has ever found hydrocarbons in the Paleozoic beds. Presumably they’ll use government land — no leasing costs. They don’t have to pay for fracking. They can probably guess the geology pretty well from what can be seen in the canyons and the numerous mountain ranges. I’d think they will do all their storage in pretty much the same place. Why ask for trouble by having multiple sites? I expect that they’ll have more than enough political trouble with one site (with multiple wells of course)

I’m probably minimizing the problems. I’m not a geologist and I’m not in the petroleum industry. But I really think geology and drilling are likely to be the more tractable elements of the scheme.

Now the legal fees ….

David Middleton November 13, 2018 at 1:16 am

> You can’t drill waste disposal wells based on guesses about the subsurface geology, much less precisely steer lateral wells through adequately ductile shale formations based on guesses about the subsurface geology.
>
> No one is likely to fund an exploration drilling program to look for ductile shale formations, suitable

Don K November 13, 2018 at 8:40 am

> "You can't drill waste disposal wells based on guesses about the subsurface geology, much less precisely steer lateral wells through adequately ductile shale formations based on guesses about the subsurface geology."
>
> It's not an oil well David. You seem to assume NO knowledge of the geology — which is clearly not the way it'll be — especially in an area with stable geology. Neither would you need steer the laterals as precisely as you do in an oil well. You don't need to traverse a specific zone to maximize ROI, Conceptually, you just need to stay in the presumably thick shale in order to maximize the (hypothetical) advantages of ductility.
>
> Keep in mind that you are talking about folks that spend well over $100M on a single fighter plane and have so far spent $15B at Yucca Mountain. The cost of drilling a test well or two to validate the geology is not going to bother them at all.
>
> OTOH, the more I think about it, the less I like the idea. It's complicated. Lots of opportunities for "who could possibly have known?" type problems. I think I'm with you. Vertical wells into bedrock seem less complicated and there seem to be fewer things that can go wrong.

David Middleton November 13, 2018 at 9:48 am

> You have to know where the shale formation is at depth before you drill the well. If you have a basin with little or no well control and a suitable shale formation that outcrops in the area, there is no way to predict where that formation will be buried

and dip of the formation at the surface, that’s not going to tell you much about where you have to drill to find it at a depth of >1 mile. You could assume that the strike and dip remain constant and drill blindly. You could shoot seismic surveys to try to map it. But no one is going to fund that. Even if you did map it, you would not be able to determine if the petrophysical properties were suitable unless you drilled numerous wells through it. On top of that, you need the formation to be relatively flat, with little structural relief… Which means that any outcrops will be a long way from where that formation is at an adequate depth.

This program isn’t set up to be funded by the government. It’s set up to be funded by the utility companies who operate nuclear power plants. The odds are that this sort of program would be government-subsidized… But not a government program.

It’s not a “bad idea.” I just don’t think Deep Isolation has thought this through very well beyond trying to gin up funding. Most of their “roster” is composed of government affairs and business development people, with a few of hydrology/environmental/waste disposal professionals. I did not see any drilling engineers listed. I suspect it’s more of a subsidy mining operation.

On the other hand, the Sandia report is loaded with engineering specifics about how the wells will be drilled and cased using “off-the-shelf” oil & gas and geothermal drilling equipment and procedures. That report is almost AFE-quality.

Ken Mitchell November 12, 2018 at 4:25 pm

He invented the plastics industry.

I strongly suspect that in 20 or 30 years, we'll invent something brilliant to do with the "nuclear waste" that you're proposing to bury.

MarkW November 12, 2018 at 7:24 pm

They already have something brilliant that they can use it for. Reprocess it and run it through the reactors again.

Michael S. Kelly, LS, BSA, Ret. November 13, 2018 at 10:42 am

That is a near-term solution compatible with our legacy light-water reactors. Fast neutron reactors can have closed fuel cycles, breeding additional fissile fuel from U238, burning up the problem minor actinides, and operating decades without refueling. The technology is well in and, but it will take a major commitment to get the NRC out of the way. President Trump is likely to be our only hope of that.

Clyde Spencer November 12, 2018 at 8:53 pm

Ken Mitchell,
You said, "I strongly suspect that in 20 or 30 years, we'll invent something brilliant to do with the "nuclear waste" that you're proposing to bury." That sounds to me more like wishful thinking rather than a forecast based on evidence in hand. I guess we could keep it where it is for the next 30 years and see if your belief comes true.

Read MarkW's comment above, or kent beuchert's comment below

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kent beuchert November 12, 2018 at 4:28 pm

One can view this concept as a brilliant attempt to accomplish something really, really dumb –
namely to bury valuable sources of enormous energy that could be employed vey cheaply to desalinize ocean water for the entire Southwest, by storing those misnamed nuclear "wastes" in dry casks that radiate 350 degree temps, and applying that heat to Pacific Ocean water piped into Death Valley.
This an idea from the Virginia_nuclear_energy_consortium article.
There are many other possible uses of this nearly free energy There is no such thing as nuclear waste.

