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1. Partial 'meltdown' at crippled Fukushima nuclear plant

Rick Wallace, Tokyo correspondent, The Australian March 29, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/partial-meltdown-at-crippled-plant/story-e6frg6so-1226029609261>

HIGHLY radioactive water, endangering workers and hindering repair efforts at the Fukushima nuclear plant, was the result of a "partial meltdown" of the fuel rods in the plant's No 2 reactor, Japan's chief government spokesman admitted yesterday.

Chief cabinet secretary Yukio Edano said the water was believed to have temporarily come into contact with the partially melted fuel rods inside the reactor.

After another day of unnerving aftershocks and fresh problems at the Fukushima plant, Mr Edano attacked the Tokyo Electric Power Company for its continued bungled handling of the crisis.

In TEPCO's latest blunder, the company announced on Sunday that water inside the turbine building of the No 2 reactor was 10 million times more radioactive than normal, only to have to correct the reading to 100,000 times more radioactive.

Mr Edano condemned the company, which failed to warn three workers about highly radioactive water before they stepped in it, for releasing the erroneous radiation data.

"Considering the fact that the monitoring of radioactivity is a major condition to ensure safety, this kind of mistake is absolutely unacceptable," he said.

The frayed nerves of residents on the coast of northern Honshu were strained again yesterday when a 6.5-magnitude quake struck 80km east of the Oshika Peninsula in Miyagi prefecture.

The quake - one of many aftershocks buffeting the region every day since the magnitude-9 blockbuster - triggered a warning of a 50cm tsunami that was later withdrawn.

Concerns over ocean contamination grew yesterday with revelations that water contaminated with radioactive iodine might be spreading. Samples showed concentrations 1150 times higher than normal taken from the north end of the plant, next to the largely undamaged reactors five and six.

Work at the Fukushima plant yesterday was focused on removing the pools of radioactive water from reactors two and three, although the effort was being hampered by high radioactivity and problems with storing the water.

The radiation level inside buildings around reactor two soared to more than 1000 millisieverts per hour on Sunday, forcing the evacuation of workers trying to restore its cooling systems.

Workers had been hoping to pump the water into huge tanks inside the reactor that are designed to hold condensed water, but they turned out to be full.

Japan's Nuclear and Industrial Safety Agency said plans to use conventional power to restart the cooling systems had been thwarted by the need to lay cables through turbine buildings flooded with the contaminated water.

"The problem is that right now nobody can reach the turbine houses where key electrical work must be done," NISA spokesman Hidehiko Nishiyama said.

"There is a possibility we may have to give up on that plan."

More than 600 people are working inside the plant in short shifts to minimise their exposure to radioactivity.

The workers who were hospitalised last week after stepping in the radioactive pool were released from hospital yesterday.

Japanese Prime Minister Naoto Kan, whose future as a leader and performance during the crisis has been the subject of considerable debate, plans to make his first visit to the tsunami-ravaged coast on Saturday.

He plans to visit the town of Rikuzentakata, where thousands of people are believed to have died or lost their homes.

A poll released yesterday showed 58 per cent of people backed the government's handling of the post-quake relief effort, while almost exactly the same proportion criticised its handling of the Fukushima nuclear crisis.

The official death toll from the quake and tsunami stands at 10,872, although is expected to climb significantly. More than 16,000 people are still missing.

2. Japan mulls closure of Fukushima nuclear plant

Press Trust Of India, Tokyo/Fukushima, March 31, 2011

First Published: 11:57 IST(31/3/2011); Last Updated: 23:34 IST(31/3/2011)

<http://www.hindustantimes.com/Japan-N-plant-must-be-scraped-PM/Article1-679679.aspx>

As Japan grappled with its worst atomic crisis in decades, Premier Naoto Kan on Thursday said the crippled Fukushima nuclear plant must be scrapped as radiation seeping into sea tested 4,385 times the legal limit, but authorities ruled out expanding the evacuation zone. During a meeting with French

President Nicolas Sarkozy in Tokyo, the two sides agreed to cooperate in crafting new international nuclear safety standards by the end of this year, Kyodo news agency reported.

"Our country's experience of this nuclear accident is very painful," Kan said. "But to prevent a recurrence of this kind of thing, I believe that we are obliged to share this experience accurately with countries all over the world."

His remarks came a day after the plant's operator, Tokyo Electric Power Company (TEPCO), said that it would scrap four stricken reactors at the facility.

3. Fukushima Nuclear Accident Update Log

International Atomic Energy Agency

<http://www.iaea.org/newscenter/news/tsunamiupdate01.html>

Fukushima Nuclear Accident Update (3 April 2011, 17:15 UTC)

Japanese authorities today informed the IAEA of the following developments at the Fukushima Daiichi nuclear power plant:

In Units 1, 2 and 3, external power supply is now being used to power the pumps that are injecting fresh water into the reactors, thus replacing temporary electrical pumps.

The switch to external power supply occurred on 3 April at:

03:02 UTC (12:02 Japan time) for Unit 1. 03:12 UTC (12:12 Japan time) for Unit 2. 03:18 UTC (12:18 Japan time) for Unit 3.

Some lighting has been reactivated in the turbine buildings of Units 1, 2, 3 and 4.

IAEA Briefing on Fukushima Nuclear Accident (3 April 2011, 12:00 UTC)

Presentation: Summary of Reactor Status

On Sunday, 3 April 2011, the IAEA provided the following information on the current status of nuclear safety in Japan:

1. Current Situation

Overall at the Fukushima Daiichi plant, the situation remains very serious.

On 2 April, transferring of water from the **Unit 1** condenser storage tank to the surge tank of the suppression pool was completed in preparation for transferring water in the basement of the **Unit 1** turbine building to the condenser. Also, on 2 April transferring of water from the **Unit 2** condenser storage tank to the surge tank of the suppression pool was started in preparation for transferring water in the basement of the **Unit 1** turbine building to the condenser.

A second US Navy barge arrived on 2 April carrying fresh water to be transferred to the "filtered water tank".

TEPCO has identified a possible leakage path from the Turbine building of **Unit 2** to the sea via a series of trenches/tunnels used to provide power to the sea water intake pumps and supply of service water to the reactor and turbine buildings. As of 2 April, 07:25 UTC, the pouring of concrete was started in an attempt to stop the water leakage. As of 2 April, 10:15 UTC, pouring of concrete had ceased and no significant decrease in the rate of leakage was observed. There is a plan to inject polymer to attempt to stop the leakage. TEPCO announced on 2 April that, following the detection of highly contaminated water leaking through a crack found in a pit near **Unit 2**, they had added 3 additional sampling points at 15 km from Fukushima Daiichi and Fukushima Daiini.

Fresh water has been continuously injected into the Reactor Pressure Vessel (RPV) of **Unit 1** through the feed-water line at an indicated flow rate of 8 m³/h using a temporary electric pump with diesel backup. Fresh water is being injected continuously into the RPVs in **Units 2 and 3** at indicated rates of 9 m³/h and 7 m³/h respectively through the fire extinguisher lines using

temporary electric pumps with diesel backup.

In **Unit 1** the indicated temperature at the feed water nozzle of the RPV is relatively stable at 259 °C and at the bottom of RPV at 117 °C. The RPV pressure indications are fluctuating and Drywell pressure is slightly decreasing. In **Unit 2** the indicated temperature at the feed water nozzle of the RPV has decreased slightly from 161 °C to 153 °C. The temperature at the bottom of RPV was not reported. Indicated Drywell pressure remains at atmospheric pressure. The indicated temperature at the feed water nozzle of the RPV in **Unit 3** is stable at 118 °C and at the bottom of the RPV is about 92 °C. The validity of the RPV temperature measurement at the feed water nozzle is still under investigation.

Injection of water into the spent fuel pool in **Unit 2** using the temporary pump was restarted on 1 April.

Units 5 and 6

Both units remain in cold shutdown with plant systems operating on off-site AC power.

Common Spent Fuel Storage Facility

The Common Spent Fuel Pool temperature is stable. TEPCO tested an "anti-scattering" agent (2 000 l) on 500 m² area around the Common Spent Fuel Storage facility on 1 April. The purpose of spraying is to prevent radioactive particles from being dispersed from the plant by winds and rain.

2. Radiation Monitoring

On 2 April, deposition of iodine-131 was detected in 7 prefectures ranging from 4 to 95 becquerel per square metre. Deposition of cesium-137 in 6 prefectures was reported on 2 April ranging from 15 to 47 becquerel per square metre. Reported gamma dose rates in the 45 prefectures showed no significant changes compared to yesterday.

Most of the previously imposed recommendations for restrictions on drinking water have been lifted. As of 2 April, one recommendation for the restriction based on iodine-131 concentration was in place in one village in the Fukushima prefecture, which applied for infants only. Meanwhile, also in this village, the iodine-131 level in drinking water has dropped below 100 becquerel per litre, which is the recommended restriction level for intake by infants. The restriction is still in place as a precautionary measure of the local authority.

Currently, one IAEA monitoring team is working in the Fukushima region. On 2 April, measurements were made at 7 locations at distances of 32 to 62 km, North and Northwest to the Fukushima nuclear power plant. The dose rates ranged from 0.6 to 4.5 microsievert per hour. At the same locations, results of beta-gamma contamination measurements ranged from 0.09 to 0.46 megabecquerel per square metre.

3. BWR Experts

The two agency experts in BWR technology have arrived in Japan. The objective of this expert visit is to have a direct exchange of views with the Japanese counterparts.

4. TEPCO Employees

TEPCO had been investigating two employees who had been missing since the earthquake of 11 March. On 2 April NISA reported that on the afternoon of 30 March the two employees were found dead in the -1 Level of the Turbine Building of **Unit 4**.

4. Time to sell uranium to India

Rory Medcalf

January 21, 2011

<http://www.theage.com.au/opinion/politics/time-to-sell-uranium-to-india-20110120-19xxw.html>

The Gillard government should proceed for the sake of economics, climate change and international fairness.

THIS week's visit by India's External Affairs Minister S. M. Krishna is rekindling a difficult debate in Australia's relations with the rising giant of south Asia.

In this newspaper yesterday, Krishna cautiously revived Delhi's call for Canberra to lift its weary ban on uranium exports, pointing out that nuclear energy could be a climate-friendly way of helping to meet the massive electricity needs of a nation seeking to lift hundreds of millions to a decent quality of life.

His comments confirm that the Labor policy forbidding uranium sales to India is a thorn in what will be one of Australia's crucial 21st century bilateral relationships.

Diplomacy, strategy, economics, climate change and notions of international fairness - all these imperatives support a rethink. It is time the Gillard government mustered the political courage to agree to sell uranium to India for civilian use. Any exports would be subject to the same protocols and safeguards we apply to others such as China and Russia. If India then did not accept reasonable conditions, the deal would be off and it would no longer be Australia's problem.

But Canberra's refusal even to negotiate defies the fact that Australia and India are natural partners: multicultural democracies facing shared challenges and hopes in the Asian century. The new India's rapid economic growth and wealth of human capital complement Australia's resources and proximity. We are neighbours in the Indian Ocean. We face common security concerns, from terrorism to the potentially destabilising impact of China's rise.

To be fair, the Rudd and Gillard governments have done much to build relations, including with greater diplomatic resourcing, high-level visits, a 2009 defence declaration, security co-operation at the Commonwealth Games and preparations for a free trade pact. Canberra took reasonable steps to respond to the dreadful attacks on Indian students.

Trade has boomed. Australian coal, gold, copper, diamonds and services make India our third-largest export destination. And India is finally shedding misperceptions of an Australia tilting China's way, thanks to WikiLeaks cables on Kevin Rudd's realism about Beijing.

Privately, many well-informed Indians understand that today's Australia is precisely the opposite of the prejudiced, unsophisticated, unimportant, unreliable nation caricatured in India's media.

But, after the student crisis, championing Australia in India is hardly a popular move. It remains an open question whether Indian Prime Minister Manmohan Singh will make a substantial visit to Australia this year - beyond attending the Commonwealth summit - unless he can announce some policy breakthrough.

The uranium issue was almost resolved four years ago, when the Howard government decided in principle to export. Now, sadly, it is the relationship's barometer of trust. The leadership in Delhi thinks Australia is withholding uranium because we distrust India. India seems unwilling to invest in a real strategic partnership until that changes.

A proper partnership would serve both nations' security interests. It could include defence exercises, exchanges of actionable intelligence, and creative co-operation involving third parties, such as working with Indonesia or the US on maritime security.

So why not sell uranium to India? Critics warn it would weaken the legal regime against the spread of nuclear weapons, the 1970 Nuclear Non-Proliferation Treaty, which India has not signed. Under that pact, most nations swapped the right to build nuclear arms for international help in nuclear energy, plus promises by the nuclear-armed states to disarm, one day.

The theory is that exempting India might lead Pakistan, Israel, Iran or North Korea to conclude that one day they too can have both the bomb and respectable nuclear commerce with the world - as if they did not already have their own reasons for wanting atomic armaments.

But consider the Indian view. Indians see the NPT as nuclear apartheid: allowing nuclear arsenals to be possessed by only the five countries that managed to test the bomb before an

artificial deadline in 1967: the US, Russia, Britain, France and China.

