Nuclear New Zealand?

Saviour? Nightmare? Nonsense?

ESR Lecture

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22 May 2008

References:

David Fleming, The Lean Guide to Nuclear Energy, a life-cycle in trouble, The Lean Economy Connection (2007)

D. Yogi Goswami and Frank Kreith, *Energy Conversion*, CRC Press, Boca Raton (2008)

Nuclear Power for New Zealand?

- Saviour?
- Nightmare?
- Nonsense?

Questions

The New Zealand Herald
nzherald.co.nz

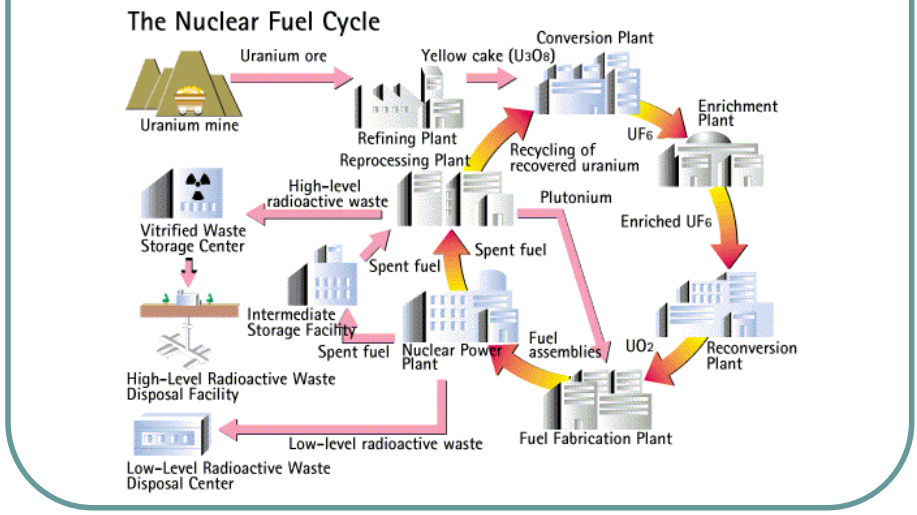
nzherald.co.nz
Web
Wednesday May 21, 2008

Fifth of NZers polled say nuclear power viable

11:40AM Monday April 07, 2008

Nearly one in five New Zealanders appear to believe nuclear power is a viable energy source, even though politicians have put it off limits.
Nineteen percent of 3546 polled in a New Zealand Business Council for Sustainable Development internet survey said nuclear power was the best electricity option for the next 10 years.

Nuclear Power Fact Sheet



www.fepc.or.jp

Anybody with a library card can find out all they want to know about how nuclear power plants work, and how the uranium fuel is resourced, processed and supplied. That is the sort of thing that I teach in my Energy Engineering lectures to Mechanical Engineers. This talk is about the reality of nuclear power in the context of New Zealand. And more importantly, this talk will ask a big question – why would we even ask if Nuclear Power is right for New Zealand?

Mining:Extraction of uranium ore (crude ore) from mines.

Refining:Removal of impurities from the ore to produce yellow cake (uranium concentrate).

Conversion:Conversion of yellow cake into uranium hexafluoride. (UF6)

Enrichment:Treatment of UF6 to increase the concentration of uranium 235, which burns readily but which is contained only in small quantities (0.7%) in UF6, to be- tween 3 and 5 percent.

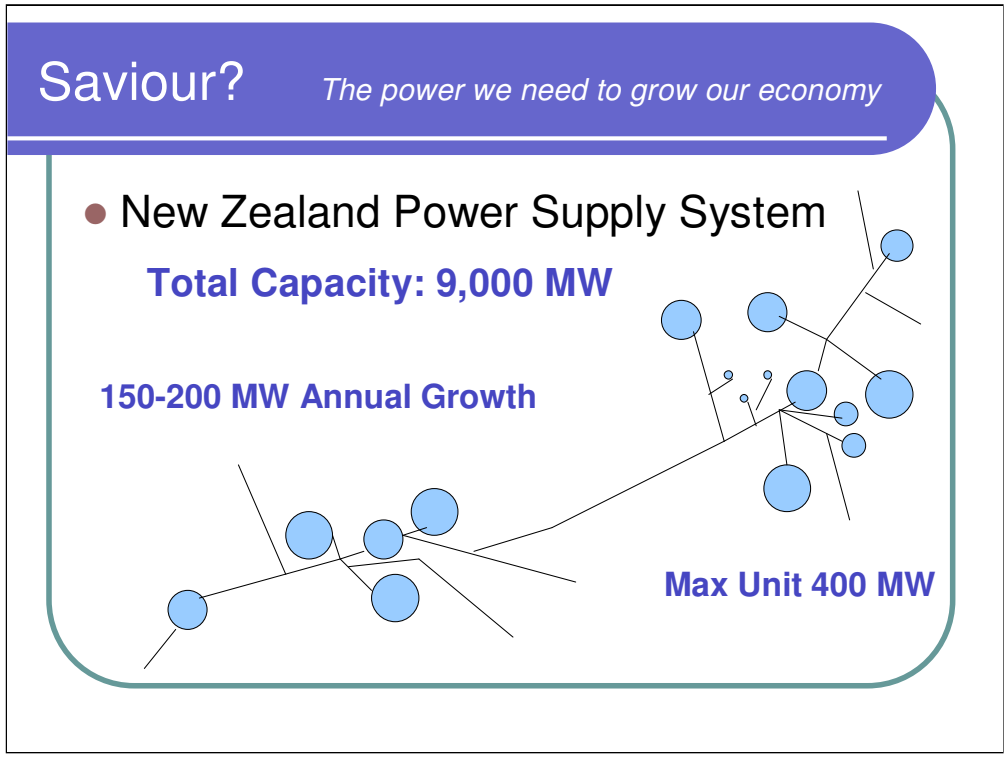
Reconversion:Conversion of enriched UF6 to uranium dioxide (UO2).