Shawn Marshall November 13, 2018 at 5:00 am

great idea.

ScarletMacaw November 12, 2018 at 4:39 pm

Reprocessing is best.

If you want to get rid of it permanently, encase the waste in glass and drop it into the subduction zone in the Marianas trench. That's a lot cheaper.

ROM November 12, 2018 at 7:01 pm

trench. That's a lot cheaper.

My thinking also for a number of years past re the disposal of large tonnages of radio active waste.

Only I would avoid the Marianas Trench system as it might become a bit too popular in the times ahead. Better somewhere way down in the remotest parts of the Southern Ocean .
Find a location down there with deep deposits of ooze and drop torpedo shaped synthetic glass containers with their incorporated radio active waste down into the ooze and forget the whole damn thing for ever afterwards.
And if somebody comes up with a proposed use for the radio active substances incorporated in those synthetic glass containment vessels then they will just have to go out and mine a fresh batch of ore for themselves instead of trying to retrieve the containment vessels, if they could ever find them.

Samuel C Cogar November 13, 2018 at 10:03 am

ScarletMacaw, ... as which often occurs, ... "great minds think alike".

I posted **this comment** up above, prior to reading yours.

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michael hart November 12, 2018 at 4:45 pm

Well, good luck. Rational scientific and engineering arguments have routinely been over-ridden by environmentalist fear mongering for most of my life. I don't see the change coming from within the US itself anytime soon.

A rough prediction: I would guess that we will have to have been buying nuclear technology for some years from places where it was not driven out (China, Russia, India), and also sending waste back to them, before it becomes OK again in the US and Western Europe.

of misinformation and outright lies about nuclear technologies. Yes, they were helped by casual and lackadaisical industrial approaches, cold war politics, and threats of nuclear war interfering with technical choices, but they played their cards well.

Ty Hallsted November 12, 2018 at 7:30 pm

It seems the tide may be turning – perhaps a silver lining forming around the cloud of climate alarmism. I hadn’t caught wind of this until watching this very good TED talk from a longtime anti-nuker who has partnered with others like himself to try and set the record straight and advocate FOR rather than against nuclear power.

Michael Shellenberger: Why I changed my mind about nuclear power:

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this project reinforces my belief that many of the people with the smarts to know that CAGW is incorrect are pushing the idea in the hope that opposition to nuclear power will stop. I am guessing that some of these folks are appalled by the direction that our future power production has taken but cannot bring themselves to admit to anyone that the monster they helped create went berserk.

James Francisco November 12, 2018 at 5:36 pm

Dangit. I knew that didn’t look right…catastrophe

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sycomputing November 12, 2018 at 5:46 pm

Don’t forget “artical”

James Francisco November 12, 2018 at 6:26 pm

Dangit again

Clyde Spencer November 12, 2018 at 8:55 pm

If you hadn’t said anything I was willing to accept that you were just trying to be funny.

Steven Mosher November 12, 2018 at 4:49 pm

There are reasons why horizontal is cheaper and safer than vertical.

David Middleton November 12, 2018 at 5:33 pm

(All other factors held equal)… Horizontal is never cheaper than vertical.

Safer? How?

DonM November 12, 2018 at 6:25 pm

WRT safer … it appears that they have a ‘patent pending plumbers trap’ to keep the rats out of the hot, ‘horizontal’, portion of the pipe. So, no radioactive rats coming back up the pipe.

WRT to cheaper … once the deep isolation team gets the vertical concept sent to regulatory purgatory, anything will be cheaper than vertical.

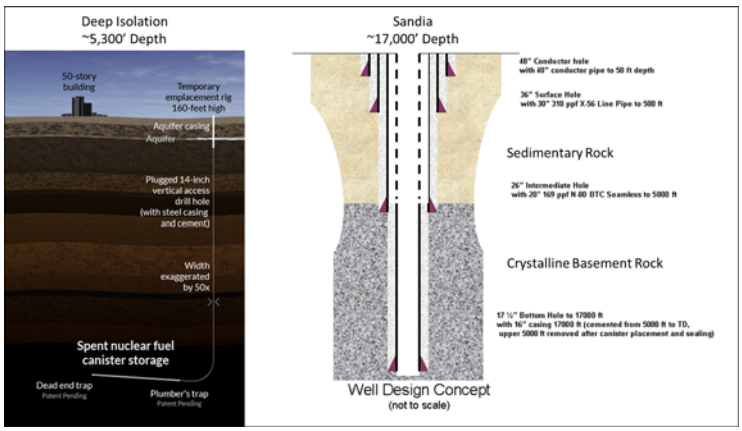
Steven Mosher November 12, 2018 at 9:47 pm

thanks don.