India is in a dangerous neighbourhood with disconcerting nuclear neighbours in China and Pakistan, and, unlike Australia, no ally offering a handy nuclear umbrella. For all that, India's nuclear deterrent is small. Delhi has a doctrine of no first strike, and supports the Obama administration's push for global nuclear disarmament.

In any case, Australia's fastidiousness is fast becoming academic. Since a 2007 US-India nuclear deal, which Australia voted for in international meetings, America and many other nations have begun legitimate nuclear business with India. Canada has agreed to sell uranium. Even Tokyo, long our partner in disarmament diplomacy, is looking at selling reactor components as it forges strategic links with Delhi. Australia could soon be the world's only substantial nuclear exporter standing aloof.

There are no ideal outcomes in diplomacy, only imperfect decisions. Canberra's full engagement with a rising India cannot be deferred forever.

Rory Medcalf is a program director at the Lowy Institute and senior research fellow in Indian strategic affairs at the University of NSW. He has served as an Australian diplomat in India.

5. Nuclear scaremongers inflate risks

David Aaronovitch, The Australian April 04, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/nuclear-scaremongers-inflate-risks/story-e6frg6so-1226032889919>

WE'LL call him the Unnamed Farmer: last week he became the first person to die as a result of damage to the nuclear plant at Fukushima.

The 64-year-old from Sukagama, 65km from the reactor, hanged himself because his crops could no longer be sold.

I am not an expert on nuclear power or any other kind of power. Like many of you, I have to read what I can, assess the arguments and the people who make them and try to come to some kind of view. Some of that opinion will be based on my experience of other, similar situations, and what was claimed at the time.

And this is what I deduce after the death of the Unnamed Farmer. A relatively elderly nuclear plant was in an area struck first by one of the five most powerful earthquakes in 110 years, and then by a 12m tsunami. The result has been partial meltdowns and radiation contamination well beyond levels declared safe. Even so, and despite this combination of catastrophes, it looks highly unlikely that leaked radioactivity will be great enough to cause serious long-term risk to human health. That compares with more than 10,000 people killed by falling buildings or in the tsunami.

There's more. Looking back on past nuclear accidents, it is now apparent that the effects on human health - although sometimes appalling - were considerably less than predicted at the time. I recall the grim warnings after Chernobyl of tens of thousands of deaths. A recent UN report on the 1986 Ukrainian fire estimated that perhaps 2000 people developed thyroid cancer, having drunk contaminated milk, of whom a score or so died from it. Apart from those killed in the explosion or on site, the report found no evidence of other fatalities or adverse health effects.

The same was true of the much less serious accident at Three Mile Island in 1979. It was true, too, of the radiation effects of the bombing of Hiroshima and Nagasaki in 1945. In other words, we are far more scared of radiation from nuclear accidents, or events, than the evidence justifies. The same UN report into Chernobyl argues that the psychological effects of the disaster, and the imagined radiation, were very significant.

This is not an argument for feeling smug about nuclear safety. It's an argument about relative risk.

As David Spiegelhalter (professor of the Public Understanding of Risk at Cambridge) has pointed out, we are content to endure whole-body CT scans, which will cause a number of cancers every year. We think it's worth it but, of course, it's our decision: the risk of fallout from a nuclear plant isn't.

So the rational question then is: how risky is nuclear power among the various options that we have for providing the country with energy, and do we need to take the risk? Both the Labour government of Blair and Brown and the coalition government agreed that Britain's energy strategy required a nuclear component. This was partly to fill an energy gap, partly to reduce dependence on oil and partly to reduce carbon emissions.

I accept the evidence that man-made carbon dioxide is likely to be a factor in climate change and that the greatest risks we run are those of failing to reduce emissions. I also accept the estimate that renewables and conservation - much though I support them - can't realistically hope to plug the coming energy gap, which itself constitutes a risk to wellbeing.

So before people dash down the 1980s paranoid route, brandishing their Edge of Darkness DVDs and chaining themselves to the fence at Sellafield wearing a luminous death's-head mask, it seems to me they have to show their alternative is less risky than developing a new generation of nuclear power stations. And they have to do it quickly.

What they shouldn't do is quote Germany to me. There, Chancellor Angela Merkel, succumbing to what one German commentator called Angstlust (anxiety-pleasure), took a sudden decision before state elections last week to close down seven reactors. She also pandered to the panic by appointing a commission to look at the "ethics" of nuclear energy, the membership to include the Cardinal Archbishop of Munich. I don't imagine a similar commission exists for all other forms of energy.

If it did, Germany would run out of prelates.

Of course, it wasn't enough. The Greens made the wholly absurd point that what Fukushima showed was that accidents that one couldn't even imagine might cause safety problems that were impossible to predict. As a proposition this was: (a) true and (b) uselessly applicable to everything. The Greens will now lead the state government in Baden-Wurtemberg.

It may be that, as some German journalists have airily suggested, nukes are not needed in their country because a massive ramping of renewables will take up the slack, while still allowing high carbon energies to be phased out.

Lucky them - but it needs pointing out that the Germans are not always great assessors of risk.

Back at the time of the great MMR (measles, mumps and rubella) vaccine scare, certain parts of Germany were infected by a form of anti-vaccination madness. The places where this happened tended to be very middle-class and Greens-leaning. A sort of vague desire for an additive-free "natural" lifestyle fuelled an approach that led to several serious measles outbreaks. Thus, among some of the most educated people in Europe, children's lives and health were put at risk for nothing more than a prejudice.

So what weight should we accord such irrationality? If you think none, then you are in conflict, it seems, with the ruling Liberal Democrat Party and - very improbably - the party's former leader Paddy Ashdown.

Last week, he said that while he had previously considered nuclear power to be necessary "to stop the world from frying", he was now afraid that it was politically unsellable.

Yes, let's fry rather than make a proper risk assessment. And now Nick Clegg has hinted to a number of hacks that he may throw some of his deputy weight around to make opening new nuclear plants more difficult. This, Nick, may be politics, but it isn't leadership.

You know why the Unnamed Farmer really died? Not because anyone would actually have been killed by his spinach - they would have had to eat tonnes of it to become ill - but because sales were stopped, just in case. That's where the Merkel-Ashdown logic gets you.

The Times

6. Bodies found as nuclear plant leak poisons ocean

Rick Wallace, Tokyo Correspondent, The Australian April 04, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/bodies-found-as-nuclear-plant-leak-poisons-ocean/story-e6frg6so-1226032895940>

THE owners of the stricken Fukushima Daiichi nuclear plant announced yesterday that the bodies of two missing workers had been found, as emergency crews worked to seal a leak that allowed highly radioactive water into the Pacific Ocean.

The Tokyo Electric Power Company said the two workers, missing since the March 11 earthquake and tsunami, were found floating in water in the basement of the turbine building in reactor No 4.

TEPCO said Kazuhiko Kokubo, 24, and Yoshiki Terashima, 21, died of bleeding from multiple wounds thought to have been sustained at about 4pm on March 11.

"It pains me that these two young workers were trying to protect the power plant while being hit by the earthquake and tsunami," said company chairman Tsunehisa Katsumata.

The disgraced utility, which has been criticised for releasing inconsistent and erroneous information, recovered the bodies on Thursday. The company said it had waited until yesterday to make the announcement because it needed to advise the workers' next of kin.

Fukushima police said the cause of death was thought to be the tsunami, not radiation.

Plant workers yesterday attempted to inject water-absorbent polymer into a 20cm crack in a pit beneath the No 2 reactor that has been blamed for radioactive leaks into the ocean. Earlier attempts to fill the crack with concrete failed.

"We are hoping the polymers will absorb water and fill in the pipe to prevent water from flowing," said the deputy director-general of Japan's Nuclear and Industrial Safety Agency, Hidehiko Nishiyama.

TEPCO said radiation readings in the air above the pit had hit 1000 millisieverts per hour - more than four times the allowable annual total for workers at the plant.

Tests of the water in the pit showed a concentration of one million becquerels per litre of iodine 131, about 10,000 times the normal level for the cooling water used in the plant.

At the time the leak was discovered, the 2m-deep pit under the reactor contained up to 20cm of contaminated water, according to TEPCO.

The nuclear safety agency said it believed the pit leaks could be the source of the contamination that has caused readings for radioactive iodine 131 in the sea just off the plant to rise to more than 4000 times the legal limit.

Checks conducted in the pits under the other five reactors showed no cracks.

Work continued over the weekend on removing from the reactor buildings the contaminated water that has been delaying rewiring work.

Reports said contaminated water was transferred to a barge to free up space in tanks on land, and a second barge had arrived.

An intensive sea search conducted by the Japanese and US militaries ended yesterday with the recovery of more than 60 bodies. The confirmed overall toll from the earthquake and tsunami topped 12,009 yesterday, with 15,472 still missing.

The Japanese government was yesterday moving to ensure local companies were given first chance at rebuilding projects in the disaster-hit areas, although some might be built using private

finance rather than public funds.

Japan's Kyodo news agency reported that rebuilding the devastated Sendai airport, as well as battered ports, sewage, water and gas plants in the region, could be done as public-private partnerships.

The agency said the government aimed to accelerate the passage of laws clearing the way for private firms to build, own and operate such assets. The changes, which have been in the making for some time, have been supported by Australian constructors, engineers and project management and services companies, which are keen to get a foothold in the lucrative Japanese market.

7. Facing a climate of uncertainty

Graham Lloyd, Environment editor, The Australian April 05, 2011 12:00AM

<http://www.theaustralian.com.au/news/features/facing-a-climate-of-uncertainty/story-e6frg6z6-1226033588994>

IT was a long way from picture postcard blue skies in Cairns yesterday as the nation's top 450 climate scientists gathered to take stock of global warming.

The tropical rainstorm may pale alongside the political cyclone that has been unleashed by the federal government's talk about a carbon tax. But the continued wet weather may prove relevant to this week's scientific discussions, which are expected to have a heavy focus on how much there is still to understand about climate change.

For Australia, whether the north can expect to get more or less rainfall because of global warming remains one of the great unknowns.

The Cairns meeting is Australia's peak biannual conference at which climate scientists meet to discuss the state of research.

And while organisers of Greenhouse 2011 say participants represent a broad church, the uniform view is undeniably one of a warmer future for the planet.

Beyond that, everything from atmospheric carbon, feedback cycles, ocean temperatures, sea levels, carbon sinks, mitigation and adaptation are on the table for discussion.

Delegates will even be told how emotional responses to climate change represent a missing link to behaviour, with those who accept man-made climate change motivated to act by fear. Others who believe the climate is changing naturally are likelier to feel irritation and refuse to engage or respond.

CSIRO principal research scientist Kevin Hennessy says understanding the causes, both natural and human, of climate change is central to the conference agenda, as is consideration of future projections of climate change globally and regionally.

Surprisingly, a key theme through the conference will be the state of scientific uncertainty.

This does not mean that sceptics have crashed the CSIRO-sponsored climate change party, however.

"These are the real uncertainties as opposed to the uncertainties that some of the sceptics might claim are important," Hennessy says.

The uncertainties include things such as the various causes of regional climate change and extreme weather events, uncertainty about the future level of greenhouse gas emissions, the rate of global warming, the rate of future sea level rises and the scale and impact of future extreme weather events.

"When we are talking about global warming it is not about whether there will be global warming but about the rate of change," Hennessy says.

The approach reflects a new approach by the climate science community after the issue lost significant momentum in the lead-up to the 2009 Copenhagen conference following claims of exaggerated research claims.

The new caution was reflected in an updated statement issued by Britain's Royal Society last year summarising the scientific evidence on climate change and its drivers.

The statement highlighted the areas where the science is well established, where there is still some debate and where substantial uncertainties remain.

The Royal Society even held a two-day discussion meeting in March last year on handling uncertainty in science.

The Australian conference agenda reflects the new approach has been taking place elsewhere ahead of the release of a new data from global modelling that will form the basis of the International Panel of Climate Changes update due in 2013.

Hennessy says by its nature the science has always been uncertain.

"The 2007 IPCC report estimated a range of global warming by the end of this century of between one and six degrees," Hennessy says.

"That incorporated uncertainty in future greenhouse gas emissions as well as uncertainty you get from 20-odd different climate models.

"When you get to sea level rises, that in turn depends on the rate of warming, but it critically depends on uncertainty around the rate of melting of the polar ice sheets.

"It is trying to get a better understanding of the magnitude of these changes, but we are highly confident of the direction of change in temperature and sea level."

This week's conference will hear that carbon dioxide emissions are tracking the mid to upper end of the IPCC predictions.

Average global temperatures are tracking in the upper to mid IPCC projections and sea level rises at the upper end of forecasts.

CSIRO sea-level specialist John Church will tell the conference Australia's tropical oceans are becoming steadily warmer and more acidic under the influence

of greenhouse gases such as carbon dioxide, which is affecting marine life in our oceans and on coastlines.

He says most scientific evidence has concluded that pushing sea temperatures to 2C above their pre-industrial values will cause a decline in ecosystems such as the Great Barrier Reef.

"At the moment it is looking like the upper half of the IPCC projections is more likely than the lower half," Hennessy says.

