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The National Radioactive Waste Repository Project: Social & Political Aspects

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Enviro06 National Young Professionals Forum; 9/5/06

Three definitions & one question

- Radioactive waste (IAEA, 1995):
  - "Material that contains or is contaminated with radionuclides at concentrations or radioactivity levels greater than clearance levels established by the appropriate authority and for which no use is foreseen"
- Repository (Collins English Dictionary, 1972):
  - A place where valuables are deposited for safety
- Dump (Collins English Dictionary, 1972):
  - Refuse or scrap heap
- Would you rather have a repository *(treasure)* or a dump (*trash)* in your backyard?

Letter from Rann (SA) to Howard, 6/3/03

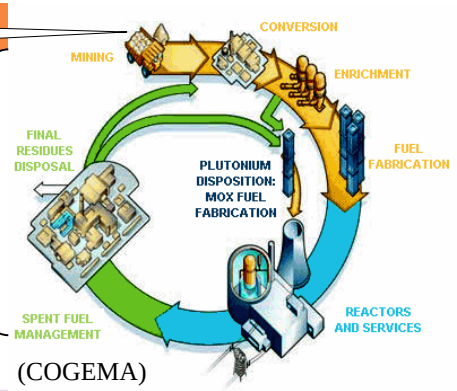
- "As part of its commitment to stop any national nuclear waste dump being built in this State, the South Australian Government will:
  - Legislate against any national nuclear or radioactive waste dump being set up in SA, including a low-level national repository and
  - Ban the transport of radioactive waste from interstate or overseas in SA for the purpose of sending it to a national waste dump in this State."
- "The South Australian Government will introduce legislation to hold a referendum of South Australians if any Commonwealth Government, now or in the future, attempts to use its powers to override state laws and seeks to establish a medium or high level nuclear waste dump in South Australia."

Land council relaxed about nuclear waste (SMH, 12/3/06)

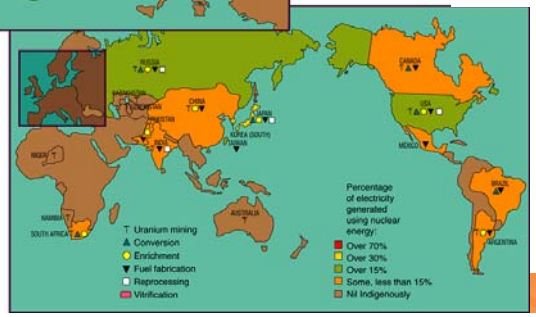
- "The Northern Land Council declared it would welcome a nuclear waste dump in its backyard after representatives inspected the nuclear facility at Lucas Heights"
- "However, the group seems likely to generate a political storm of its own after dismissing environmental concerns and the objections of Clare Martin, the Chief Minister of the Northern Territory"
- "Mr Daly said the council would not receive money for supporting a waste dump, but he indicated that education and health benefits would be sought for local communities"
- "After the Federal Court rebuffed its bid to build a facility in South Australia against the wishes of the state government, the Federal Government passed legislation in 2005 dictating that a nuclear waste repository would be established in the Northern Territory by 2011"

Radioactive wastes

Uranium



(COGEMA)



The civilian nuclear fuel cycle

(Uranium Information Centre)

IAEA categories of radioactive waste (radwaste)

Exempt	Activity levels below clearance levels (can be disposed of through general waste management procedures)
Low level	Contains enough radioactive material to require action for the protection of people but not so much that it requires shielding in handling, storage or transportation.
Short-lived intermediate	Requires shielding, but needs little or no provision for heat dissipation, and contains low concentrations of long-lived radionuclides (less than 4000 Bq/g of alpha emitters). Radionuclides generally have a half-life of less than 30 years.
Long-lived intermediate	Requires shielding, but needs little or no provision for heat dissipation. Concentrations of long-lived radionuclides (generally have a half-life of greater than 30 years) exceed limitations for short lived waste.
High level *weapons & power stations*	Contains large concentrations of both short and long-lived radioactive nuclides, and is sufficiently radioactive to require both shielding and cooling. It generates more than two kilowatts per cubic metre of heat.