I did not think I would have to explain the plumbers trap to Dave

Also

David Middleton November 13, 2018 at 1:24



Deep Isolation: The contaminated water will flow down-hill into the plumber's trap, where gravity will prevent it from flowing back up 5,300′ of vertical wellbore, accesible at the surface.

Sandia: Gravity won't prevent the contaminated water from flowing back up 17,000′ of vertical wellbore, the upper 5,000′ of which has been cemented and permanently plugged.

Did you catch the sarcastic bit?

GeoNC November 13, 2018 at 4:13 am

Retrieveable cast iron bridge plug works just the same on a vertical well as a horizontal one. Why would you think you need a plumber's trap (not a term used in O&G industry) with no fluid in the hole?

DonM November 13, 2018 at 12:41 pm

steve, you are welcome, any time buddy.

> I added "all other factors held equal," because someone might be tempted to say that a 5,300′ TVD horizontal well is cheaper than a 17,000′ vertical well.

Stephen Rasey November 12, 2018 at 4:53 pm

> I much prefer to store reactor waste in a place where it is recoverable. As the first line stated, reprocessing is far preferable to disposal. A compromise is to reprocess after say 50 years, when the shortest half-life radionucleotides have decayed appreciably.
>
> What I have not heard about is the issue of waste heat. How many cubic meters of rock are needed per original fuel rod is needed to disperse the heat of the decaying rod in a formation that has low water permeability? Indeed, we might find out about "thermal fracking" of the formation.
>
> Consider the Rocky Mountain Arsenal #3 well. It was used by Dow Chemical / US Army to bury 180 million gallons of toxic waste from the nerve gas factory on site in 1966. I think it is well accepted that that well was the cause of three Mag 5+ earthquakes to strike northern Denver in 1967-68. The link of the earthquakes to the well is generally accepted, but I think there is uncertainty about the mechanism. The generally accepted mechanism is raised pore pressure along inactive faults.
>
> The minority view (and the one I hold) is that it was a thermal shock to the basement; you drop 180 million gallons of water+otherstuff at surface temperature down to 12,500′ subsurface and you will cool — and contract — the basement rocks. Why do I think that is significant? Because while the well was pumping, there were many small Mag 2,3 quakes. The three M5+ quakes happened 6, 12, and 18 months AFTER the well was capped. Hypothesis: pore pressure AND rock contraction caused the small quakes. But thermal EXPANSION from rewarming of the rocks is the cause of the M5+ quakes.
>
> I said it was a minority view. But there are at least three other cases where large volumes of water pumped down wells for tertiary recovery or disposal have caused quakes. Rangely, CO is the famous

volumes.

Moral of the story: It might not be just the pore pressure. It might also be changes in bulk rock temperature over large areas. And if so, placing hot and highly radioactive rods deep underground will have a thermal effect on the country rock.

David Middleton November 12, 2018 at 6:46 pm

Neither proposal features injecting fluids into formations at depth. Containers of nuclear waste would be lowered to the bottom of the cased boreholes and plugged.

Stephen Rasey November 12, 2018 at 7:05 pm

Did you overlook the issue thermal expansion of the rock due to heat from radioactive decay? Just how much heat in joules does a spent rod expel over its first five years? How many rods per bore hole? What is the thermal conductivity of a ductile impermeable shale like that proposed?

Perhaps the steel casing is a thermal relief.

David Middleton November 12, 2018 at 7:48 pm

> *“ Thermal hydrologic calculations estimate the thermal pulse from emplaced waste to be small (less than 20° C at 10 meters from the borehole, for less than a few hundred years), and to result in maximum total vertical fluid movement of ~100 m. Reducing conditions will sharply limit solubilities of most dose-critical radionuclides at depth, and high ionic strengths of deep fluids*

Chris4692 November 12, 2018 at 4:54 pm

Why not collect all that waste in one place and recover the heat?

Steven Mosher November 12, 2018 at 9:42 pm

The risk of moving it is non zero

David Middleton November 13, 2018 at 1:26 am

Yep… Deep Isolation is definitely far superior to keeping it in “swimming pools.”

MarkW November 13, 2018 at 9:13 am

You don’t have to move it to the bore holes????

Canman November 12, 2018 at 4:57 pm

A minor mistake — Elizabeth Muller is Richard Muller’s daughter, not his wife.

David Middleton November 12, 2018 at 5:42 pm

Will edit.

Ron November 12, 2018 at 5:08 pm

Do your cost estimates (84 billion in todays dollars) take into account cost reductions in the drilling technology since the 2007 study?

David Middleton November 12, 2018 at 5:43 pm

The cost estimates are from the 2009 Sandia study… So the answer is mostly no.

Ron November 12, 2018 at 5:48 pm

David Middleton November 12, 2018 at 6:15 pm

Either way, the costs are out of date and proabably cheaper now.

Pat Frank November 12, 2018 at 5:30 pm

“*Steve Mosher … A scientist at Berkeley Earth …*”

Don’t make me laugh. Steve Mosher has no training and no experience. He doesn’t know anything about science.