Fabrication:Sintering of UO2 to form it into hardened pellets which are sealed inside zirconium alloy tubes for arrangement into fuel assemblies.

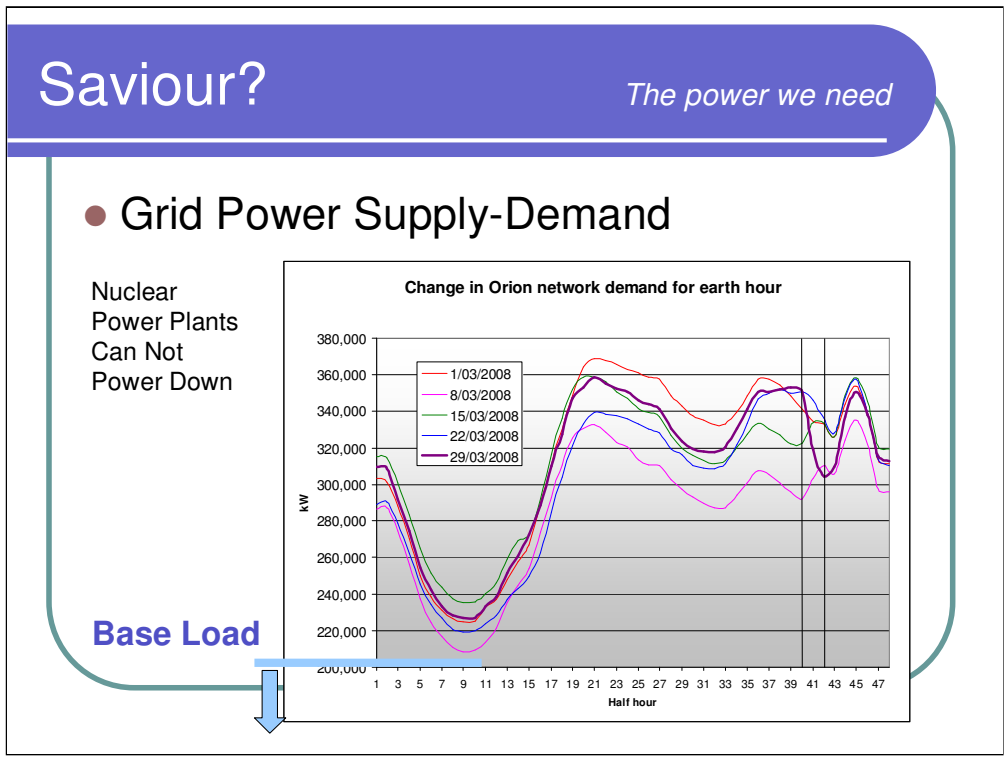
Generation:Loading of fuel assemblies into a reactor for use in the generation of electric power.

Reprocessing:Recovery of the residual unburned uranium and newly produced plutonium in fuel that has been in use for three or four years or so (spent fuel) and separation of the radioactive waste.

Re-use:Recovered uranium and plutonium is processed to be burned as fuel again.



Firstly, there is the reality of the power supply system in New Zealand. The Electricity Commission says that strictly from the power engineering perspective, nuclear power plants do not fit into our power supply system. Because of the linear nature of our grid, and the fact that we are not part of a larger network, the maximum generator on our grid is about 400 MW.



Source: Courtesy of Orion Energy

Nuclear power plants are “Base Load” only. Strictly. No kidding. That means that all of our existing power supply may have to be shut down at night to keep the thermal plants, including the nuclear plant, going. That’s not efficient use of resources.

Not even the craziest nuclear advocate in New Zealand would suggest that we would have the capability of designing and building a nuclear reactor ourselves. Surely! So let's go shopping for a nuclear power plant.

As you can see, there aren't any currently approved designs that meet our 400 MW upper limit. And the trend among all existing designers is for bigger plants. This is because of the blow out in cost of nuclear power plants. Even the smallest facility would still incur all of the expenses of safety monitoring, the high staff requirements, the very high staff qualification requirements, and the handling and materials expenses. The only prospect for nuclear power being profitable is for government support, loan guarantees, liability limitations, and whopping huge power plants to improve the economy of scale.

Saviour?

Power we can afford

- What's the Price?

Unknown

UK – Govt. commitment to rapid expansion
- BUT Must be privately financed

USA - $12 b in tax breaks
- $20b+ loan guarantees
- Liability limits on accidents
- $2b DOE insurance against cost over-runs

At this point, in the UK, there is no move by private industry to go into nuclear power plant development without massive government support. The government has declared that it will not finance or subsidise these developments. Don't look for new nuclear power plants in the UK.

Source: Paul Brown, Voodoo Economics and the Doomed Nuclear Renaissance, Friends of the Earth Publishing (2008)

Saviour?

Power we can afford

- Any other costs?