Penny Whetton, a senior scientist with the CSIRO's Centre for Australian Weather and Climate Research, says there are two ways to deal with the uncertainty.

"One is trying to reduce it," she says. "The other is working with uncertainty and communicating it because we have to decide how to deal with the climate change issue while the information is somewhat uncertain.

"There are some things we know with great certainty in our climate change understanding and some things we know with less certainty, and we really need to make that clear in our communications as well.

"The best example is that we are expecting increasing temperatures in future and the only uncertainty associated with that is how much and exactly how rapid it will be.

"If you move to another variable such as rainfall change, although we are reasonably certain about decreased rainfall in southern Australia we don't actually know the direction of rainfall

change in northern Australia.

"As we go forward, some of that growth in knowledge creates new uncertainties while clarifying the certainties we have been previously working with."

Whetton is involved in the collation of the next set of national climate projections for the 21st century, which are planned for release in 2014.

The projections are for a range of factors including sea levels, seasonal-average temperatures, rainfall, as well as extreme weather events such as heatwaves, fires, droughts, floods and cyclones.

Whetton is looking to the upcoming release of updated global climate modelling to remove some of the uncertainties, particularly with regard to regional variation.

"We will get twice the number of models and 50 or 60 times the amount of data we got the last time we went through this exercise," Whetton says.

"I will be most interested in what the models show about the change in temperatures over Australia, changes in precipitation patterns, changes in extreme events such as very hot days and extreme rainfall events."

Clarification is also needed on what global warming means for rainfall in the tropical north.

"I will be particularly interested to see what the new crop of models are showing for rainfall in northern Australia because that has been a major source of uncertainty," Whetton says.

"Many lines of evidence over many years have pointed towards decreases in rain in southern Australia.

"But it has been more uncertain about how precipitation will change in the north, with some models showing decrease and some showing increase," she says.

From this week's conference, Whetton says she is looking forward to more information on some of the processes taking place in the atmosphere that drive climate change.

"I am expecting to come away from here with a better understanding of what drives changes in climate in a particular direction in a particular location as opposed to another," she says.

"I am expecting better understanding on how climate drives the El Nino and La Nina systems and how climate change may affect tropical cyclone occurrence."

Research is still under way to establish what role, if any, climate change has had on the most recent extreme rainfall events in Queensland.

Climate scientists generally say it is not possible to identify a climate change signal in any particular weather event.

And the higher than average rainfall in eastern Australia last year is consistent with the La Nina weather pattern.

But the question of whether the La Nina system was strengthened by associated climate change phenomena is contested, just as there is global discussion about the extent to which natural feedback mechanisms, such as cloud and air-borne particulate matter, complicate the task of modelling effectively.

One of the reasons global climate models differ from one another on how much warming they show relates to different feedback processes operating in those models.

Water vapour feedback is well understood as a positive feedback, reinforcing warming.

Aerosols tend to have a cooling effect, but the amount of aerosol in the atmosphere is expected to decrease, limiting their beneficial effect.

While high cloud is understood to reinforce warming, there is uncertainty about the extent to which low cloud has a cooling effect.

According to Hennessy, it is OK to disagree.

"This is a conference where the latest science is put on show and I would expect a broad range of people to be attending, both those who are sceptical and those who are more of an advocate than others," he says.

"There has been some very robust discussion. That is the sort of thing we expect in a conference in this area."

8. Blast risk mars Fukushima nuclear plant plugging

Rick Wallace, Tokyo correspondent, The Australian April 07, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/blast-risk-mars-fukushima-nuclear-plant-plugging/story-e6frg6so-1226034890727>

A LEAK at Japan's stricken Fukushima Daiichi nuclear plant, which was dumping highly radioactive water into the Pacific Ocean, was plugged yesterday in a rare positive step following fears over spiking contamination levels in fish.

The flow of water, thought to have been coming from the core of the No 2 reactor, was stemmed by injecting a sealant called water glass into a pit.

But a host of problems remain at the plant, which was crippled after the magnitude-9 earthquake and subsequent tsunami that hit northeast Japan on March 11.

Plant operator TEPCO prepared yesterday to inject nitrogen gas into the containment vessel of the No 1 reactor to avoid another hydrogen explosion. The utility also plans to inject nitrogen at the No 2 and 3 reactors.

Hydrogen explosions in the week after the tsunami caused widespread damage to the No 1 and 3 reactors.

Contact between the fuel rods within the reactors and the water being used to cool them generates enough hydrogen to explode when it mixes with oxygen.

The injection of non-flammable nitrogen is thought to reduce the risk of ignition. Radioactivity levels at the plant remain high, with Japan's national broadcaster reporting that readings in some parts of the plant could not be measured because they exceeded the scale on gauges.

TEPCO estimated that 70 per cent of the fuel rods in the No 1 reactor and 20-30 per cent of the fuel rods in reactors 2 and 3 had been damaged.

The latest casualty figures released by Japan's National Police Agency yesterday morning showed 12,468 people dead and 15,091 missing.

The leak that was plugged yesterday is thought to have been a significant source of radioactive contamination in the ocean around the Fukushima plant that has already entered the food chain.

Fishermen in Ibaraki prefecture have suspended operations after samples of sand eels caught off the coast south of the plant showed high levels of radioactive iodine.

Despite criticism from fishermen, and the South Korean government, the plant's operator, TEPCO, pushed on with plans to dump millions of litres of "moderately" radioactive seawater.

The dumping, which began on Monday and will see 11.5 million litres of water end up in the ocean, is aimed at freeing up space at the plant to store more heavily contaminated water.

The dumping sparked a furious row between TEPCO and the government, with Chief Cabinet Secretary Yukio Edano forced to apologise to South Korea and to local fishermen for failing to explain the move properly.

Japan's Agriculture Minister Michihiko Kano criticised TEPCO for failing to notify his ministry about the dumping, which was approved by the Nuclear and Industrial Safety Agency.

A furious Mr Kano said the failure to warn him was "deplorable" and TEPCO "must get its act together".

The government has suggested that TEPCO should compensate fishermen for losses stemming from the contamination.

9. The Intelligent Voter's Guide to Global Warming (Part I)

Geoffrey Lehmann, Peter Farrell & Dick Warburton

<http://www.quadrant.org.au/magazine/issue/2011/3/the-intelligent-voter-s-guide-to-global-warming>

Geoffrey Lehmann is a poet. He was formerly a partner of a major international accounting firm and Chairman of the Australian Tax Research Foundation.

Peter Farrell is Founder and Executive Chairman of Resmed Inc, foundation Director and former Professor of the Graduate School of Biomedical Engineering at the University of New South Wales, Chair of the Executive Council, Division of Sleep Medicine, Harvard Medical School and Member Visiting Committee, Whitaker College of Life Sciences MIT.

Dick Warburton is Chairman of Westfield Retail Trust, Magellan Flagship Fund Ltd and the Board of Taxation and a Director of Citigroup Pty Ltd and of the Smith Family of which he is also Chairman-elect. He is a former Chairman and CEO of Du Pont Australia and New Zealand.

Part II is published in April *Quadrant*.

In a news story on March 20, 2000, "Snow falls are now just a thing of the past", the UK's Independent newspaper reported:

Sledges, snowmen, snowballs ... are all a rapidly diminishing part of Britain's culture, as warmer winters—which scientists are attributing to global climate change—produce not only fewer white Christmases, but fewer white Januaries and Februaries ... According to Dr David Viner, a senior research scientist at the climatic research unit (CRU) of the University of East Anglia, within a few years winter snowfall will become "a very rare and exciting event ... Children just aren't going to know what snow is".

This millenarian prediction from the world's most prominent climate research centre was a dud. When the news story appeared ten years ago, an unanticipated pause in global warming was already taking place, and global warming has not resumed since then. On January 7, 2010, a NASA satellite photographed the UK covered entirely by a blanket of snow. The published photograph shows the familiar shape of the map of England, Scotland and Wales, frozen white, and set in an ocean of dark blue silk, with the edges partly obscured by wisps of cloud. In the winter just ending, Britain underwent yet another winter of heavy snowfalls. On November 29 the Independent had a story headed, "Cold comfort for a Britain stuck in a deep freeze".

With Julia Gillard's sudden switch to support for a carbon price, Australia in 2013 could be the first country to hold an election with anthropogenic global warming (AGW) as the pivotal issue. If Tony Abbott is still Opposition Leader he will see an emissions trading scheme (ETS), or carbon tax, as a target that is as vulnerable as John Hewson's GST proposal in 1993. At that time Abbott was Hewson's press secretary, and Hewson was "cooked slowly" by Paul Keating in a protracted election campaign.

We have written this piece as an intelligent voter's guide to global warming—to provide basic information often missing from the debate. In Part 1 we examine the science, and in Part 2 the practicalities of an ETS and carbon tax, and the politics. All three aspects—science, economics and the associated politics—intersect and drive each other.

I. The science

Man-made emissions are likely to cause a doubling of atmospheric carbon dioxide during this century and this increase will continue to have a warming effect on global temperatures. One of

the disappointing distortions of the climate science debate is the claim that sceptics deny this relationship. What sceptics are sceptical about is the strength of this AGW effect. A strong AGW effect would be an increase in global average temperatures of 2.5 to 4 degrees or more, with potentially disruptive outcomes, such as a possible large rise in sea levels. A weak AGW effect would be an increase of 1 degree or less, a number of much less concern.

One of the constants of climate, like that day-to-day local phenomenon the weather, is its variability. We are living during a warmer period known as an interglacial, which began about 11,400 years ago. It is an “interglacial” because for the previous 2.5 million years, much of northern Eurasia and North America has been blanketed by kilometres-deep ice sheets. This ice age or glacial has been interrupted by warmer interglacials of from 10,000 to 20,000 years occurring at intervals of about 100,000 years.

These transitions—into and out of an ice age—are triggered by various, overlapping Croll–Milankovich cycles which change how much solar radiation our planet receives, and where. Croll–Milankovich cycles are due mainly to interactions with the gravitational fields of other planets, and shift the Earth’s orientation and orbit around the sun and can be precisely calculated backwards and forwards through time. The start of our interglacial was dramatic and occurred over a human lifetime.

The eccentricity of the Earth’s orbit is currently small and decreasing. This will continue for 30,000 years, which means that our current interglacial is likely to be exceptionally prolonged. By some lucky happenstance our civilisation sits in an astronomical sweet spot, and we probably have hundreds of generations to prepare for the likely return of an ice age.

Average temperatures during an interglacial are stabler than during a glacial. But over the last 5000 years there have been climatic changes severe enough to have disrupted a number of agrarian societies. As well as the Croll–Milankovitch cycles, there are variations in the output and nature of radiation from the sun itself. A solar cycle of about eleven years manifests itself visibly by sunspots. As the cycle reaches its maximum, sunspots become more frequent, and total solar irradiance increases slightly.

This difference in total solar output (only about 0.1 per cent) is regarded as insufficient in itself to cause climate changes of any significance. However, the sun’s short-wave radiation (from the ultraviolet through to x-rays) varies greatly and has significant effects on the earth’s stratosphere, the layer of air about ten to fifty kilometres above the Earth’s surface in temperate latitudes.

There is also a “solar wind” (a stream of charged particles), whose variable intensity may predict the intensity of the next solar cycle. The solar wind causes the spectacular displays of lights known as auroras and protects Earth’s atmosphere from cosmic rays from outside the solar system. It is argued controversially that cosmic rays (they are in fact particles, not rays), may trigger cloud formation and affect climate. Over the last 10,000 years, changes in solar activity and the nature of solar radiation (but not changes in total solar output) have most likely had significant climatic effects.

There was a Little Ice Age, from about 1300 until about 1850, typified by the freezing of the River Thames and a decline in European agriculture. This 550-year span is associated with three periods of low sunspot activity, known as minima. During these low sunspot periods, the solar wind is also less active, fewer auroras are observed and cosmic rays from outside the solar system cause the formation of carbon-14 in the atmosphere; this is detected in tree rings (as trees inhale carbon dioxide). Conversely, periods of high solar activity result in reduced carbon-14 levels in tree rings. Brian Fagan, an archaeologist, writes that tree rings show:

a well-defined fall in 14C levels and a peak in solar activity between about AD 1100 and 1250, the height of Europe’s Medieval Warm Period ... There is certainly a nearly perfect coincidence between major fluctuations in global temperature over the last 1000 years and the changes in 14C levels identified in tree rings. This implies that long-term changes in solar radiation may have had a profound effect on terrestrial climate over decades, even centuries.

There was an immediate temperature spike when the current interglacial began 11,400 years ago. Average temperatures at many sites from 8000 to 10,000 years ago were about 2 degrees warmer than now. Since then global average temperatures have gradually declined, with peaks and troughs, and variations from site to site. A central Greenland ice core shows a Minoan warming about 3500 years ago, a Roman warming about 2000 years ago, the Medieval Warm Period, and the twentieth-century warming, with each new warming being about 1 degree cooler than its predecessor. Richard B. Alley, who worked on this ice core, commented: “the best paleothermometers are probably those on the ice sheets”.