And Berkeley Earth doesn’t know that thermometers have resolution limits. Of course, neither does UKMet or NASA GISS. Yet one more tragedy of equity scholars in science.

Steve Heins November 12, 2018 at 5:54 pm

Chemists don’t know anything about climate either.
…
Glass houses Frank.

Ed Bo November 12, 2018 at 6:59 pm

Serious chemists like Pat know a lot about precision of measurement (e.g. for temperature) and proper techniques of data analysis (including uncertainties). Most climate scientists, not so much.

So true – especially analytical chemists. Ones I've worked with are excellent at managing very large data sets (data bases) including quality control of the data which seems a struggle for some climate scientists.

Clyde Spencer November 12, 2018 at 9:02 pm

Steve Heins,
Surely you aren't suggesting that we should dismiss the contributions of Arrhenius! He is widely considered to be a chemist, albeit trained in physics.

Philip Mulholland November 13, 2018 at 12:01 am

"Chemists don't know anything about climate either."
Seriously? This is a food fight I've got to join.
The study of carbon sequestration is fundamentally a geochemical / biochemical discipline.
I have only just discovered from the chemists that "bicarbonate" ions are amphoteric substances with all the implications this fact has for ocean water chemistry and pH buffering.

Pat Frank November 13, 2018 at 8:55 am

My work in that field is about physical error analysis, Steve Heins, not about the climate. Zero points for you.

Steve Heins November 13, 2018 at 12:33 pm

.
https://www.skeptic.com/reading_room/a-climate-of-belief/
.
Sure does look like a glass house to me.

Pat Frank November 13, 2018 at 4:40 pm

I did write that, Steve Heins. Your empty derision means nothing.

Follow your laughter up with a real criticism (if you can), or end up looking the fool.

Steve Heins November 13, 2018 at 4:58 pm

The only thing that will stop me from laughing at you, is when you stop chiding Steve for being outside of his academic training.....because you are no better than him.

Steve Heins November 13, 2018 at 5:02 pm

You want "real" criticism? You are correct when you say that thermometers have resolution limits. But that is not the same thing as the error in sampling a population mean. Apples and oranges sir.

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foolish.

Ignorance itself is not shameful. Everyone is ignorant about most things.

However ignorant laughter is a personally shameful matter. Only the foolish are shameless when they laugh out of ignorance.

One who does not learn from foolish behavior merits the noun.

Pat Frank November 13, 2018 at 9:20 pm

Steve Heins, your “real criticism” (November 13, 2018 at 5:02 pm) was not about the Skeptic paper. That paper was your challenge, not my work on systematic sensor measurement error or instrumental resolution.

Your move to thermometers is a diversion. You have no criticism of the Skeptic analysis and apparently cannot bring yourself to admit it.

On thermometers, my work is about systematic error due to uncontrolled environmental variables. Such error is known to be non-normal.

Non-normal error violates the assumptions governing the Central Limit Theorem. Systematic error does not diminish with repeated measurements. Repeated measurements can even increase total physical error.

The mean of systematic error reveals nothing of the physically correct value of a measurement. Your reference to population means is irrelevant.

Your supposition that I have confused resolution and systematic measurement error has no foundation in fact or in any of my analyses

michael hart November 13, 2018 at 11:57 am

Yes, Pat Frank. I thought that one was too easy, like shooting rats in a barrel.
But the English graduate does seem to have a good understanding of what might benefit him financially. And it hasn’t stopped him stooping to insult people like Stephen Wilde for only being a lawyer. I expect to see more hypocrisy from Mr Steve “Kinetics can tell you nothing” Mosher.

Clyde Spencer November 12, 2018 at 9:05 pm

Pat Frank,
I’d give you a ‘Thumbs Up” if there was one to click on!

Pat Frank November 13, 2018 at 8:57 am

Thanks, Clyde. 🙂

fred250 November 13, 2018 at 2:25 am

“He doesn’t know anything about science.”

He was hired mainly as a mouthpiece/frontman.

And he has proven himself to be spectacularly BAD at it.

If I was BEST, I would be asking him, pleading with him.....

.... "please stop trying to help" !!!

Canman November 12, 2018 at 6:05 pm

Does it really need to be buried? It doesn't take a lot of space. Can't it stay where it is? It would certainly be more easily recoverable. I assume it's in pretty solid containers. If any surprises are found in the robustness of the containers, they're more accessible for re-containment. Perhaps with some marketing they could be decorative pillars in some resort where people could vacation with the fuel of tomorrow.

MarkW November 13, 2018 at 9:15 am

Where it is now are pools at the various nuclear power plants. Those pools are filling up, and the plant operators have been paying a tax to the federal government for decades to pay for a permanent solution.