Soaring

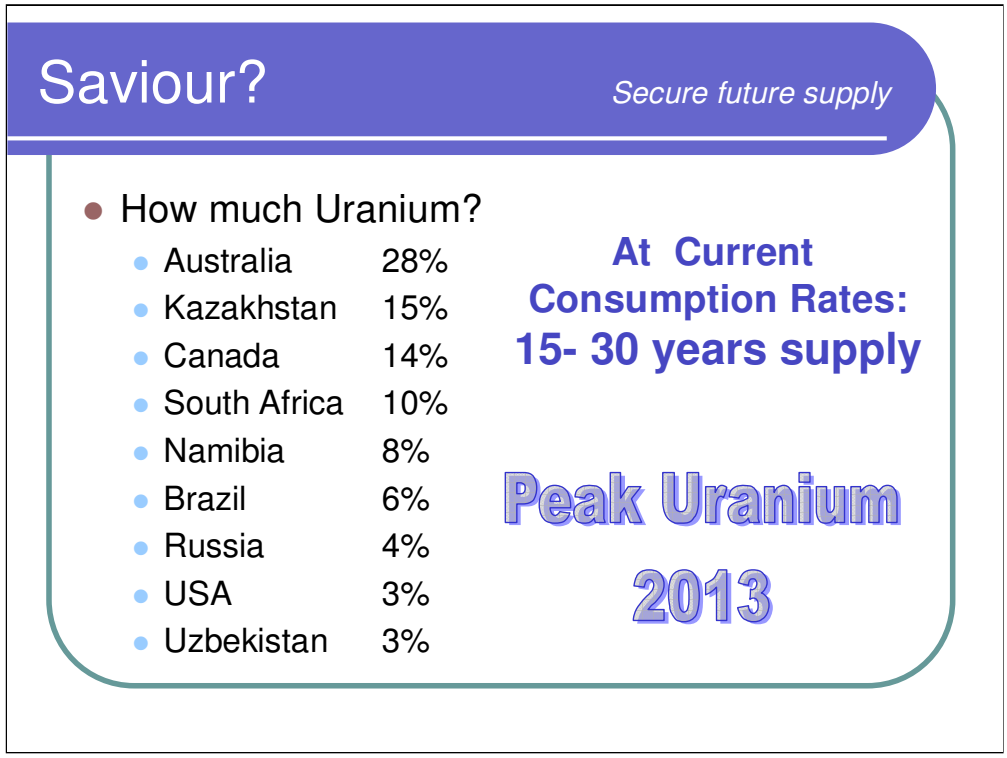
UK 19 Nuclear Sites: decommissioning

£73 billion so far and rising

USA Yucca Mountain Nuclear Waste Repository

$50 billion so far and no waste stored

Storm van Leeuwen and Smith (2007) Sustainable Development Commission (2006)



Uranium Supply and the Nuclear Option

Paul Mobbs, Mobbs' Environmental Investigations and Research,

3 Grosvenor Road, Banbury OX16 5HN.Tel./fax 01295 261864. Email meir@fraw.org.uk.

Published in Oxford Energy Forum, the quarterly journal of the Oxford Institute for Energy Studies,

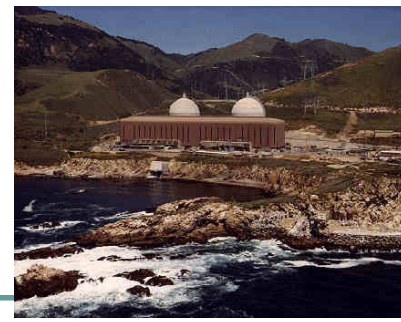
Issue 61, May 2005. (see http://www.oxfordenergy.org/ for details of the OIES).

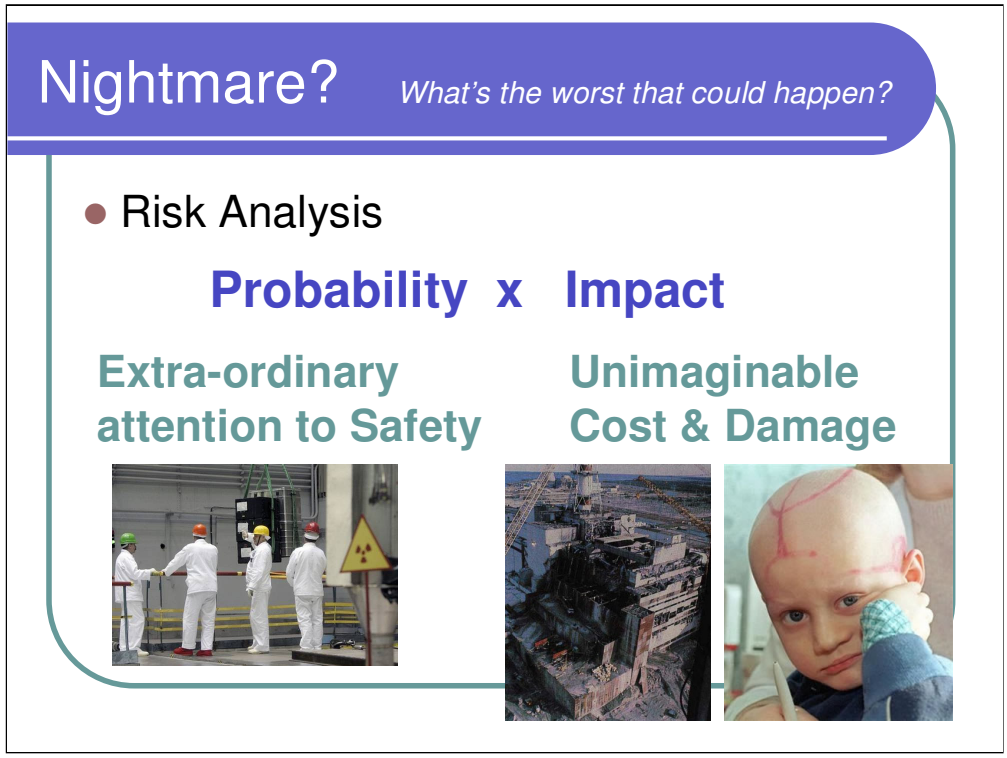
Saviour?

- Current reactor designs too big for NZ
- Doesn't improve GHG emissions
- Impossibly expensive
- U_{235} Supply Crunch

But let's be real,
you already knew this!