Ice cores, when available, are perhaps the best evidence of temperatures in the past, because the isotopic composition of a section from an ice core reflects just one main influence. This is the temperature of the air from which it condensed, as heavier molecules of water vapour (with more neutrons) are the first to condense when air chills. Climate scientists who argue for a strong AGW effect have tended to rely on less reliable proxy evidence such as tree rings (which may reflect a number of influences, for example the availability of such key nutrients as water) when claiming that recent temperatures are “hotter than ever”.

The pre-industrial level of atmospheric carbon dioxide was about 280 parts per million volume (ppmv). In the late 1940s this began a steady rise to the current level of about 390 ppmv. The steady graph of this year-by-year rise, with a small seasonal wobble as northern hemisphere plants inhale carbon dioxide in spring and summer, points to a single dominant cause—man-made emissions. To the extent that this is causing a greenhouse effect humans are responsible.

Carbon dioxide is transparent to most incoming solar radiation. But it is opaque to certain wavelengths of infrared or “black body” radiation and blocks the escape of this radiation into space from the sun-warmed surface of our planet. Hence the greenhouse effect. In the absence of positive or negative feedbacks, the doubling of atmospheric carbon dioxide would eventually raise global average temperatures by about 1 degree. The main qualifiers here are “eventually” and the role of feedbacks.

A majority of Western climate scientists, in predicting severe global warming, argue that there are positive feedbacks causing a strong AGW effect. As increased levels of carbon dioxide heat the atmosphere, atmospheric water vapour (humidity) increases. This water vapour is also a greenhouse gas, and is already far more plentiful than carbon dioxide. Increasing it will amplify the warming caused by increased carbon dioxide—perhaps by up to 5 degrees or more for a doubling of carbon dioxide, according to some general circulation models relied upon by the United Nations Intergovernmental Panel on Climate Change (IPCC).

However, other climate scientists argue that the feedbacks can be negative, so there is only a weak AGW effect. The relationship between a warming atmosphere and increased water vapour is complex. Increased water vapour will eventually condense, warming the air around it, as latent heat is released by the change from a gaseous to a liquid state. The condensed vapour may become low-level cloud, which has a cooling effect (as it reflects incoming radiation), or high-level cirrus cloud, which has an overall greenhouse effect.

Data from weather balloons (radio-sondes) suggest that with increased warmth at the planet’s surface, there may be less water vapour in the atmosphere above about three kilometres, where a positive feedback from water vapour might occur. It is also argued that high-level cirrus cloud cover, which blocks escaping radiation, decreases over tropical oceans as temperature increases. The IPCC’s Fourth Assessment Report of 2007 acknowledges: “Cloud feedbacks remain the largest source of uncertainty.”

The second qualifier about a doubling of carbon dioxide raising global temperatures is 1 degree “eventually”. The oceans and atmosphere have been described as unequal dancing partners, with the atmosphere reacting quickly and the oceans heavy-footed, slow and out of step.

Radiative or climate forcing is the net change in incoming and outgoing radiation energy in the climate. It is measured in watts per square metre. There is a positive forcing if, for example, an increase in greenhouse gases blocks outgoing radiation, and there is a negative forcing if, for example, reduced sunlight enters the Earth’s atmosphere as its orbit becomes more eccentric.

Oceans have about 200 times the mass of the atmosphere. They may take some hundreds of years to respond fully to an increase in radiative forcing (typically extra sunlight determined by a Croll–Milankovich cycle). Among nine errors found by a British court, Al Gore's movie *An Inconvenient Truth* erroneously assumed that carbon dioxide levels and temperature rose and fell simultaneously—there was an “exact fit”. This was referred to as “Error 3” in the proceedings, which were initiated by a school governor (a lorry driver) against the educational authorities.

The Al Gore movie implied that carbon dioxide levels were somehow driving temperature. At about the time the movie was made, clear evidence emerged that carbon dioxide levels rise and fall several hundreds of years after a rise or fall in temperature. Carbon dioxide changes lag behind temperature changes. Historically, carbon dioxide has not been the significant driver of temperature that was once assumed. The erroneous assumption of an “exact fit” between carbon dioxide and temperature has contributed greatly to the present popular misunderstandings surrounding AGW.

There are various explanations for this lag. Warming water has a reduced ability to retain carbon dioxide and as the oceans slowly warm or cool they may release (or absorb) carbon dioxide. Temperature-induced changes in biological activity, rainfall or the weathering of rocks also play a role.

It is surprising that the ocean depths respond at all to changes in radiative forcing. Compared with metals, water is a poor conductor of heat. Intuitively you might expect the warmer, lighter water to sit at the surface and not mix with the colder depths. But there is a slow mixing, as exemplified by the Atlantic's Gulf Stream. When the Atlantic's surface is heated at the tropics by sunlight, some water evaporates. The remainder becomes saltier and heads north to colder latitudes, where it chills. This saltier water, as it chills, becomes heavier than the cold water which it overlays. It sinks and mixes with deep currents that head back to the tropics where they upwell again. An enormous conveyor belt is created, warming North Atlantic coastal regions.

The different cycles of these ill-assorted dancing partners, the atmosphere and ocean, contribute to the chaotic behaviour of climate. Several oceanic oscillations have been identified that influence climate. The peak for recent warming, 1998, was the outcome of an exceptional El Niño event in the Pacific. A big El Niño event in 2010 has also caused a recent jump in global average temperatures, which may now be about to subside. The oceans are not well understood. Methods for systematically measuring ocean temperatures, starting in the nineteenth century, have varied and only become reliable in the last five years (with a small, very recent, decline during this time observed in ocean temperatures). The ocean is where any excess heat must theoretically end up, since dry land eventually gives up any received heat while the oceans absorb it; however, recent evidence shows that this is just not happening.

Another puzzle for climate modellers is that global average temperatures have not kept up with the steady rise in atmospheric carbon dioxide. General circulation models relied on by the IPCC predicted these temperatures would rise in the current decade, but this has not happened. Accurate measurements of atmospheric carbon dioxide began as recently as 1958. The significant recent rise in atmospheric carbon dioxide began in about 1950. But there was no increase in global average temperatures until about 1976. In fact from 1940 to 1975, a period sometimes called “the Little Cooling”, temperatures appear to have been slightly lower than in the 1930s of dust-bowl fame.

Pro-AGW climate scientists claim the Little Cooling was caused by aerosols, such as sulphur dioxide, produced by the rapid expansion of industry and motorised transport that began in about 1950. According to these scientists, by 1976 there was a reduction in these aerosols because of clean air legislation in Western countries, allowing the warming from extra carbon dioxide to take effect. There are two problems with this explanation. The largely oceanic southern hemisphere, where there are few of these anthropogenic northern hemisphere aerosols, was also subject to the Little Cooling. Also, as aerosols from North Atlantic countries decreased, this may have been matched by an increase in aerosols from the rapid industrialisation of China and India in the late twentieth century.

The 1980s were warmer than the 1970s, the 1990s were warmer than the 1980s, and the 2000s have been warmer than the 1990s. However, the rise in temperatures starting in 1976 stopped in about 2000. Since then temperatures have flattened out and may have reduced. Although the decade to 2009 has on average been warmer than the average of the previous decade, it has not become warmer than the final years of the last decade, as strong-AGW models predicted. Atmospheric carbon dioxide has been steadily rising from 1950 to the present, but there has been a significant increase in temperature for only twenty-five of those sixty years.

This increase has been about 0.4 degrees and is broadly equal to the increase from 1860 to 1940, when changes in atmospheric carbon dioxide could not have been an influence. All of this suggests there is not a clear correlation between the rise in atmospheric carbon dioxide over the last sixty years and the recent increase in temperatures. The increase that has occurred, which is only fractions of a degree, is explicable as a natural fluctuation, part of the chaotic dance movements of the climate, although it is likely that there is a small AGW contribution, which is extremely difficult to identify.

The modest increase in temperatures does not fit well with bold predictions of increases of several degrees over the remainder of this century. There is a further problem with these predictions. This is that the greenhouse effect of carbon dioxide increases is logarithmic. It is not linear. Richard Lindzen, a climate scientist who is a professor of meteorology at MIT, has explained:

In terms of climate forcing, greenhouse gases added to the atmosphere through man's activities since the late nineteenth century have already produced three-quarters of the radiative forcing that we expect from a doubling of CO₂ ... the impact of CO₂ is nonlinear in the sense that each added unit contributes less than its predecessor. For example, if doubling CO₂ from its value in the late nineteenth century—from about 290 parts per million by volume (ppmv) to 580 ppmv—causes a 2 per cent increase in radiative forcing, then to obtain another 2 percent increase in radiative forcing we must increase CO₂ by an additional 580 ppmv rather than by another 290 ppmv. At present, the concentration of CO₂ is about 380 ppmv. The easiest way to understand this is to consider adding thin layers of paint to a pane of glass. The first layer cuts out much of the light, the next layer cuts out more, but subsequent layers do less and less because the painted pane is already essentially opaque.

Lindzen's "already produced" radiative forcing should not be confused with the effect of this forcing on global average temperatures, which may take decades or centuries to respond, because of the thermal inertia of the oceans. His conclusion is that if we believe the climate models, "we have long since passed the point where mitigation is a viable strategy". His estimate of the future outcome is: "Attempts to assess climate sensitivity by direct observation of cloud processes, and other means, point to a conclusion that doubling of CO₂ would lead to about 0.5 degrees warming or less."

The critical issue in the global warming debate is climate sensitivity. There is general agreement that acting by itself there would be a weak AGW of about 1 degree from a doubling of atmospheric carbon dioxide above pre-industrial levels. If there are positive feedbacks which amplify that effect above 1 degree, the climate is more sensitive, and if there are negative feedbacks that would reduce that warming below 1 degree, the climate is less sensitive.

One way of estimating sensitivity is to examine past events, where there is a known change in radiative forcing and it is simple to calculate the extra (or fewer) watts per square metre that result from the change and observe the effect on average temperatures to obtain a value for sensitivity. When the Last Glacial Maximum finally ended about 11,400 years ago, there was a large increase in average temperatures relative to the increase in solar radiation reaching the Earth at that time (from a Croll–Milankovich cycle). Supporters of the strong AGW case point to this event as evidence for positive feedbacks and a high value for climate sensitivity.

Deducing climate sensitivity to radiative forcing from extra sunlight when the Last Glacial Maximum ended and using that number to determine the climate sensitivity to radiative forcing

from extra carbon dioxide at the present time, when average temperatures are several degrees warmer, is not straightforward. As well as the initial radiative forcing from extra sunlight at the end of the Last Glacial Maximum, there would be the following forcings induced by the change in solar radiation received by Earth: (1) reduced albedo (reflection of sunlight into space) as ice and snow retreat and dark vegetation advances and rocks and earth are exposed; (2) additional trace greenhouse gases from various sources, in particular methane (a much more potent greenhouse gas than carbon dioxide) released from melting permafrost; and (3) the greenhouse effect of additional water vapour as ice and snow melt. The value of these induced forcings can only be inferred with a high degree of uncertainty.

A further reason for scepticism is the temperature trend for central Greenland over the last 100,000 years. An ice core shows that during the last 10,000 years average temperatures in central Greenland have varied by no more than about 2 or 3 degrees. But over the previous 90,000 years (the period of the last ice age) there were sixteen sudden fluctuations of about 10 degrees or more (some of almost 20 degrees) with many smaller fluctuations of about 5 degrees. These violent and frequent jumps compared with the current relative stability in central Greenland indicate that climate sensitivity during the 90,000 years of the last glacial may have been much higher than now. There may have been positive feedbacks then that no longer operate when temperatures are warmer.

Climate sensitivity has also been estimated from short-term cooling following recent volcanic eruptions and the global temperature trend in the twentieth century. Some high and low numbers for climate sensitivity have been estimated from recent volcanic eruptions. So this is a contested area. The global temperature trend over the twentieth century may also not provide a convincing basis for determining sensitivity. There are peaks and troughs in the modest warming of about 0.8 degrees occurring since the late nineteenth century, which could have been affected by a variety of poorly understood influences, such as clouds and oceanic oscillations. Add to this the uncertainty about the exact extent of current warming. Land surface temperature measurements tend to be concentrated near cities, which are heat islands. Despite corrections for this effect, there is evidence of "contamination patterns" in regard to land surface records, relied upon by climate scientists, "related to urbanisation and other socioeconomic influences" causing "an overall warm bias over land". Our current level of understanding is such that studies relying on past events to produce a high (or low) value for climate sensitivity are dartboard science.

There is also a crucial piece of evidence, publicised by David Evans, suggesting it is unlikely that climate sensitivity is a large number. Evans, an electrical engineer and mathematician, worked for the Australian Greenhouse Office (now the Department of Climate Change) from 1999 to 2005, modelling Australia's carbon. He became sceptical when, in his view, "the evidence supporting the idea that CO₂ emissions were the main cause of global warming reversed itself from 1998 to 2006". The crucial evidence Evans found is in a 2006 report, *Temperature Trends in the Lower Atmosphere* by the US government's Climate Change Science Program (CCSP). Climate modellers had predicted a "hotspot" in the atmosphere, at a height of about twelve kilometres in the tropics, which would prove that climate sensitivity was a high number. This "hotspot" should have emerged over the period of global warming which occurred from the late 1970s until the end of the twentieth century. But many thousands of radiosonde measurements from 1979 to 1999 found it did not.