Stephen Rasey November 12, 2018 at 6:32 pm

In this decision making / preference discussion, we should not overlook that spent reactor rods typically contain 93-95% unburned U + 2-3% Pu + highly radioactive (of short half-lives) fission products and reactor poisons. Ultimately, we need to reprocess this resource in the future. We must not assume the supply of Uranium and Thorium are limitless.

Disposal options that prevent any responsible recovery and reprocessing in 50-100 years are worthy of the Luddites.

The answer is that they don't care about facts. They care about making nuclear power unatainable and un affordable. What they really want is to impoverish and demoralize the deplorables of flyover country, so that their rule remains unchallenged.

Craig from Oz November 12, 2018 at 6:58 pm

Oh more interest to me is not will this method work, but more that the backers believe there is a long term market for this.

So someone at least does not believe nuclear is going to be replaced with sunbeams and unicorns any time soon.

David Middleton November 13, 2018 at 2:43 am

+42

MarkW November 12, 2018 at 7:16 pm

An expensive and wasteful solution to a non-existent problem.
No wonder Mosher is for it.

Steven Mosher November 12, 2018 at 9:39 pm

weirdly its cheaper than all other viable solutions.
also its already paid for. the funds to store the waste have already been collected to be spent on storage.

Canman November 12, 2018 at 11:37 pm

How can it be cheaper than laving it where it is?

David Middleton November 13, 2018 at 1:27 am

And Mosh… You guys do have a better solution than surface storage.

MarkW November 13, 2018 at 9:20 am

Use politics to eliminate all viable solutions, then whine that your prefered solutions are the best that remain.

Yucca Mtn is built and ready to take shipments.
The two complaints about Yucca Mtn were that you couldn’t guarantee isolation for 100’s of thousands of years, and transporting the waste to the disposal site also exist for your so called solution.

The best solution, by far, is reprocessing. Instead of wasting money on non-solutions, why not try to resolve the political problems that are keeping us from reprocessing.

Amos E Stone November 13, 2018 at 12:41 pm

There’s more U235 in spent fuel from a PWR than there is in the original ore, and a bunch of plutonium too

job of growing our own idiots.

David Hood November 12, 2018 at 7:18 pm

Umm…nuclear waste….there should be no such thing.
Spent nuclear fuel I'll accept, but it should not be thought of, or treated as waste…not just quite yet.
As I understand it, most such 'spent' fuel rods have only given up approx 1 to 3 % of the potential nuclear energy and as such still can contribute to future energy production.
Now for the caveat – IF 4th generation nuclear reactors are FINALLY developed.

So, no 'waste' storage costs, NO reprocessing costs, just a source of cheap (well, its waste isn't it) source of fuel for our future use.

No, I am NOT a scientist and NO don't bother asking me to add much more to the above.
Those that DO work in this arena, such as Kirk Sorenson, would be well able to add the reasons why this 'waste' problem, is actually a huge potential reservoir of future nuclear fuel.
(Hint: it was Kirk who suggested this use of the fuel anyway)

Mike Borgelt November 12, 2018 at 7:40 pm

Guys, and Charles the moderator. The previous poster claiming to be Mike Borgelt isn't me.

[Ok, so the Brisbane Mike is the real one? Or is the Osaka Mike the real one? Perhaps the real Mike is from Quita Ecuador? Though one wonders how you went from Ecuador to Japan in 3 hours (which is what the IP Addresses and comment timestamps show.) Perhaps you should change your password to something other than "M1ke1sAw3s0m3"… -mod]

Thank goodness for that, since you were a bit of a jerk!

🙂

Dr. S. Jeevananda Reddy November 12, 2018 at 7:47 pm

Nuclear power:

Do we need to clean our heads with fire???

Dr. S. Jeevananda Reddy

Smart Rock November 12, 2018 at 8:59 pm

There is so much energy potential tied up in those "once-through" fuel rods, that it's a crime to bury them and withhold all that energy from future generations. It's somewhere between 70 and 100 times the energy that the fuel generated on its short life in the reactor. I forget the actual number, and anyway it depends on whether breeder reactors are used.

Leave the "spent" fuel in swimming pools inside secure areas at nuclear plants (where it's quite safe for now) and save the billions that it would cost to bury it, and the billions to retrieve it for future use when the anti-nuclear panic has subsided.

Paul Schauble November 12, 2018 at 9:48 pm

Let me inject a bit of perspective here.

Depending on the exact fuel composition and degree of burn in the reactor, fuel assemblies are no more radioactive than the ore that was originally mined to make them in 600-1000 years. We have

be retrievable. At some point we will want that unused uranium back.

Hans Erren November 12, 2018 at 10:01 pm

Waste is next generations' resource. Deep burial therefore destroys a valuable resource.

David Middleton November 13, 2018 at 2:50 am

It's not "destroyed. It becomes a man-made "ore body" at a known depth and location. It's sort of geocached. If the attidudes about and economics of reprocessing change, and technology continues to improve, future mining companies might be able to re-drill the wells and recover the waste containers.