So WHY are you even asking?





The Chernobyl Reactor Incident

On April 25, 1986, Russian engineers and scientists begin preliminary tests on Chernobyl power plant's 4th reactor. What they didn't realize was that they were about to cause a meltdown that would kill them instantly and would have severe consequences that would extend even to the present day. The test was conducted in order to create a sufficient supply of energy to prevent overheating in the event of a shutdown. In order to do this properly, several alterations in the generator's magnetic fields had to be made, requiring the engineers to lower the power output to unstable levels. In order to control the experiment, the automatic control system was shut down. After some work, stability was reached at very low power outputs. Unfortunately, manual control of the water pressure wasn't maintained. The reactor began to create excess heat. Without the automatic control, the control rods couldn't be reinserted in time; a deadly chain reaction had begun.

Within a matter of 3-4 seconds, the reactor went from 5% output to 100 times its normal level. The water in the reactor flash-boiled, creating an explosion that leveled thousands of tons of concrete and steel, including the housing for the reactor. The steam carried almost 70% of the nuclear material out of the reactor into the surrounding environment.

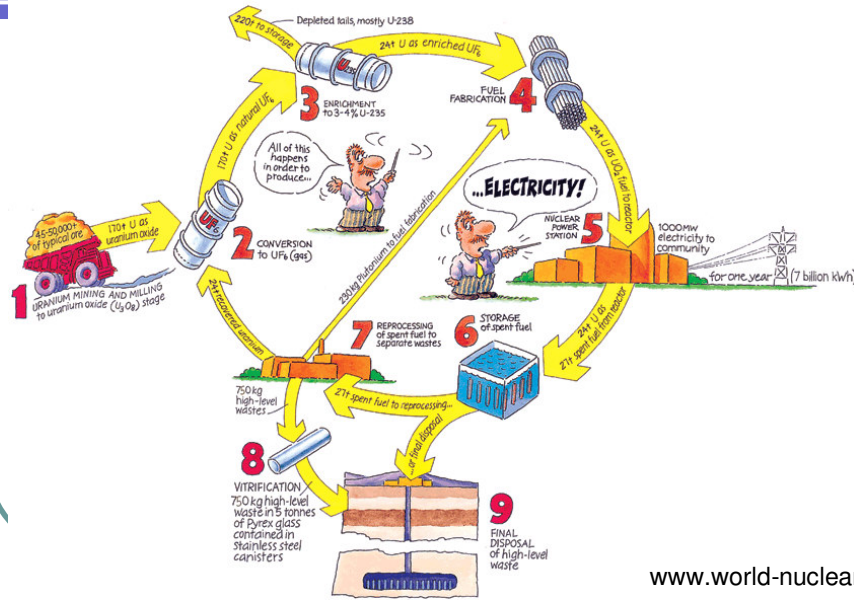
Several thousand volunteers died on the scene, and it is estimated that 7,000 to 10,000 volunteers died in total, considering short and long-term effects. Thousands of miles from the scene, the birth defect rate became double the world average.

It is also estimated that 150,000 were put at risk for thyroid cancer, and over 800,000 children were put at risk of contracting leukemia. 2 million acres of land (1/5 of the usable farmland in the Ukraine) was, and still is, completely unusable.

It remains difficult to determine the scope of the disaster; radiation resulting from the event was detected all over the globe. It is estimated that it may cost up to $400 billion and will take up to 200 years to correct the damage done to the area, and to compensate those affected by the meltdown.

Nightmare?

The Waste Streams

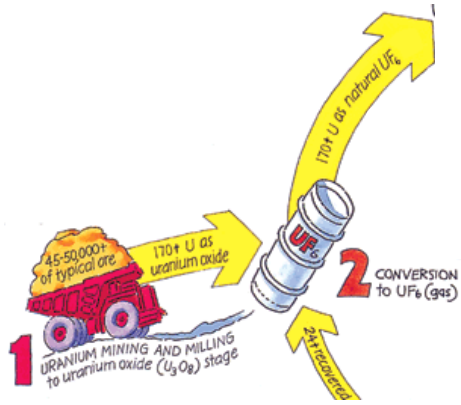


www.world-nuclear.org

www.world-nuclear.org

Nightmare?

The Waste Streams



Mining, Tailings
Crushing
Conversion

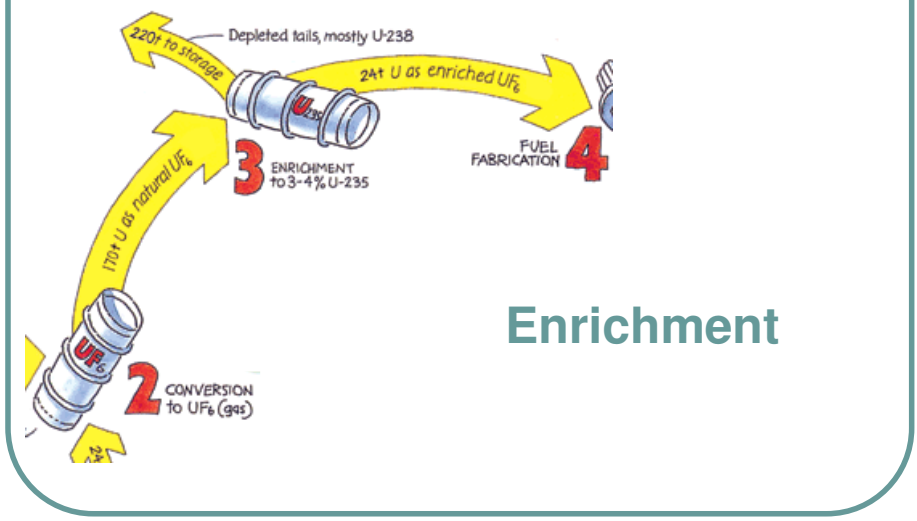
The uranium tailings piles around the desert southwest in the USA are still polluting ground water and rivers and causing health problems. They always will. Forever.