Why is this evidence crucial? It is well known that air temperature decreases with altitude, except for rare temperature inversions, until the stratosphere is reached. This reduction in temperature, caused by the reduction in air pressure with increasing altitude, is known as the "lapse rate". The lapse rate reduces with increases in humidity. The lapse rate would be about 10 degrees per kilometre of altitude if air was perfectly dry and rising quickly. But if air is very humid, it can be as low as 4 degrees per kilometre.

When global average temperatures were increasing over the period from 1979 to the end of the twentieth century, the extra water vapour generated by these higher temperatures could increase the depth of humid atmosphere. The CCSP's 2006 report predicted: "the lapse rate can be expected to decrease with warming such that temperature changes aloft exceed those at the

surface". However, the radiosonde measurements confounded this prediction. The report found: "observational data sets show more warming at the surface than in the troposphere [the atmosphere up to about twelve kilometres], while most model runs have larger warming aloft than at the surface."

If warming at the surface exceeded warming in the upper troposphere, this probably means the extra humidity was condensing into low-level clouds, which reflected incoming sunlight (with a negative effect on temperature), rather than increasing the depth of humid air that would have a greenhouse effect. Although the CCSP is silent on the matter, the inference is that climate sensitivity is a low number and feedbacks from changes in radiative forcing are negative rather than positive.

The IPCC's First Assessment Report in 1990 and Second Assessment Report in 1995 included graphs showing that temperatures were warmer in the Medieval Warm Period from about 1000 to 1300 than they were towards the end of the twentieth century and that there was a Little Ice Age. This was the widely accepted view at that time and confirmed by numerous studies. (It has since been confirmed by Loehle and McCulloch's 2000-year temperature reconstruction, published in 2008, based on eighteen series of non-tree-ring proxies, which found that the warmest tridecade of the Medieval Warm Period "was warmer than the most recent tridecade, but not significantly so".)

Then in its Third Assessment Report of 2001, the IPCC dropped graphs which showed a warmer period in medieval times and instead included the now notorious "hockey stick" graph. This new graph purported to show northern hemisphere temperatures from 1000 to the end of the twentieth century, with the Medieval Warm Period and the Little Ice Age as minor fluctuations in a relatively flat line, and a sharp rise only at the end of the twentieth century, resembling the blade of a hockey stick. It supposedly represented a warming in the last two decades of the twentieth century which was unprecedented over the previous 1000 years.

The hockey stick came from a 1999 study by Michael Mann and co-authors based mainly on studies of growth rings of trees, and also ice cores and coral, which provided proxy evidence of climate over the last 1000 years and built on an earlier study the co-authors published in the influential science journal *Nature*. In promoting this rewriting of climate history, the IPCC ignored numerous earlier studies and anecdotal historical evidence of the Medieval Warm Period and Little Ice Age.

The wider climate science community accepted this convenient reversal of a historical paradigm. It required two amateurs to demolish the hockey stick. Stephen McIntyre, living in Toronto, had been a statistician working at the speculative end of the mining industry. He had memories of Vikings in Greenland from his schooldays and became casually interested in the IPCC's hockey stick.

In April 2003 he was surprised to read an article by an IPCC author, Keith Briffa from the University of East Anglia, finding a decline in growth-ring widths for a large sample of trees in the twentieth century. A decline in growth-ring widths would indicate a decline in temperature. This seemed at variance with the use of tree-ring widths in the IPCC's hockey stick to show a temperature increase in the twentieth century. McIntyre assumed there was an explanation for this. Out of curiosity he wrote to Mann, the main author of the hockey stick. According to McIntyre:

To my astonishment, Mann said that he had forgotten where the data were. It seemed that nobody had verified the study in the way that I was used to things being verified [in the mining industry where geologists must make available all data on which their reports are based]. I thought—well, if nobody else has done this, I will.

McIntyre was not an academic. He teamed up with Ross McKittrick, a professor of economics at the University of Guelph, and together they published an analysis of Mann's hockey stick. They found the data did not produce the results claimed by Mann and his co-authors "due to collation errors, unjustifiable truncation or extrapolation of source data, obsolete data, geographical location errors, incorrect calculation of principal components and other quality control defects".

The findings of McIntyre and McKittrick caused a furore. A committee headed by Edward J. Wegman, a professor of statistics and chair of the US National Research Council's Committee on Applied and Theoretical Statistics, lodged a ninety-two-page report (including appendices) with the US Congress in 2006. The Wegman report found McIntyre and McKittrick's criticisms of the hockey stick were "valid and their arguments to be compelling". The report identified a "decentering error" in Mann's hockey stick findings, caused by selecting the period 1902 to 1995, when temperatures were rising, to calibrate the proxy data set. This was unrepresentative and dissimilar to the millennium temperature profile and "its net effect ... is to preferentially choose the so-called hockey stick shapes". The report suggested Mann and his co-authors may not have been aware of their error and found: "Even though their work has a very significant statistical component ... there is no evidence that Dr Mann or any of the other authors in paleoclimatology studies have significant interactions with mainstream statisticians."

McIntyre and McKittrick found that the hockey stick shape disappeared, using Mann's data, if a particular bristlecone pine chronology was omitted. This chronology was contained in Graybill and Idso's 1993 study, "Detecting the Aerial Fertilization Effect of Atmospheric CO₂ Enrichment in Tree Ring Chronologies". The purpose of the study was to test if increases in atmospheric carbon dioxide had a fertilising effect on bristlecone pines, and they did. The tree rings were wider. Arguably a study designed to determine the fertilising effect of carbon dioxide should not have been included in a later survey using tree rings as temperature proxies. Higher carbon dioxide levels rather than warmer temperatures may have been the main influence on the increased rate of growth. Tree rings are problematical temperature proxies because they may be a proxy for rainfall and a variety of influences as well as temperature.

The outcome was that a historical paradigm—the existence of a distinct Medieval Warm Period and Little Ice Age—was jettisoned on the basis of ambiguous data from some bristlecone pines. This paradigm had been established by more than a hundred studies of which more than twenty related to the southern hemisphere, although it should be emphasised that the southern hemisphere data are not conclusive regarding a Medieval Warm Period.

The hockey stick was a cause célèbre among a group of interested observers, and its defects were publicised on a website, Climate Audit, which McIntyre now set up. But the deficiencies of the IPCC process did not become known to a wide public until the Climategate e-mails, more than a thousand of them, were leaked or hacked from the website of the University of East Anglia in November 2009. The most notorious of these was an e-mail from Professor Philip Jones to Mann and his co-authors dated November 16, 1999, which stated: "I've just completed Mike's Nature trick [referring to the journal where the hockey stick first appeared] of adding in the real temps to each series for the last 20 years (ie from 1981 onwards) and from 1961 for Keith's to hide the decline ... Cheers Phil."

We have already alluded to Keith Briffa's tree rings anomalously indicating a decline in temperature in the late twentieth century. This e-mail is referring to a graph in the IPCC's Third Assessment Report showing several coloured lines that converge in the late twentieth century, at which point a green line representing Briffa's study is amputated, because including it in full would have shown a decline in temperature, implying a credibility problem with the IPCC's methodology. McIntyre has written regarding this e-mail:

As a reviewer of the [IPCC's] Fourth Assessment Report I asked that the deleted data be shown and explained as best they could. They refused. Jones's version of the trick was even more simplistic [than Mann's]—he simply spliced temperature data onto tree ring data, removing the real data—a technique that Mann later denied had ever been used.

The hockey stick has spawned a number of new hockey sticks. As recently as November 2009 a "news scan" with the reassuring headline "Still Hotter than Ever" in the Scientific American (a sister publication of Nature) affirmed: "A new analysis creates a better 'hockey stick' of rising temperatures." These attempts to resuscitate the hockey stick have been criticised on McIntyre's Climate Audit website, mainly on the basis that the new hockey sticks essentially recycle the same questionable data—a view which is confirmed in a Climategate e-mail of Briffa's. McIntyre

has continued to find errors in new studies, such as the cherry-picking of data. The relish and banality of the headline “Still Hotter than Ever” and the phrase “better ‘hockey stick’” are symptomatic. They are the language of a climate change industry intent on self-preservation and selling a product.

The original hockey stick should have been buried and forgotten after the Wegman report. What is of greater concern is that a wider community of climate scientists has stood by the authors after errors were exposed, and continues to do so. If the groupthink of climate scientists requires them to defend the pseudoscience of the hockey stick, can their other findings be trusted?

10. The Intelligent Voter’s Guide to Global Warming (Part II)

Geoffrey Lehmann, Peter Farrell & Dick Warburton

<http://www.quadrant.org.au/magazine/issue/2011/4/the-intelligent-voter-s-guide-to-global-warming-part-ii>

The economics and politics

What the Americans call “cap and trade”, Europe and Australia call an emissions trading scheme (ETS). It works in the following way. Governments place a cap on an emitter’s level of emissions. As an alternative to reducing emissions to the capped limit, the emitter can buy credits either from other emitters who have reduced emissions below their cap, or from developers of emission-reducing projects, typically in poorer countries. In the latter case, credits are awarded only if a certifier hypothesises *before* an emissions-reducing activity is undertaken, that it would not occur unless the credits are awarded: the creditable activity must be “uneconomic” without the credits. It is perverse to create a reward for otherwise uneconomic activities. Certification involves making a prediction, and is inherently subjective and impossible to audit effectively. After the credits are certified, there should be an audit to verify the creditable activity has taken place, which may be years later. The US Government Accountability Office reported on the UN’s Clean Development Mechanism:

some offset credits were awarded for projects that would have occurred even in the absence of the CDM, despite a rigorous screening process. Such projects do not represent net emission reductions and can compromise the integrity of programs ... that allow the use of CDM credits for compliance.

Christopher Booker has pointed out that 50 per cent of all “certified emission reduction credits” under the UN’s Clean Development Mechanism were being bought from China, the world’s biggest carbon dioxide emitter, which has been building an average of two coal-fired power stations a week. China has generated these credits from its massive “uneconomic” program of hydroelectric projects, of which the Three Gorges scheme on the Yangtse is an example. (Hydroelectricity is the cheapest form of power. So how were these credits certified?) The Asian Development Bank in 2006 estimated China would obtain an annual income of up to US\$2.25 billion from selling credits.

Typically under an ETS, an emitter in a rich country may face the prospect of expensive changes to come within its cap—for example by changing from coal to gas to generate electricity. As an alternative to reducing its emissions, the emitter is allowed to purchase carbon offsets arising from a certified project in a developing country. It will do this if the offsets are cheaper, which is often the case. In this way emitters in rich countries do not have to change their ways. Nor, because of the hazards of certification, can there be any confidence about a meaningful reduction of emissions in the poor country.

One of the problems with a cap on existing emitters is how to set the level of the cap. The US Government Accountability Office reported on Phase 1 of Europe’s ETS that “in 2006, a release of emissions data revealed that the supply of allowances—the cap—exceeded the demand, and the allowance price collapsed. Overall, the cumulative effect ... on emissions is uncertain because of a lack of baseline emissions data.” As Russia’s industrial output declined after the base date for

emissions under the Kyoto Protocol, the Russians had excess allowances they could trade—what has come to be called “the Russian problem”. A common criticism is that an ETS has the perverse effect of rewarding the biggest emitters.

In December 2009 Europol, the European criminal intelligence agency, warned that ETS fraud had resulted in around €5 billion in lost revenues and as much as 90 per cent of the entire market volume on emissions exchanges was caused by fraudulent activity. In late April 2010 there were twenty-five arrests in the UK and Germany for ETS fraud, involving more than a hundred suspects employed by banks and energy traders. A Europol official, Rafael Rondelez, has described the ETS as “an incredibly lucrative target for criminals”. This is because a carbon credit is “an intangible good ... With this, it’s just the click of a mouse.”

Suggesting that the market is the best mechanism for setting the carbon price is to ignore the events that led to the GFC, for which one of the triggers was speculation in derivative instruments. Enron and Lehman Brothers were vociferous advocates of carbon pricing. An ETS adds volatility to the financial system.

The claim that business needs an ETS to “obtain certainty” is spurious. Europe has an ETS, but the price of carbon has been volatile and the market has crashed three times since it began in 2005. A carbon tax can provide certainty during periods when governments do not adjust the rules. But an ETS is inherently volatile and adds extra uncertainty into business decisions.

An ETS was successfully adopted for eliminating sulphur dioxide emissions (which were causing acid rain) and chlorofluorocarbons (CFCs) that were depleting atmospheric ozone (which filters out dangerous ultraviolet radiation). In both cases the emission sources could be more easily identified and were less pervasive than carbon dioxide emissions (less than 4 per cent of carbon dioxide emissions are caused by human activity), and there were emission-reduction strategies that could be readily adopted.