Robert of Texas November 12, 2018 at 10:15 pm

Yucca mountain was a perfectly good answer as to storing the used materials. Recycling first is even better. Eventually we will be wanting this so-called waste… Trying to store it for hundreds of thousands of years is just ridiculous. No one can foretell the future, not even climate scientists.

Why this country cannot execute reasonable plans is beyond me… You would think as much as we spend on education our population would be at least slightly educated – instead they are a superstitious lot worshiping at the foot of Chicken Little.

David Middleton November 13, 2018 at 2:50 am

Yucca Mountain was ideal.

Alan Watt, Climate Denialist Level 7
November 13, 2018 at 5:03 am

In addition to not being a lawyer I am also not a nuclear engineer. But having observed the Yucca Mountain debacle it is clear that the political barriers to waste storage must be solved before we debate the merits of the available technical solutions. We have a technically viable solution today that is not being used because of political forces. What makes anyone think that will change if you propose a new method? Sure, they will gladly accept the funding and jobs to build something new, but then scuttle it once we try to use it.

IMHO the best solution to nuclear waste is to produce less of it, which means breeder reactors. That doesn't help the US currently because all our commercial reactors are light water models that were designed to produce plutonium for the military. However Canada has CANDU (heavy water) reactors which I have read can be fueled with waste from conventional reactors. So if we're not going to build more nuclear weapons, my solution would be to reprocess the fuel and send whatever we can't use to Canada to be burned up in their reactors.

What you have is less than 10% of the current volume of waste without all the really nasty long-lived stuff. This make the disposal and storage problem at least an order of magnitude easier, cheaper and safer.

Worried about moving plutonium around? Since the 1950's up until relatively recently we've had plutonium flying over our heads all around the world in B-52s 24 hours a day

anyplace else in the world that can burn it up. It would be like old times.

Tom in Florida November 13, 2018 at 6:08 am

> "it is clear that the political barriers to waste storage must be solved before we debate the merits of the available technical solutions."
>
> Well Alan, since we cannot even overcome the political barriers of how to count votes I think there will never be a real debate about anything in science. Yes,I have finally thrown in the towel. Let the voters reap what they sow. I am old enough now to just go out into the Nevada desert and wait for the aliens to come and take me away.

MarkW November 13, 2018 at 9:48 am

> I thought they stood down the nuclear B-52's shortly after the Soviet Union collapsed.
> I also thought the B-52's were on hot standby. Ready to take off in a minute or two once an alert was sounded.

Alan Watt, Climate Denialist Level 7
November 13, 2018 at 12:24 pm

> My information comes from retired USAF General Philip Breedlove, former SACEUR from a talk he gave here on Nov 5th. He said the service life of the B-52 program had recently been extended into

Ah, here we go:

> *“ The B-52 has been in active service with the USAF since 1955. As of December 2015, 58 were in active service with 18 in reserve.[11] The bombers flew under the Strategic Air Command (SAC) until it was disestablished in 1992 and its aircraft absorbed into the Air Combat Command (ACC); in 2010 all B-52 Stratofortresses were transferred from the ACC to the newly created Air Force Global Strike Command (AFGSC). Superior performance at high subsonic speeds and relatively low operating costs have kept the B-52 in service despite the advent of later, more advanced aircraft, including the canceled Mach 3 B-70 Valkyrie, the variable-geometry B-1 Lancer, and the stealth B-2 Spirit. The B-52 completed sixty years of continuous service with its original operator in 2015. After being upgraded between 2013 and 2015, it is expected to serve into the 2050s*

A fleetwide modernization of the B-52s was announced in 2013. The upgraded H models can carry twenty 2,000-lb JDAMs. I should think a very modest flight schedule should be sufficient to transport all our spent fuel to Canada for safe fissioning in their reactors.

Gilbert K. Arnold November 13, 2018 at 10:51 am

Guys: A lot of this was covered in a book written in 1994 entitled: “Whose backyard, whose risk : fear and fairness in toxic and nuclear waste siting” by Michael Gerrard. Available on Amazon (and possibly Barnes&Noble). Well worth reading.

Johann Wundersamer November 12, 2018 at 10:22 pm

that exist: thei’re RADIOACTIVE!

So from subduction zones this materials sinks directly to the earth core. Problem solved.

MarkW November 13, 2018 at 9:22 am

Tritium is radioactive.

Johann Wundersamer November 12, 2018 at 11:17 pm

corrected molecules –> atoms:

Cheapest way to get rid of nuclear waste – place it in tectonic subduction zones.

Radioactive material consists of the “biggest” = heaviest atoms that exist: thei’re RADIOACTIVE!

So from subduction zones this materials sinks directly to the earth core. Problem solved.

_____

https://www.google.at/search?q=periodic+table+elements+list&oq=periodic+table+elements&aqs=chrome.