Even the ones that have been “cleaned up”, which means piled somewhere else, will pose health hazards for any humans who happen to settle nearby for the next 200,000 years or so.

It’s more sad that silly really.

Nightmare?

The Waste Streams



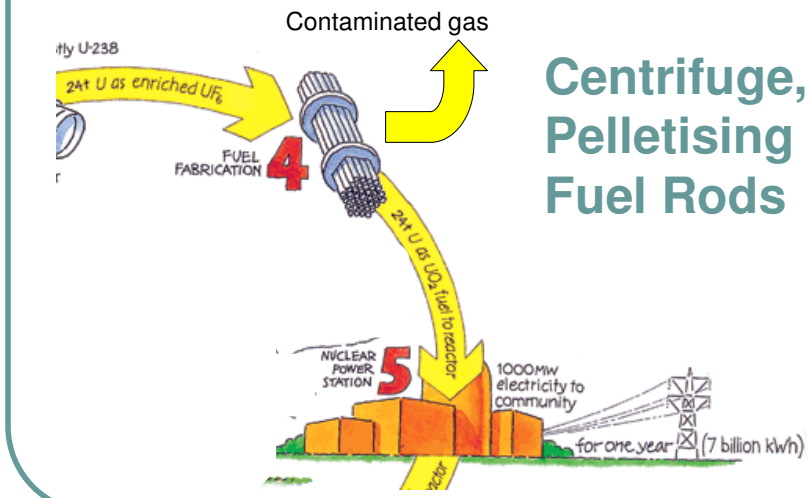
Depleted tails are currently sitting in warehouses. There is nowhere for them to go. The UF6 gas, "depleted" of U235 is still U238 which will produce harmful radioactive decay energy and materials for well over 100,000 years.

The really fun thing about depleted tails is that it will explode on exposure to water, even the tiny amount of water vapor in air! Thus widely distributing the uranium oxide and other isotopes that results. How will mankind continue to store this dangerous gas in high-tech cylinders and keep it safe from air, forever? FOREVER? These storage facilities for depleted tails Will be a disaster between now and 100,000 years from now.

A nuclear power plant, with 1000 highly trained, continuously monitored operators and highest level of security safety systems have had a pretty good track record! Think about it, over the 30 year life of the 400+ power plants in the world there has only been one mega-disaster! But, over the 1st 200 year life of a depleted tails storage facility, post-peak oil, post-peak coal, post-peak uranium… with no operating income, perhaps with no nuclear safety commission…. Do you want to calculate those odds? Who is going to pay to look after this stuff, FOREVER?

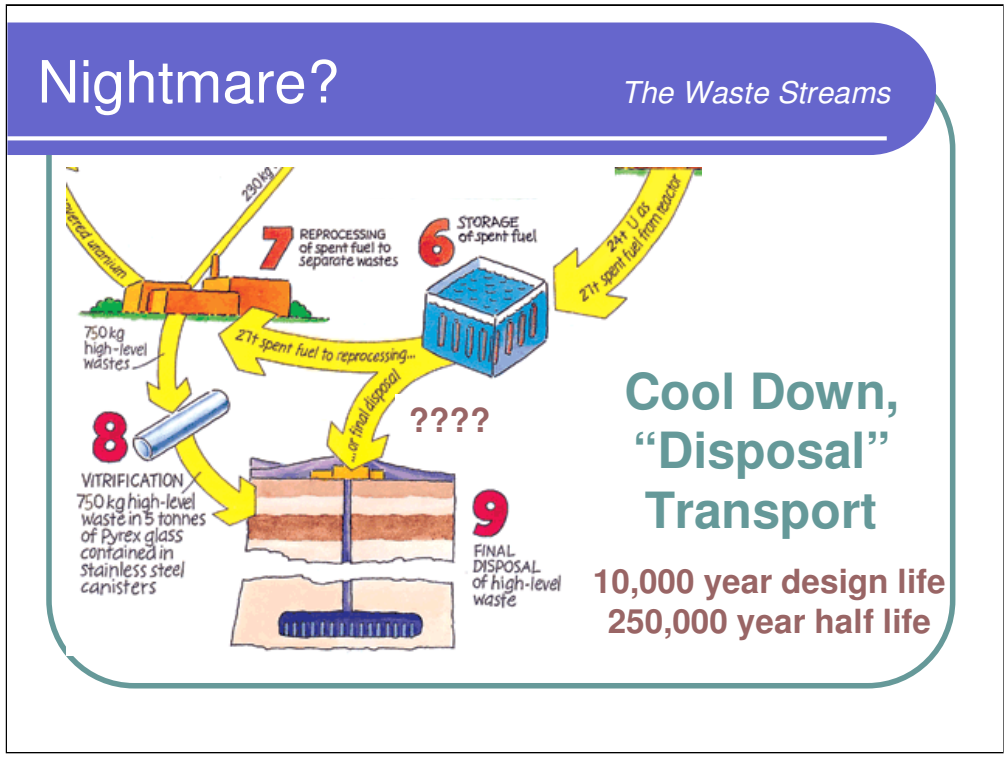
Nightmare?

The Waste Streams



Centrifuge, Pelletising Fuel Rods

There are known leaks of contaminated gases from the fuel fabrication processing plants. This is not an area that the public usually looks into because they often aren't aware of it. Also, the world is currently getting at least 20% of U235 supplied from stockpiled material. It lasts for ever. It's not like it's going to go bad.