Except for nuclear power, there are no straightforward strategies for reducing dependence on fossil fuels without large economic costs. Wind and solar generators often cannot function when needed. Wind machines operate at only about 25 per cent capacity in the UK. Even when the wind is blowing, “back-up capacity, usually gas-fired ... had to be kept running, using fuel, generating steam, emitting CO₂, ready to ramp up its turbines the moment sufficient supply from the wind machines stopped coming”. Two main obstacles with renewables are the difficulty of establishing transmission lines from sunny or windy places to where the power is needed and the absence of utility-scale storage technology for intermittent renewable energies. A US comparison estimated the following electricity generation costs per kilowatt hour: hydroelectric \$0.03; nuclear and coal \$0.04; wind power \$0.08; natural gas \$0.10 (other estimates for gas suggest about \$0.04); solar power (construction costs only, ignoring production costs for which reliable data were unavailable) \$0.22.

The technology for carbon capture and sequestration has yet to be developed for integration with fossil fuel power plants. Carbon sequestration might double the cost of electricity—or more. Stripping out the carbon dioxide from exhaust gases is energy intensive, cutting output of a plant by as much as 28 per cent. Existing power plants would require large pipelines carrying carbon dioxide under high pressure, sometimes over long distances, to massive voids in the earth or ocean, that are able to hold the gas without leakage. The only current viable alternative to burning fossil fuels is to go nuclear. Although current known reserves of uranium are limited, it is likely that by developing new nuclear technologies and with new sources of uranium, humanity’s electricity needs could be satisfied by nuclear power for many hundreds of years or more.

Once it is created, an ETS, like a system for licensing taxis, is difficult to change, even if it is not working. A new class of property owners—holders of carbon credits—is created, with a vested interest in the status quo. James Hansen of NASA, a leading climate scientist and AGW activist, has claimed an ETS rewards polluters, and denounces it as like the medieval system of papal indulgences. Hansen instead advocates “an increasing carbon tax” starting at \$1 per gallon of petrol and rising in future years.

The precautionary principle requires that a mechanism for controlling emissions can adjust to

changing circumstances. A carbon tax (unlike an ETS) satisfies this requirement. But what level should it be set at? Assuming the correctness of the strong AGW case, estimates of climate damage functions vary from \$15 to \$300 per tonne of carbon. The level at which the tax is set will be an exercise in dartboard economics. Moreover it is a recipe for continuing uncertainty as politicians keep changing their minds, as they always do with taxes. Business cannot get certainty from a carbon tax. The only certainty for business is no carbon tax.

A carbon tax set at a level high enough to change human behaviour cannot be made to work in a democracy. The 2010 *Hartwell Paper* was published under the auspices of Oxford University and the London School of Economics, and the fourteen co-authors comprise a distinguished interdisciplinary group of experts, including a lead IPCC author, political scientists and economists. Instead of a high-rate carbon tax, they recommend a carbon tax where all tax receipts are hypothecated to fund energy innovation, and the tax is set at a low rate that is unlikely to significantly modify consumer behaviour. They report:

Recent accumulating experience suggests that whereas it might seem straightforward to use taxation to modify consumer behaviour by setting a carbon price, energy demand is pretty inelastic and it has not proved possible to create carbon tax regimes that are simultaneously efficient in reducing demand or in stimulating innovation and that are accepted or even well tolerated by democratic societies.

Energy demand is “pretty inelastic” because people will not choose other goods or services to substitute for energy that keeps them warm or cool, cooks their food and provides transportation. Mechanisms such as a carbon tax are intended to send a price signal to consumers that they should consume less energy that is carbon intensive. But if alternative energy sources are limited, people will still choose to consume carbon-intensive energy, unless the price is set at a prohibitive level. In Western democracies an ETS or carbon tax would normally be accompanied by a proposal to compensate poorer voters for the higher price, *so they do not have to change their behaviour*. Neither the rich nor the poor will turn off their radiators and the price signal will be ineffective.

Punitive measures that actually reduce carbon dioxide emissions are most likely to affect poor people who currently lack access to electricity. The *Hartwell Paper* points out:

Present estimates suggest that about 1.5 billion people worldwide lack access to electricity. Many scenarios for the “successful” implementation of mitigation policies leave what we believe to be an unacceptable number of people literally in the dark. For instance, the International Energy Authority’s (IEA) 2009 450 Scenario to 2030 has global emissions for a trajectory to stabilisation at 450 ppm carbon dioxide; yet 1.3 billion people worldwide remain without access to electricity ... such scenarios inescapably paint a picture of rich countries who value limiting emissions over economic development elsewhere in the world ... We believe that leaving more than a billion people without access to electricity by 2030 would represent policy failure.

Population pressure is a major driver of carbon dioxide emissions, loss of biodiversity and environmental degradation. Punitive measures to reduce carbon dioxide emissions are likely to prolong poverty. Poorer people in countries where access to education is limited have more children. Measures to increase education levels for both sexes and sexual equality in poor countries may be more effective in reducing carbon dioxide emissions than measures directed specifically at emissions, which may exacerbate the problem.

An ETS was attractive to investment banks and industry participants keen to trade in carbon credits, and to supranational bodies such as the UN and EU, as the awarding and trading of carbon credits required supervision by an international body. Relative to a carbon tax, an ETS was also attractive to politicians as it was a hidden tax, and to consultants as there were many more consulting opportunities with an ETS. We use the past tense, because the international adoption of an ETS is improbable after the media non-event of the two-week Cancun talkfest in 2010, and the Copenhagen debacle in 2009, with China and India not co-operating, and Obama's retreat from climate change action following the mid-term congressional election.

Politics has oversimplified the AGW debate and politicians have relied on phoney economic projections such as Britain's Stern Report. The *Hartwell Paper* points out:

plausible futures using computer models ... are sufficient to undergird just about any view of the future that one prefers ... the "projective" models they produce have frequently been conflated implicitly and sometimes wilfully with what politicians really want ... that is precise forecasts of the future.

One of the simplifications of climate change politics has been to ignore other man-made greenhouse gases. The *Hartwell* authors point out: "Shine and Sturges estimated that 40 per cent of the heat trapped by anthropogenic gases in the Earth's atmosphere is due to gases other than carbon dioxide."

Politics has led to crude sloganeering. Australia's proposed Carbon Pollution Reduction Scheme is a misnomer. It is a scheme to reduce carbon dioxide, not carbon. Carbon in the form of airborne soot is a pollutant. Carbon dioxide *is not*. Astronauts and nuclear submarine crew breathe an atmosphere with carbon dioxide controlled to or equal to 8000 ppmv, and it comes out in our breath at about 40000 ppmv or over 100 times the current carbon dioxide content of the atmosphere, which is 390 ppmv. Carbon dioxide is a crop nutrient without which we would simply perish. Added at a level of 500 ppmv or more to the atmosphere of greenhouses growing tomatoes, it increases production levels by 15 to 20 per cent.

Much of the politics of climate science is being driven by the UN and its agency, the IPCC. The IPCC process, with dozens of authors from a number of countries co-operating to produce lengthy assessment reports—there have been four so far—has enforced a team mentality and discouraged dissent. The apparently unstoppable express train for climate action crashed with the UN's 2009 Copenhagen conference and the Climategate e-mails.

If AGW is a big problem, one of the main obstacles to a solution is Green opposition to nuclear power. This is a damaging contradiction at the heart of global warming politics. In a recent interview a climate scientist and leading advocate for action against climate change, James Hansen, acknowledged the limits of renewables and endorsed nuclear power as comparable to coal in cost, and recommended fourth-generation nuclear technology as this burns all of the fuel—not just 1 or 2 per cent as with current nuclear reactors—and eliminates the waste problem.

Identifying big problems enhances scientists' access to funding. It is interesting that the climate scientists Hubert Lamb, who founded the Hadley Climate Research Unit, and Stephen Schneider, two early supporters of a strong AGW effect, at first raised the possibility of a new ice age. The IPCC with its four assessment reports has been an enormous project over more than a decade, involving thousands of scientists. Big projects justify themselves by identifying big problems and recommending big solutions.

There are parallels with the Human Genome Project. Ten years ago the leaders of the Human Genome Project predicted "personalised medicine" was likely to emerge by 2010 from their project to sequence human DNA. President Clinton predicted it would "revolutionise the diagnosis, prevention and treatment of most, if not all, human diseases". This has not happened. One of the breakthroughs expected was the discovery of "common variants" in the genome spreading to say 5 per cent of a population and causing disease, and allowing treatments for a wide range of patients. Dissenters, a self-described "lunatic fringe", argued this was unlikely for statistical (evolutionary) reasons, and that combinations, differing from individual to individual, of rare variants, were more likely to cause genetic susceptibility to a disease. The lunatic fringe dissenters have become the majority and an early proponent of the Human Genome Project now says, "The vast majority of [common] variants have shed no light on the biology of diseases."

The sparseness of medical outcomes so far from the Human Genome Project cannot be fudged. But until the climate sends an unequivocal signal, the IPCC, another big project like the Human Genome Project, can continue to make claims such as "2500 of the world's leading scientists have reached a consensus that human activities are having a significant influence on the climate". A lead IPCC author, Mike Hulme, has pointed out that such claims "are disingenuous. That particular consensus judgement, as are many others in the IPCC reports, is reached by only

a few dozen experts in the specific field of detection and attribution studies; other IPCC authors are experts in other fields.”

The best-selling author Michael Crichton had an MD from Harvard and undertook a post-doctoral fellowship at the Salk Institute. He was a vocal AGW sceptic. In his 2003 Caltech Lecture, “Aliens Cause Global Warming”, he mocked consensus science:

I regard consensus science as an extremely pernicious development that ought to be stopped cold in its tracks. Historically, the claim of consensus has been the first refuge of scoundrels; it is a way to avoid debate by claiming the matter is already settled ... the work of science has nothing whatever to do with consensus. Consensus is the business of politics. Science, on the contrary, requires only one investigator who happens to be right, which means that he or she has results that are verifiable by reference to the real world ... Consensus is invoked only where the science is not solid enough ... Nobody says the consensus is that the sun is 93 million miles away. It would never occur to anyone to speak that way.

John Ioannidis, described by the *Atlantic* as “a meta-researcher ... one of the world's foremost experts on the credibility of medical research” and perhaps “one of the most influential scientists alive” found in his famous and provocatively titled paper “Why Most Published Research Findings are False”:

A research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance. Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true. Moreover, for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias.

His conclusion was: “It can be proven that most claimed research findings are false.”

Several of his “corollaries” indicating that medical research findings are likely to be false may be applied to climate studies: the smallness of “effect sizes”, being global average temperature changes of fractions of a degree on which many climate studies rely; the large number of relationships (with sun, clouds, albedo, aerosols, greenhouse gases and oceans interacting); the flexibility of design (for example replacing an inconvenient part of a tree-ring sequence with thermometer measurements); and the large teams of climate scientists chasing results of statistical significance with the encouragement of carbon traders, bankers, consultants and the renewable energy industry. Ioannidis’s findings have been “widely accepted by the medical community” and he has become a celebrity speaker at international medical conferences (so much so that he has cut back on commitments, because of vertigo from excessive travel). The politicisation of climate science means that it is yet to experience its Ioannidis moment.

As Lenin once said, “What is to be done?” The un-Leninist answer may be that Australia should do nothing to reduce its carbon dioxide emissions, if we do not wish to embrace the nuclear power option. Non-cosmetic reductions of emissions do not come cheap. The UK Climate Change Act 2008 legislates for an 80 per cent reduction from the 1990 level of UK carbon dioxide emissions by 2050. To achieve this ambitious target will cost £14.7 to £18.3 billion annually over forty years according to the UK’s Department of Energy and Climate Change. (Benefits are estimated at up to more than double the cost.) Britain, unlike Australia, has nuclear power plants. The cost for a nuclear-free Australia of an equivalent program would be much greater per head of population and is not politically sustainable.

Richard Lindzen has pointed out that much of the radiative effect of carbon dioxide emissions has already occurred. The next 100 ppmv added by mankind will have only about half the effect of the first 100 ppmv. The scientific case for a strong AGW effect is weak. The hockey stick, promoted by the IPCC and Al Gore, has serious statistical errors. It misrepresents past temperatures.

Global average temperatures have not risen as models predicted. Despite its ETS, Europe's contribution to carbon dioxide emissions increased by 1.5 per cent in the first two years of operation. Since the Kyoto Protocol of 1997, carbon dioxide emissions from fossil fuels and cement production have significantly increased. Developing nations will not adopt an ETS or carbon tax that impedes the economic growth they need to lift their populations out of poverty. They are not waiting for a signal from Australia, a country with less than 2 per cent of the world economy.

As proposed by Bjorn Lomborg, there are many worthwhile causes to fund with our taxes and philanthropic dollars that rank ahead of possible global warming—such as ensuring safe drinking water and educating both sexes in poor countries, eliminating malaria and other tropical diseases, maintaining biodiversity and cleaning up real pollutants. Adaptation to adverse climate change, *if* and when it does occur, may be the best and only viable strategy.

11. Fukushima looked ugly but the alternative is so much worse

Graham Lloyd, Environment editor, The Australian April 09, 2011 12:00AM

<http://www.theaustralian.com.au/news/fukushima-looked-ugly-but-the-alternative-is-so-much-worse/story-0-1226035842401>

THE Fukushima nuclear emergency has intensified the global climate change debate.