MarkW November 13, 2018 at 9:23 am

Adding extra radioactivity increases the temperature of the core, which causes an increase in vulcanism.

---

of the core, which causes an increase in vulcanism.”

OTOH in subducting tetonic plates there IS already radioactive materials – we digged our radioactive material from that very plate.

Sort of recycling.

Retired Kit P November 12, 2018 at 11:42 pm

So what is the problem again?

Now that I retired from the nuclear industry I am having more frequent senior moments. It is really embarrassing to find yourself stand in front of the frig with a cold beer mug trying to remember why you went to the frig.

These days I worry about motor homes safety. By my thing is something is a problem then you will find evidence of the problem. While there are lots of discussions on the topic in the RV forums, when I check the stats less then 10 people die in a motor home as a result of accident.

Spent nuclear fuel is like watching paint dry. When people talk about dying of boredom, I think it is just an expression.

Geoff Sherrington November 13, 2018 at 1:46 am

The immediate problem, if there is one, is that there are many ways to properly manage spent nuclear fuel. There are many processes in the top ten. All are suitable by any standard applied with mature knowledge of physics and chemistry.
The pity is that having isolated a top ten, there is never-ending argument about which is the better of that ten, when any one would do.
The first cut should ask “do we want to isolate this material for the

delay of the onset of the evil hour. It is patently ridiculous to argue this method or that.
And yes, I have a long history of involvement in the nuclear fuel cycle, at a level able to influence national policies, so you can be assured that I am not blowing smoke.
For goodness sake, choose a method then deploy it. The risk of a wrong choice is negligible. Geoff.

Dr. Strangelove November 13, 2018 at 4:35 am

The more economical nuclear waste (fuel) disposal is to build a breeder reactor. This 600-MW breeder reactor (BN-600) in Russia has been operating since 1980.

https://alchetron.com/cdn/bn-600-reactor-6ae2dd2f-5cfd-40d2-b4c5-1b013cb985e-resize-750.jpeg

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Joe Banks November 13, 2018 at 5:26 am

Norway has a Plutonium/Mox reactor called THOR. It uses thorium pellets and plutonium or other types of nuclear waste pellets to run a conventional light water reactor. It converts all the waste into not harmless but much less hazardous and shorter half life waste. All while working better than a conventional uranium rod.

---

beng135 November 13, 2018 at 8:50 am

Quite right. Blows the "bury it" meme out of the water. Time to get out of nursery-school mentality & become intelligent adults concerning this issue.

Remind me again, what's his degree in, because as I recall it wasn't in any field of science hence calling his a scientist is fake news.

---

beng135 November 13, 2018 at 8:45 am

They're really loose with the definition of "scientist" anymore. Maybe Mosher stayed at a Holiday Inn?

MarkW November 13, 2018 at 9:50 am

A scientist is anyone who does science. A degree isn't necessary.

John Endicott November 13, 2018 at 12:54 pm

A scientist is anyone who does science.

well there you have it, Mosh is no scientist.

Geoff Sherrington November 13, 2018 at 5:02 pm

And a brain surgeon is anyone who does brain surgery?
Geoff

John Endicott

school science class is a scientist (after all they were doing science). Somehow I always thought the bar for being a scientist was higher than that. But considering Mikey Mann, perhaps it isn't.

Bob boder November 13, 2018 at 10:12 am

Not to defend Mosher, but there are plenty of "real" scientists that post just as stupid stuff as non-scientists. Not so sure a degree makes someone intelligent or worth listen to. If being a "scientists" determines who are the ones qualified to discuss a topic that affects everyone then we are all screwed.

John Endicott November 15, 2018 at 9:50 am

No one is saying a degree is needed to make someone intelligent or worth listening to (that's certainly not what I was implying). But if someone is going to be referred to as a "scientist" they best have the bona fides to back that up.

Shane Hanson November 13, 2018 at 6:07 am

The project Yucca Mountain was a boondoogle to Nevada. They spent billions, and continue to spend money on it and not use it. Frankly, the bore hole idea is cool but a complete waste of time and money. The fuel can be reprocessed. Secondly, it guards itself pretty well. Radiation decreases at 1/distance^2. We need to get back to reprocessing and using the spent fuel. A nuclear reactor only uses about 10% of the fuel it is loaded with. At that point the pressure in the fuel is too high and the stainless steal growth or aluminum

Tasfay Martinov November 13, 2018 at 6:32 am

Steve
Congratulations on this excellent effort to bring some sense into nuclear long term disposal!
The failure to solve this problem for approaching a century is becoming an embarrassment to the human race.

Lurker Pete November 13, 2018 at 6:36 am

Since in 3 of the examples given, the ground temp is over 100C, and the heat given off by the stored waste would raise it further, what happens if water leaks into the well?