Storage of spent fuel. Now this is just great. 27 tons of stuff per year that has to be protected and kept cool in isolated cooling water pools for 60-100 years until it's cool enough for remote control robots to pack into some kind of storage container and be driven to "final disposal" somewhere. Do you suppose Australia would take it back?

In the USA, there is so much risk to life due to the growth in suburbs all along the interstate highway system that they can't come up with a plan fro moving the spent fuel from the storage tanks (starting in around 2040 when there will be how much petrol?) at the nuclear reactors in the East to the Yucca Mountain repository in Nevada. One truck can carry about 40 tons, you do the math of how many trucks this would take.

And, shall we even discuss the repository? This is the most evil joke of all. Yes, we have writing. We can put signs up around the repositories. We'll make sure they use the universal symbol for all mankind for all time that says this is deadly don't go here forever!

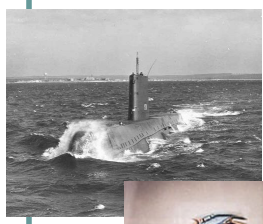
You know that disk they put on Voyager – That message to intelligent life forms out in the galaxy that might pick up that little space ship in a million years? It says who we were, and where we were, and what our greatest symphony sounded like, and what our voices sounded like. We need to make a little disk to put on the repository door that tells the people of 100,000 years in the future how terribly sorry we were and tries to explain how we could have done such a stupid thing so that this mistake is never repeated in human history.

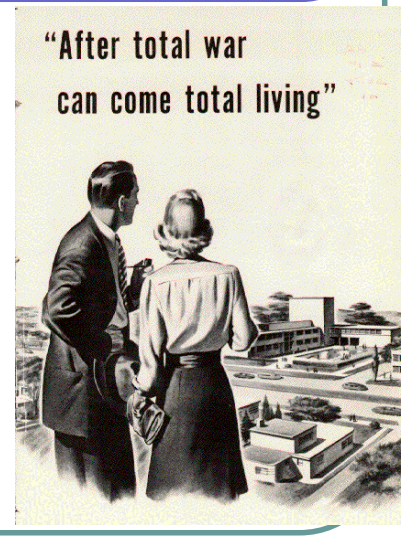
That is if we can get all the dangerous stuff into one spot.,

Nonsense?

What kind of people would do this?

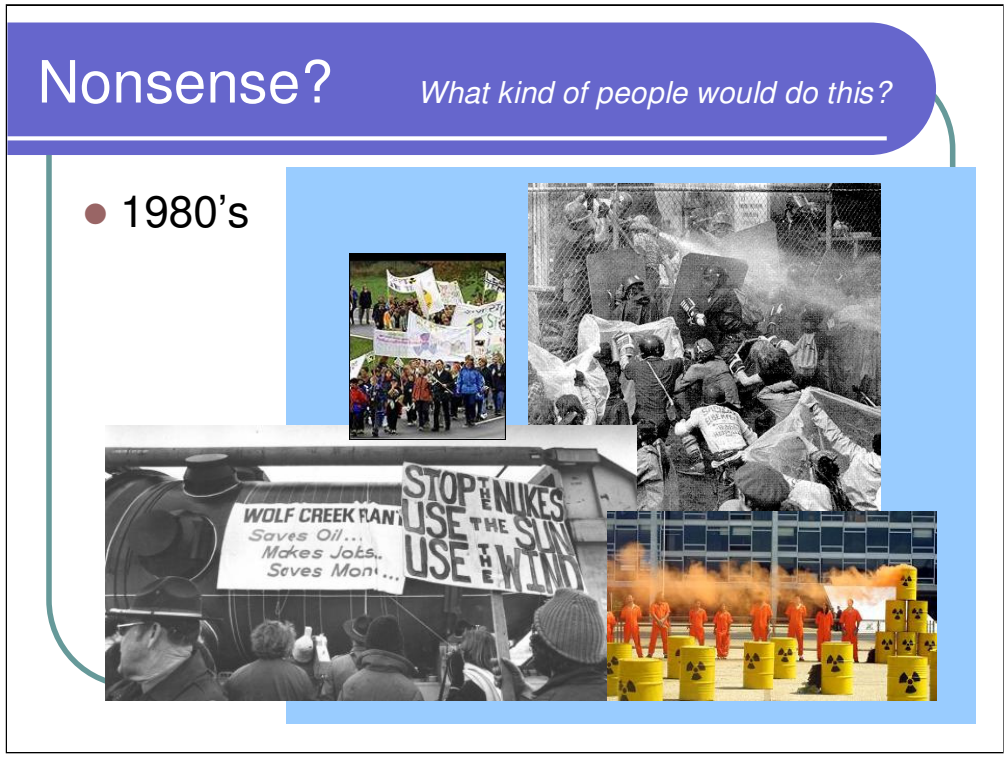
- 1950's





OK, so maybe, just maybe you could forgive the people in the 1050's and 60's for what they did. They really thought that new materials and new science would come along that would make radioactive materials "safe enough for babies to play with".

In fact, nuclear power was almost seen as an atonement for using nuclear weapons in WWII. Turning swords into plows and all that.



But, by the time the first nuclear power plants came up for decommissioning, it was clear that the miracles of science and engineering were not going to make nuclear power clean and safe and abundant. It was basically all over at that point. Well before Three Mile Island and years before Chernobyl. It was actually the prospect of decommissioning the first power plants that caused the cancelling of all the new plant orders in the USA.

Nonsense? *What kind of people would do this?*

But, somebody at some giant energy company will make a load of money off the government just to do the feasibility study for a new plant, and if those guys are your friends….