Japan's post-tsunami crisis has prompted an immediate reappraisal of ambitious nuclear energy plans in the booming markets of China and India and hastened the withdrawal of ageing plants in Western Europe, most notably Germany.

According to some calculations, if the world's nuclear ambitions are reduced because of Fukushima global carbon emissions could increase by an additional three billion tonnes by 2030.

Some believe this would be enough to push global temperature rises beyond 2 per cent and into a potentially calamitous upward spiral.

This has caused leading environmental campaigners, such as British author George Monbiot, to reappraise their attitude towards nuclear energy with some dramatic results.

Monbiot has not only changed from nuclear avoider to pro-nuclear campaigner he has taken on the long-standing figurehead of the anti-nuclear cause, Australia's Helen Caldicott.

"I'm very worried that the global response to what's happening in Fukushima will be to shut down nuclear power stations around the world and to cancel future nuclear power stations, and that what will happen is that they will be replaced by coal," Monbiot wrote this week.

And after years of campaigning against nuclear power, Monbiot now describes the exaggerated claims of the health impacts of radioactivity as akin to what he believes are the pseudo-scientific pleadings of climate change deniers.

"The anti-nuclear movement to which I once belonged has misled the world about the impacts of radiation on human health," Monbiot wrote.

Monbiot cites a UN Scientific Committee report into the Chernobyl accident, which found that of the workers who tried to contain the emergency at Chernobyl, 134 suffered acute radiation syndrome; 28 died soon afterwards. Nineteen others died later, but generally not from diseases associated with radiation. The remaining 87 have suffered other complications, including four cases of solid cancer and two of leukaemia.

In the rest of the Chernobyl population there have been 6848 cases of thyroid cancer among young children arising "almost entirely" from the Soviet Union's failure to prevent people from drinking milk contaminated with iodine 131.

Otherwise "there has been no persuasive evidence of any other health effect in the general population that can be attributed to radiation exposure".

Japanese authorities have responded with greater speed and precision to the Fukushima emergency than did their Soviet counterparts at Chernobyl, which was a much more serious accident.

Nonetheless, the Fukushima accident has again demonstrated the strength of community fears about radioactivity.

But it has also served to highlight the fact that rejecting nuclear power is not a zero sum game when it comes to carbon and climate change.

The environmental and health effects of burning more coal and gas can be much worse than the risk of radioactive fallout.

The evidence is that for countries at the forefront of the so-called nuclear renaissance, a future without nuclear would undoubtedly put new strains on demand for fossil fuels such as coal and gas.

Despite some wildly enthusiastic claims, present renewable technologies are not yet advanced enough to replace fossil fuels for base load power.

And government programs to promote them are either too clumsy or poorly targeted to give the impetus needed to catch up.

This is particularly the case in Australia where a report this week by the Grattan Institute lifted the lid on how the hundreds of millions of dollars promised by government for renewable programs is being recycled rather than spent.

The report found that, on average, for every \$1 million the government has announced under its \$7 billion of grant tendering programs, only \$30,000 of operational projects result within five years and only \$180,000 within 10 years.

The Clean Energy Council says it is still early days in both technological development and deployment.

And the council's chief executive, Matthew Warren, says the ability of renewable technologies to displace fossil fuels or replace nuclear will vary widely according to location.

Worldwide, despite the enthusiastic assumptions of clean energy boosters, the evidence is there is still a long way to go.

Much will depend on the successful development of new generation technologies such as carbon capture and storage, thorium-based reactors, algae, wave, tidal and geothermal, all of which are still in the development phase.

And in its first Clean Energy Progress Report released this week, the International Energy Agency provided a relatively downbeat assessment.

The report said the success stories in developing renewable energy technologies were being overshadowed by surging demand for fossil fuels, which were outstripping deployment of renewables.

The IEA's deputy executive director, Richard Jones, said the world's dependence on fossil fuels was posing short-term risks to political stability and economic activity and threatening environmental stability.

"Despite countries' best efforts, the world is coming ever closer to missing targets that we believe are essential for meeting the goal agreed in Cancun to limit the growth in global average temperatures to less than 2C," Jones said.

Even with large scale investment in renewable sources of energy, worldwide renewable electricity generation since 1990 grew an average of 2.7 per cent a year, which is less than the 3 per cent growth for total electricity generation.

The IEA says achieving the goal of halving global energy-related CO2 emissions by 2050 would

require a doubling of all renewable generation use by 2020 from today's level.

Without nuclear, the challenge is even bigger.

The IEA report says while nuclear capacity has remained nearly flat for the past decade, countries are now constructing 66 nuclear reactors that should add 60 gigawatts by 2015.

But the recent earthquake in Japan and resulting damage has led countries to review nuclear safety and investments.

"As a result, nuclear expansion is likely to be slower than planned," the IEA said.

An analysis by French bank Societe Generale estimates that if all 34 countries in the OECD were to shut their nuclear power plants and replace them with gas plants before technology to capture their carbon emissions is developed, OECD carbon emissions could rise by nearly one billion tonnes of CO₂ a year.

Germany has already pledged to shut down eight ageing nuclear plants before the end of the year. And the country's deputy environment minister has said the decision has already been made to phase out all nuclear power in Germany before 2020.

According to an analysis by Thomson Reuters Point Carbon, Germany's initial decision to close all its nuclear power stations built prior to 1980 for three months would result in eight million tonnes of CO₂ being pumped into the atmosphere if fossil fuel stations were used to fill the resulting energy gap. German energy traders say stopping Germany's nuclear program would boost the company's demand for coal by about four million tonnes.

Deutsche Bank has estimated that if Germany's seven oldest reactors were permanently shut down immediately and the remaining 10 allowed to continue generating under terms of revised legislation passed in 2010, Germany would generate an additional 250 million tonnes of CO₂ between 2011 and 2020.

Lynas has estimated a complete German nuclear phase-out would produce an additional half a billion tonnes of CO₂ by 2020.

Pressure is also mounting to head off a resumption of the nuclear power program in the US, despite President Barack Obama's continue support.

A US phase-out of nuclear power, replaced by an equal share of coal and gas by 2030 would produce another half gigatonne of CO₂ emissions.

If the US phased out only the 23 nuclear power plants with the same design as Japan's troubled Fukushima Daiichi nuclear complex by 2030, carbon dioxide emissions in the US would increase overall by at least 1 per cent.

China is at the forefront of the new era of nuclear construction and development and is planning a four-fold growth in nuclear power to 40GW.

But consideration of new plants has been frozen in the wake of the Japan emergency.

If China were to shy away from nuclear the lost power would most likely be made up by coal-fired power, which is already growing at a faster rate than nuclear, hydro, gas, wind and solar combined.

An additional 260GW of coal-fired power generation is already in the pipeline, compared with 40GW for nuclear, 63GW of new hydro, 22GW in gas-fired generation, 48GW of new wind power and 5GW of solar.

If China were to abandon plans to build 100 Chinese nuclear plants by 2030, each could be replaced by coal fired power stations emitting 10 million tonnes per year, resulting in an additional one gigatonne of CO₂ a year.

If the anticipated nuclear renaissance falters in other OECD countries such as Japan, Britain and the rest of the European Union, another half-gigatonne of CO₂ emissions could result from

additional fossil fuel plants.

This is why the IEA says in order to achieve a 50 per cent reduction in energy-related CO2 emissions by 2050, IEA research shows that about 100 large-scale carbon capture and storage projects will be needed by 2020, and more than 3000 by 2050.

"This represents a significant scale-up from the five large-scale carbon capture and storage projects that are in operation today."

For Australian nuclear expert Ziggy Switkowski, the contribution made by nuclear energy to limiting global carbon emissions is obvious.

Nuclear currently supplies 14 per cent of the world's electricity, which is responsible for 15 billion tonnes of CO2 emissions a year, he says.

Given these figures, the world's 440 nuclear plants avoid the emission of about two billion tonnes of CO2 a year.

The Australian uranium used to generate about one quarter of the world's nuclear power saves about 500 million tonnes of CO2 almost equal to Australia's total carbon emissions of about 600 million tonnes a year.

12. It's madness to sacrifice ourselves for nothing

Greg Sheridan, Foreign editor, The Australian April 09, 2011 12:00AM

<http://www.theaustralian.com.au/national-affairs/commentary/its-madness-to-sacrifice-ourselves-for-nothing/story-e6frgd0x-1226036215554>

EVERY so often Australians accuse themselves of being out of step. The implication is that we should "catch up with the world". Sometimes this has been a useful spur to reform, sometimes it has been nonsense.

But the Gillard government is attempting to put Australia off-side with the practice of virtually the entire world. And it is doing so by pursuing a puritan ideological obsession that virtually no one else in the world is doing.

I refer, of course, to the proposed carbon tax. If the carbon tax goes ahead, to be replaced in due course by an emissions trading scheme with a fixed carbon emissions target, Australia will have among the most extreme climate-change policies in the world.

Gillard has shown herself to be a highly reactive politician. And it is characteristic of her that she overreacts. The ETS was unpopular before the last election, so she urged Kevin Rudd to dump it. After the election, Labor was worried about hemorrhaging votes on its left to the Greens, so every Labor right-winger who had ever bruised a ballot became a champion of gay marriage. And Gillard embraced the carbon tax.

Lately Gillard has been under pressure, not least from the Labor Right, for being too close to the Greens - so she's embraced the Bible, a newly minted life-long love of America and social conservatism.

The problem with these wild overreactions is twofold. After a time they lose their credibility. And in the meantime we're stuck with the carbon tax.

Let's have a simple rundown of what the rest of the world is doing. In Europe there has indeed been an ETS for some years. But more than 95 per cent of the carbon permits in its first years were given out for free. The scheme had little effect on reducing greenhouse emissions. It was widely regarded as a joke, although European officials who come to Australia are inevitably interviewed reverentially by uninformed ABC personalities who never hold them to account for this.

Europe says it is going to fix its ETS. But even so, the vast majority of Europe's export industries

will qualify for free or highly discounted carbon permits.

Some heavy manufacturing has left Europe and gone to China. But as Graeme Kraehe of Bluestone Steel pointed out, carbon emissions attributable to European imports have risen massively. So any carbon reductions from European manufacturing have been more than matched by carbon increases from non-European manufacturers now supplying Europe's population. Out of this, there is little or no net carbon reduction for the planet.

What about China?

China is the world's biggest greenhouse gas emitter, responsible for nearly a quarter of the world's new carbon. The Gillard government's Greg Combet uses a Jesuitical form of words, which is a first cousin to rank fraud, when he talks about China. He recently spoke of an "implicit carbon price" in "certain sectors" of the Chinese economy. Gillard herself frequently talks of China decommissioning coal-fired power stations.

Let's be quite clear. China is engaged in a massive, yes massive, increase in carbon emissions. As Gary Banks from the Productivity Commission has made clear, the implicit carbon price exists only in Combet's dreams. China does not impose a carbon price across its economy. Banks has concluded that you simply cannot work out an economy-wide implicit carbon price from the carbon-reduction measures for economies that do not impose direct carbon prices.

But despite the Gillard government's propaganda, and its many slyly misleading convolutions, Beijing has never, ever promised to cut its carbon emissions. It is indeed decommissioning old coal-fired power stations and replacing them with new coal-fired power stations. These will be more efficient than the old. So China can claim it's reducing its carbon intensity, that is, the amount of carbon per unit of output. But overall it plans huge increases in greenhouse gas emissions.

Its Copenhagen offer, on some estimates, would have seen its carbon emissions grow by 500 per cent on 1990 levels by 2020.

Take the steel industry. In the past decade, China's steel industry has more than quadrupled in size. That means it is producing one billion tonnes of extra carbon per year from that industry alone.

One can only conclude that the Gillard government is deliberately attempting to mislead the Australian people about what is happening in China.

China faces huge environmental and pollution problems, of which carbon is a part. And undoubtedly it is trying to produce goods more cleanly. But if you ever hear a government minister, or an interviewer, claim China is reducing emissions, or has a price on carbon, you know they are talking through their hat.

In the US, the administration of Barack Obama has definitively abandoned any support for an emissions trading scheme or a carbon tax. Such policies face overwhelming congressional opposition, from the Democrats as well as the Republicans.

Again Combet misleads gullible ABC interviewers by trying to claim the US's few state-based emission reduction schemes are somehow comparable to what he is planning to do to the Australian economy. In fact the state-based schemes in the US are in the process of atrophy. They are very shallow schemes, covering small portions of their economy, with low carbon prices.

The Gillard government's proposed carbon tax is meant to cover the whole of the Australian economy, with a few sectors exempt. There is hardly a country in the world that has done anything like that. Certainly the state-based systems in the US are not remotely equivalent.

In our own region, the contrast between what the Gillard government is planning to do, and what our neighbours are actually doing, is even more stark. Before the giant earthquake and tsunami that devastated Japan's northern shores and created the continuing crisis at the Fukushima nuclear power plants, the Japanese had already decided to postpone any legislation for an emissions trading scheme. The early design of the Japanese scheme that has been postponed

looked as though it would be a replica of the ineffective European scheme, with most carbon permits initially issued for free.