OK casing failures are rare etc. according to the other thread on fracking “Ground water can be contaminated if a well’s steel casing and cement fails or fluids are spilled on the surface, but these problems are uncommon, local and can be fixed” and “The rate of mechanical failures in hydraulically fractured wells in the Denver-Julesburg (DJ) Basin of Colorado, has been estimated at 0.06% to 0.15% and none were due to the fracking process itself (Sherwood, et al. 2016)”

How long can the steel/cement casing/steel canisters etc. be guaranteed for, and what kind of fail-safe prevents a radioactive geyser in x 10’s of yrs?

Bob Hoye November 13, 2018 at 6:44 am

David –good summary of the horizontal drilling idea.
Cheaper than mining storage space at depth.
But in geological time risky.
For decades I've suggested just glassing the stuff, then put it into used shipping containers and wrap that with lead.
Drop it into the Mid-Atlantic rift.
Bye-Bye
Gone

Tasfay Martinov November 13, 2018 at 12:35 pm

That would work, only not a forming tectonic boundary like the mid-Atlantic; rather a subduction zone like the west Pacific at or near the Marianas trench. Then it goes down into the magma and it's real gone. This has been also proposed already for decades. But stopped by dog-in-the-manger activist paralysis.

The nuclear impasse is an embarrassment to the human race and caused by hard-wired politics driven stupidity. Humanity is responding to this by producing more autists, especially high functioning autists (HFAs), where enhanced cerebral development occurs at the expense of complex, devious and counterproductive social behaviours. Some problems will only be solved by HFAs, byzantines just get hopelessly bogged down in useless politics.

beng135 November 13, 2018 at 7:21 am

Wow. The level of utter stupidity coming out of Berkeley is even worse than usual. No, don't reprocess valuable nuclear material & extract further energy out of it while reducing its radioactivity/half-

littlepeaks November 13, 2018 at 7:48 am

There's still a problem. Where would we drill these boreholes? Remember that there is always the "NIMBY syndrome".

David Middleton November 13, 2018 at 8:12 am

NIMBY'ism is a universal constant.

Gilbert K. Arnold November 13, 2018 at 11:03 am

Guys: A lot of this was discussed in a book by Michael Gerrard entitled: "Whose Backyard, Whose Risk: Fear and Fairness in Toxic and Nuclear Waste Siting" published in 1994. Available on Amazon or Barnes&Noble.

Mike Borgelt November 13, 2018 at 5:17 pm

Perhaps you should change your password to something other than "M1ke1sAw3s0m3"... -mod]

Nothing like that has ever been my password.

I'm in Queensland, Australia but not in Brisbane. I've been posting here for what must be close to 10 years and this form of identity theft has happened before here but nowhere else.

If you look back at my posts over the years you'll see that the idiot worried about the Hanford waste is not my style. I'm a big fan of nuclear energy, re-processing and waste storage (and Project

Agriculture. I'm a "used to be" forecaster with the Australian Bureau of Meteorology (a long time ago).

"[Ok, so the Brisbane Mike is the real one? Or is the Osaka Mike the real one? Perhaps the real Mike is from Quita Ecuador? Though one wonders how you went from Ecuador to Japan in 3 hours (which is what the IP Addresses and comment timestamps show.)"

Sounds like the imposter is faking IP addresses as well as identity.

John Endicott November 14, 2018 at 11:51 am

~~Dark Helmet~~ Mod:
1-2-3-4-5? That's the stupidest combination I've ever heard of in my life! That's the kinda thing an idiot would have ~~on his luggage~~ as a password!

~~President Skroob~~ Mike Borgelt:
1, 2, 3, 4, 5? That's amazing! I've got the same ~~combination on my luggage~~ password!

with apologies, just what came to mind reading your post 🙂

Though to be fair, posting here doesn't require a password anyone can type in any name when making a post.

Sounds like the imposter is faking IP addresses as well as identity

They're probably using a VPN to hide their own IP address.

Comments are closed.

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M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

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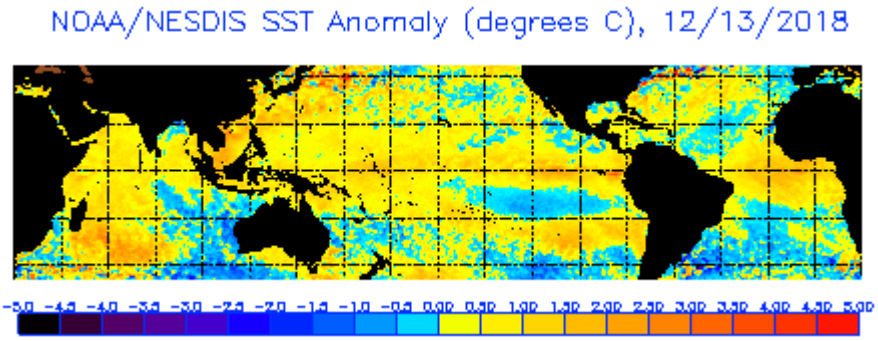

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