Now, I want to ask you to think for a moment, about the decision to build a nuclear power reactor in New Zealand. A decision made at a particular point in time. A decision that will be aimed at 30 years of power supply. A decision that will cause 100,000 years of grief. What kind of people would do that?

There is no way that a nuclear power plant would ever be built in New Zealand. It simply will never happen. But, I'm fascinated that the press would even be bringing it up, and I'm really fascinated that one in five, or even one in three according to another poll, New Zealanders would actually consider it. It's fascinating that we have that kind of technology ignorance. It's also fascinating that we have that kind of disregard for other people because we are so focused on our own needs and securities and comforts. How did we get to be like this? Is it because we don't know those people who we will harm? Well, let's go there now, into the future and see what they think of us.

2010 Jason

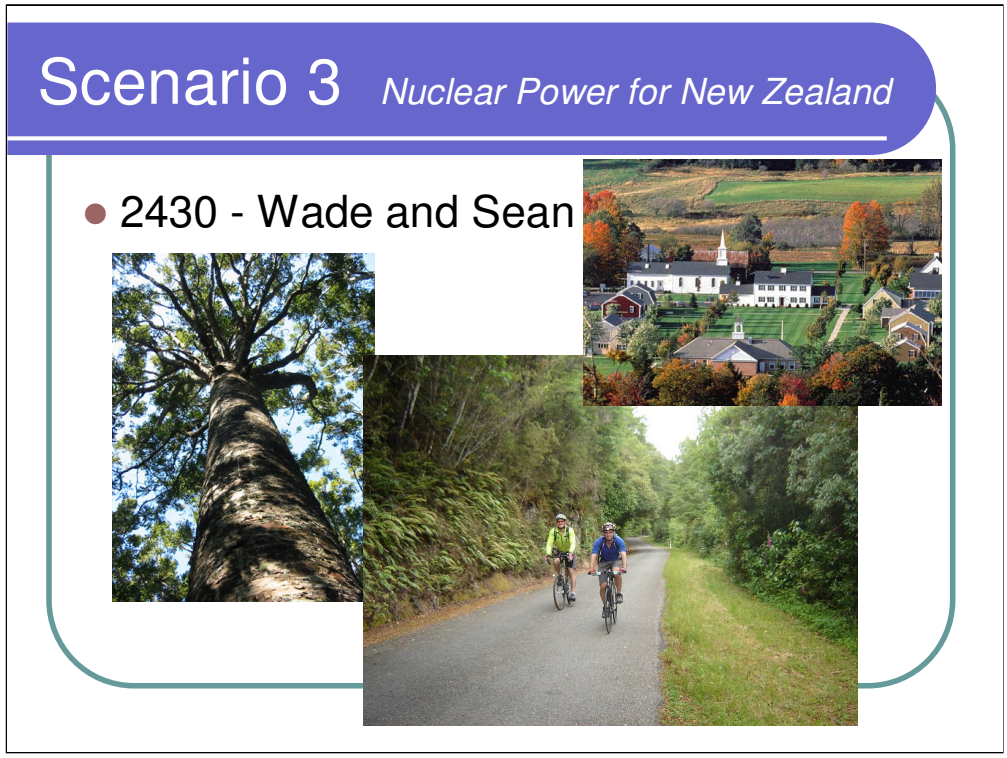
Done with homework, time for an on-line computer game! explorer… Geeze, Mum's changed the home page to the news again. Government signs contract with General Electric to deliver a 1200 MW nuclear reactor to be built at Tuakau along the Waikato river to supply secure power to the North Island… The energy minister said it is a great step forward to provide the power we need for electrification of our transport system in light of the fuel shortages and $5.00 per litre fuel prices. (No kidding – Dad won't let me drive anywhere without paying for the petrol) The minister also further stated that New Zealand would be leading the world on moving to zero carbon transport, and that all safety measures would be put in place and monitored through a joint agreement with the UK Nuclear Directorate.

Blah Blah, www.grand theft auto2. com…..

2160 Martin

I don't know how I'm going to deal with this. The government basically gave me a blank check! Now I've got to try to get them to pay my bills and then tell them to go get stuffed. All I had to do was find a company that would bring the right equipment up the Waikato river to Tuakau, use their remote-controlled robots to pack the spent fuel rods into containers, and load the them onto my ship. Yea, right. I've made good money in freight and passenger transport. I have the most reliable ships in New Zealand. And there's good markets in Australia and Asia for our products. Of course, the people here lap up any electronic components and finished metals or materials or spices that I bring back.

But, I should have known the government people were daft when it comes to moving that nuclear rubbish. I can't believe I've already wasted so much time and money on this venture. I should have learnt more about that stuff beforehand. But nobody talks about it, it's just that big concrete bunker there in Tuakau that has to be guarded and maintained. But, man, I can't believe what a mess it's hiding. The fuel rods have "cooled down" apparently, but there's corrosion all over the place, and they think that there's a risk of failure of the structure. According to the physics professor from the uni that I talked to, anybody who goes near that stuff will die. He also said that if the structure or the systems fail, that all the stuff in there could catch fire and could release radioactive materials all over the place. It all depends on how the wind is blowing how many people would get sick or die. Unbelievable. I guess it explains why nobody has been reclaiming and resourcing that Tuakau area the way they have the other stuff from the last century. It also explains why I couldn't find any companies that would do the job. My sailors also refused to go on the ship with the nuclear waste. All we had to do was take it out to the deep southern ocean and tip it overboard, and charge what ever we wanted. Bugger.



2430 Wade and Sean

Nice day for a delivery ride. My younger brother Hamish and his mate Matt wanted to make the run to the city, but it was our turn and the weather is fine. We got the message that a packet of the electronics and computer components we ordered were in. We've got several folks with computers that are getting a bit finicky, over 20 years old so some of the components start to go, and they needed some new parts. We took a load of Kauri bowls to the town for Mr. Jack and got good price.