After the tsunami, economic reconstruction will be the key. Japan will need to replace the nuclear-generated power it has lost, and probably find some other source for the nuclear power it was planning. That inevitably means a lot more carbon emissions. Japan won't hurt its economy with an ETS or a new tax.

Something like this may well affect Germany too, if, as seems likely, its nuclear power industry is scaled back. Some European nations have carbon taxes as well as the ETS, although others, such as France, have abandoned carbon taxes altogether.

South Korea had planned to start a carbon reduction scheme in 2013, although there seem to be endless delays and not much more than half the economy was to be covered. Again it seems the early permits were to be issued mostly for free. It is extremely unlikely South Korea will disadvantage itself compared with its northeast Asian neighbours.

India, which accounts for about 5 per cent of global emissions and rising, has no plans for an ETS or an economy-wide carbon price. Its voluntary offers to reduce carbon intensity - like China, India has never offered to decrease carbon emissions - according to some analysts, involve an overall 350 per cent increase of carbon emissions on 1990 levels by 2020.

Canada did sign up to the now defunct Kyoto Protocol, but never went anywhere near meeting its targets (whereas Australia, having not signed up, did meet its targets). I mistakenly wrote recently that Canada has an ETS. It does not. Nor does it have a carbon tax.

Russia, because of the collapse of the old Soviet-era industries, fell well below its 1990 level emissions. But Russia's economic development plans involve massive carbon emission increases from here onwards.

The countries that compete with us to sell resources to China, such as Indonesia and Chile, are doing close to nothing to inconvenience their economies on this score. The notable thing about the Indonesian press and political debate is that climate change never figures at all.

Part of the corruption of the European ETS was that it involved buying carbon credits from Third World countries by sponsoring anti-greenhouse schemes there. But these were mostly ineffective, if not outright rorts.

It is a nonsense to describe the imposition of a carbon tax as an economic "reform" for Australia. If the proponents of the tax were honest, they would acknowledge that it is completely implausible that a massive cost imposition on the Australian economy will benefit the Australian economy. Instead, Australians are being asked to engage in a massive act of altruism - although the benefits of that altruism are doubtful, even for the global environment, given that high-carbon activities will simply shift to other countries.

Australians, like most people in the world, want to do something to help the environment, and to reduce carbon emissions. But it must be at a reasonable cost.

Many national governments have engaged in extravagant rhetoric about climate change. All are hopeful that new and better technologies will emerge. But you can't wish these into existence. Funds for research are one of the most obvious ways to attempt to make things better.

There are some reasonable things Australia can do that would reduce emissions. But if we impose an economy-wide tax and reduce emissions by the absurd amount the government claims, we will be imposing a giant cost on the economy, with absolutely unpredictable economic consequences. And we will also, incidentally, be wholly out of step with the rest of the world.

13. Japan raises nuclear crisis rating to highest level

By Kenji Hall and John M. Glionna, Los Angeles Times, April 12, 2011

<http://www.latimes.com/news/nationworld/world/la-fg-japan-earthquake-20110412,0,2410014.story>

The level 7 rating for the crisis at the quake- and tsunami-stricken Fukushima power plant is based on the amount radiation released. A day earlier, three new quakes hit as Japan announces plans to expand the evacuation zone.

Reporting from Tokyo and Rikuzentakata, Japan— Japanese nuclear regulatory officials Tuesday raised the severity rating at the earthquake- and tsunami-damaged Fukushima Daiichi power plant to the highest level by international standards, equaling the 1986 Chernobyl meltdown in the former Soviet Union.

The country's Nuclear and Industrial Safety Agency announced that because of the amount of radioactive material released from the plant after the magnitude 9 earthquake a month ago, the rating would be changed to level 7, a "major accident" on the International Atomic Energy Agency's scale, up from a level 5, an "accident with wider consequences."

In a nationally televised news conference, the agency's spokesman, Hidehiko Nishiyama, said the decision was based on the amount of radioactive iodine and cesium spewed from the power plant in Fukushima, north of Tokyo.

Nishiyama stressed that the radiation from the Fukushima nuclear plant was 10% of the amount at Chernobyl. He also said that unlike at Chernobyl, there had been no deaths linked to the accident at Fukushima.

"At Chernobyl, the reactor itself exploded," he said. "At Fukushima some radioactivity has leaked from the reactor, but the reactor itself continues to keep most of the radioactive material inside. In that sense, this is different from Chernobyl."

Before the rating was elevated, the disaster had been rated at the same level as the 1979 Three Mile Island accident near Middletown, Pa.

But Minoru Ogoda of Japan's Nuclear and Industrial Safety Agency said the change in the severity rating came because "the impact of radiation leaks has been widespread from the air, vegetables, tap water and the ocean," the Associated Press reported.

Measuring severity on the international scale involves factors including the amount of radiation released, how wide an area it reaches and how long any problems may last.

Officials said the rating reflects the severity of the problem at the outset, when radiation levels were highest. Those levels have since fallen sharply, they said.

Experts, nevertheless, say it will take years to recover from the damage incurred at the Fukushima plant.

More than 27,000 people were left dead or missing as the disaster last month, centered in the northeast, destroyed fishing towns and caused severe damage to homes, businesses and almost everything else along more than 200 miles of coastline. The government has estimated economic losses of as much as \$300 billion, not including costs such as the cleanup of the Fukushima plant, which is operated by Tokyo Electric Power Co.

The announcement by nuclear agency officials came the day after three powerful aftershocks struck already jittery northeastern Japan within the span of 10 minutes, as the government announced new plans to expand the evacuation area near the stricken nuclear plant due to high radiation levels.

Japan is trying to rebuild after the March 11 quake triggered a deadly tsunami that also left tens of thousands homeless. The tsunami has caused several fires and explosions at the Fukushima Daiichi plant, which has leaked dangerous isotopes into the air, soil and water.

The first of Monday's temblors, which trapped some victims in collapsed homes and vehicles, hit at 5:16 p.m. near the coast in Fukushima prefecture, registering a magnitude 7.1 at a depth of 6 miles underground, according to the Japan Meteorological Agency.

It was sizable enough to rock buildings in Tokyo, about 150 miles to the south. A magnitude 6 quake hit a minute later in the same area, followed by another temblor, measuring magnitude 5.6, nine minutes after that.

Aftershocks continued hours later, the agency said. In neighboring Ibaraki prefecture, one man died after falling and hitting his head during the shaking, according to the local Ryugasaki fire department.

The quakes also triggered a landslide that buried three homes in Iwaki city. Two people died in the landslide, including a 16-year-old girl, according to public broadcaster NHK. Three other men pulled from the rubble were unconscious and taken to a hospital, NHK said. Rescuers continued their efforts Tuesday.

Officials issued a tsunami warning after the quakes but later lifted it.

The quakes temporarily knocked out the power to the Fukushima plant and led to a 50-minute stoppage in the water-spraying operations to cool four of the plant's six reactors. Highways were closed, bullet train services to the region were halted briefly, and as many 220,000 homes in Fukushima prefecture were without power.

Tokyo Electric Power Co. said a fire broke out on the plant's premises Tuesday morning at a building where batteries are stored. Within minutes, firefighters put out the blaze, and there appeared to be no impact on workers' efforts to cool four of the reactors, the company said in a statement.

On Monday, Chief Cabinet Secretary Yukio Edano said the government would expand a 12-mile evacuation area near the nuclear plant, adding to the ranks of the thousands who have already been told to leave their homes.

Unlike the government's previous evacuation orders, the new one is based on data that show higher than normal radiation levels extending to towns and villages that lie beyond the 12- to 18-mile zone around the plant. The government has advised residents in the zone to stay indoors.

It was unclear how many residents would be affected by the new order, which the government plans to carry out over the next month. Edano noted that the risk of a massive radiation leak from the Fukushima plant was "considerably lower."

14. Fukushima fears 'are inflated'

Rick Wallace, Tokyo correspondent, The Australian April 14, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/fukushima-fears-are-inflated/story-e6frg6so-1226038724675>

"The Fukushima accident and Chernobyl are very different," he said. "Chernobyl happened when the reactor had power, it was a huge explosion, vapour, power explosion, and then you had a huge graphite fire."

Mr Flory echoed Japan's comments that the Fukushima radiation releases had been less than one-tenth of the total released at Chernobyl.

The re-rating of the Fukushima crisis to the highest level on the international INES scale -- a category 7 -- has sparked global concern about its impact.

Japan had previously judged the incident to be a category 5, and the dramatic upgrading of its severity amid new estimates of the amount of radioactivity released caused alarm in some quarters.

Chief Cabinet Secretary Yukio Edano refused to say whether any foreign governments had expressed concerns about the re-rating. However, he said Japan had taken precautions on the basis of the worst-case scenario and the upgrading did not mean they were deficient. The confusion was heightened by the fact the INES scale effectively does not cater for the clear

distinction between a disaster such as Chernobyl and the Fukushima crisis.

Japan's latest estimates put the amount of material released into the air at Fukushima at 370 terabecquerels of iodine 131 equivalent, about 7 per cent of the estimated 5200 terabecquerels released at Chernobyl.

The limitations of the INES scale, and the juxtaposition of the severity upgrade with Prime Minister Naoto Kan's comments that things were improving at the plant, fostered an atmosphere of confusion.

Timing issues aside, Mr Kan's comments about gradual improvement were correct and the re-rating of the incident was based almost wholly on radiation releases that occurred in the first week of the crisis.

Still, the Chernobyl linkage appeared to rattle some governments. Immediately after the change, The Philippines initiated charter flights to evacuate about 2000 Filipinos living within 100km of the plant. Australia's Department of Foreign Affairs and Trade updated its travel advice on Japan to reflect the re-rating, but described it as a "technical adjustment" that nuclear regulator ARPANSA said would not change the radiological health risk in Tokyo from its "low" level.

The US nuclear regulator said it was not surprised by the re-rating but backed Japan's handling of the crisis. Russia's atomic energy body, Rosatom, said the re-rating was "exaggerated" and the incident had not exceeded level 5. France's nuclear agency backed the view that Fukushima would not become another Chernobyl.

Radiation confusion has also been causing problems for evacuees from within the exclusion zone around the plant.

Reports have emerged that these people were being turned away from evacuation centres because of unfounded fears they might contaminate others.

Fukushima evacuees were being asked for local government-issued "radiation-free" certificates before being allowed to enter centres, Japanese media reports said.

Critics said the measures were discriminatory and reminiscent of the stigma that was applied to survivors of the Hiroshima and Nagasaki blasts.

But those running evacuation centres said the certificates were necessary for the peace of mind of others inside the centres.

The recovery in Japan from the disaster continues to gather momentum. Sendai Airport yesterday reopened, a month after it was swamped by the tsunami.

At the Fukushima Daiichi plant, the pumping of highly radioactive water from the basement of the No 2 reactor into a storage tank continued, despite a new magnitude-5.8 quake that shook the region.

The economic impact of the disaster was reinforced yesterday when the Cabinet Office downgraded its economic assessment for the first time in six months. The nascent recovery was "a thing of the past", it said.

15. Nuclear fallout to hit rice planting

Rick Wallace, Tokyo correspondent, The Australian April 11, 2011 12:00AM

<http://www.theaustralian.com.au/news/world/nuclear-fallout-to-hit-rice-planting/story-e6frg6so-1226036861265>

RICE planting in areas where radioactive fallout from the Fukushima Daiichi plant has contaminated the soil is set to be banned as Japan marks a month since the Great Tohoku earthquake and tsunami.

It is the first time contamination fears have spread to a crop that has an almost spiritual significance in Japan.

Planting, which is on the verge of starting, will be banned in areas where the concentration of radioactive cesium in the soil exceeds 5000 becquerels/kg.

Japan's Ministry of Agriculture, Fisheries and Forestry says rice absorbs 10 per cent of the cesium in soil. It intends applying the ban to areas beyond the 30km exclusion zone around the stricken plant. Plant operator TEPCO will have to compensate those affected.

Recent surveys of more than 70 rice fields showed the cesium content breached the new limit in just two paddies in Iitate village about 40km from the plant.

Workers at the Daiichi plant yesterday began building steel barriers to fence off the ocean around the intake of the No 2 reactor, where high radioactive readings had been found in seawater. Although TEPCO says it has stopped a leak that was discharging highly radioactive water into the ocean, it plans to construct several more barriers.

Fresh samples of sand eels taken from the nearby coast on Saturday showed radioactive substances continuing to enter the marine food chain, with one of four samples breaching the limit of radioactive cesium. The utility was close to completing a program of dumping 11.5 million litres of "moderately" radioactive water from the plant to clear space for storage of highly radioactive water building up in pools in reactor buildings.

Japanese Prime Minister Naoto Kan -- who visited the tsunami-battered port of Ishinomaki yesterday -- will today publish a letter of thanks to nations and citizens who have assisted Japan's recovery.

Figures from Japan's National Police Agency put the death toll at 12,985 yesterday and the number still missing at 14,809.

Japan voted yesterday in municipal, prefectural, mayor and gubernatorial elections after a sombre campaign. Results will be studied for how candidates' views on nuclear energy and disaster prevention were received.

An anti-nuclear protest in Tokyo yesterday attracted a few thousand people -- a sizeable crowd for Japan.