We got some weird news when we were taking a break at the pub. They said a boatload of immigrants were planning to go into the fall-out zone to do some prospecting. Crazy buggers. How could they not know about fall-out zones? They've got them all over the world for God's sake. This fella said that the local authorities were going to stop them taking in fertile women, children, and men who had children. It's not like there isn't plenty of land around and work to do, but no, they're just sure there must be something really valuable in there that people just don't want others getting. That kind of thinking is dangerous, but it's hard to change people's minds, especially some of those foreigners.

Our people are historians. We know that it's important to study the past so we don't make mistakes. There's nothing in that Waikato region but ghosts! What a nightmare that was – the Tuakau Disaster. Once the structure started failing, it would kill anyone who tried to go in to do anything. There were plenty of heroes who sacrificed themselves to try to shore up the thing, but it ended up killing all of the men and horses. Then it caught on fire and burned for 25 years, it ruined the country. I guess they did their best back in the day. But the people you really have to wonder about are those mad bastards back in the Blind Ages of the 21st Century who built the thing in the first place, and shipped in the uranium to put in it. The history books say that they knew full well what they were doing. They knew that the plant would only produce power for about 25-30 years, then they'd have a right expensive and dangerous mess on their hands and no solutions. What in the world did they think they were doing, that was so important that it was worth killing so many people, and causing such destruction? Look at us, we use so much less energy than they did and we have everything we need. That's the difference between our modern world and those ignorant, greedy days. The scholars say that no matter what they had, they always thought they needed more. It was like a weird shared social belief that their survival depended on always increasing their consumption of everything. What a load of nonsense. Some people say they couldn't have known it was going to blow up, but that's nonsense too. I think they were so obsessed with their fears of not having more that they didn't care what kind of nightmare other people would have to endure so they could have what they wanted. That's the most important lesson we've learned from history. We have everything we need.

Generous Creator, grant me the peace to want what I have, and accept what I'm given with grace.

And those people had so bloody much! Too much probably, it made them insane. Man, if I could travel back in time. If I could tell them what they did. Better, I could tell them not to do it! I could show them how we've set things up so that everyone uses what they need. I could show them how much smarter we are now, how we've made things work and how we make sure we don't screw things up…

Oh well, they lived their nightmare didn't they?

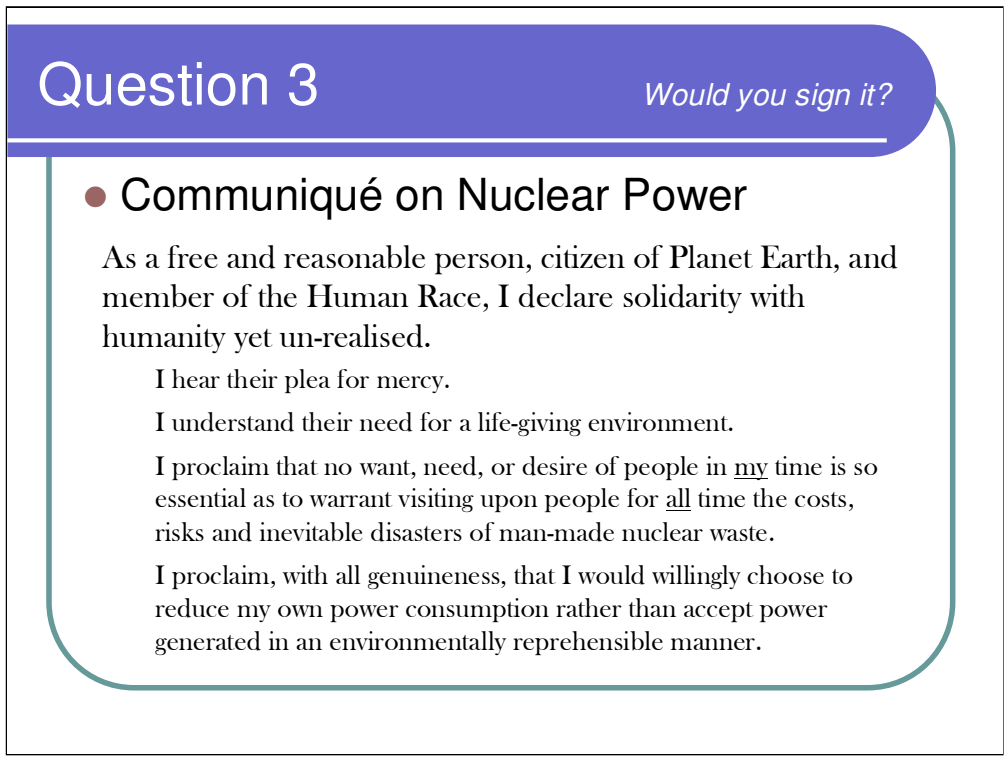
Wonder what's on for dinner?

Question 1

- What do you need more electricity for?

Question 2

- During the span of your entire lifetime, what would you use electricity for that would be so important that it warrants visiting the Nuclear Nightmare on countless numbers of other people?



Here is a declaration that I made about nuclear power. You are welcome to sign it if you agree with me.

As a free and reasonable person, citizen of Planet Earth, and member of the Human Race, I declare solidarity with humanity yet un-realised.

I hear their plea for mercy.

I understand their need for a life-giving environment.

I proclaim that no want, need, or desire of people in my time is so essential as to warrant visiting upon people for all time the costs, risks and inevitable disasters of man-made nuclear waste.

I proclaim, with all genuineness, that I would willingly choose to reduce my own power consumption rather than accept power generated in an environmentally reprehensible manner.