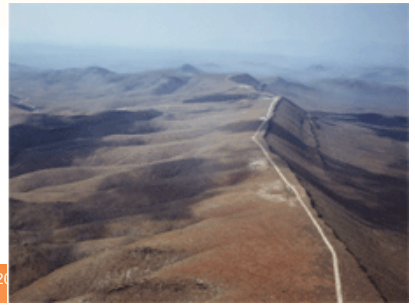
Management of radioactive waste

- Managing the sequence of generation, storage and disposal of radioactive waste
- Generation: what categories are produced?
  - High level waste from weapons programs or nuclear power stations
  - Medium & low level wastes from a range of sites
- Storage (reversible, temporary):
  - To allow "cooling" of waste under controlled conditions perhaps for decades (eg Aust. reactors Moata & HIFAR)
- Disposal (long-term, possibly irreversible):
  - "discarding with no intention of retrieval" (ARPANSA), by one of two methods:
    - Concentrate & retain in repositories
    - Dilute & disperse in the environment (eg depleted uranium in weapons)

High level waste: Yucca Mountain, USA

(www.ocrwm.doe.gov; www.gao.gov/new.items/d06313.pdf)

- At the Nevada Test Site, 100 miles NW of Las Vegas; "a safe repository for 77k tonnes of high level waste"
- The Department of Energy began studying Yucca Mountain in 1978 *(opposed by Nevada state govt)*
- "After more than 20 years of project work, DOE is again faced with substantial quality assurance & other challenges to submit a fully defensible license application to NRC" (GAO, March 2006)
- Now unlikely to open before 2012

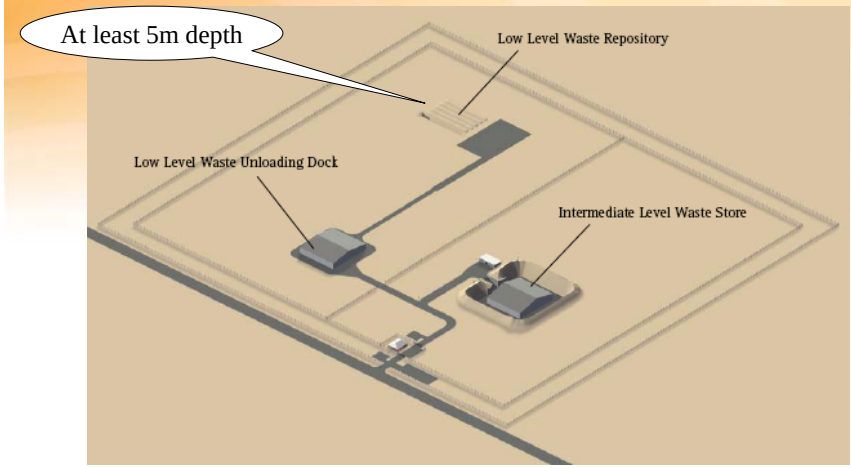


Radioactive waste in Australia

(Australian government, DEST web site, accessed 12/3/06)

- Australia "does not produce high level waste" & has no plans to import it; each jurisdiction is responsible for its own low & intermediate level waste
- 7/04: The Australian government "will construct co-located facilities for low & intermediate level waste":
  - Three NT locations under consideration:
    - Fishers Ridge, DoD property, southeast of RAAF Base Tindal, near Katherine
    - Mt Everard, DoD property, 200km northwest of Alice Springs
    - Harts Range, DoD property, 40km northeast of Alice Springs

Commonwealth RadWaste Management Facility: *Storage & repository design concept* (DEST)



What influence will public input have?

Facility site assessment process (DEST)

How well will this site be managed in the future?

Opportunity for public input

- 2005–06: Site investigations
- Late 2006: Preferred site(s) referred to Minister for the Environment for environmental assesment
- Late 2007: Decision of Minister for the Environment and Heritage
- 2008/09: Assessment of siting licence by ARPANSA[1] Public Works Committee Inquiry
- 2009: Siting works commence[2]
- 2009/10: Assessment of construction licence by ARPANSA
- 2010: Construction commences[2]
- 2011: Assessment of operating licence by ARPANSA
- Late 2011: Operations commence[2]

Senate Committee findings on uranium mining in Australia (ECITARC, 2003)

- That "uranium mining presents unique hazards and risks to both human health and the environment."
- That "a pattern of underperformance and non-compliance can be shown."
- That there were "gaps in knowledge and an absence of reliable data on which to measure the extent of contamination or its impact on the environment."
- That operations of mines "suggests that short-term considerations have been given greater weight than the potential for permanent damage to the environment."
- That "changes in (sic) were necessary in order to protect the environment and its inhabitants from 'serious or irreversible damage' "
- That "the frequency of leaks and spills is evidence that self-regulation by the mining companies has failed to prevent incidents which have the potential to cause significant environmental damage."

The broader question of nuclear energy

- Engineering has military origins:
  - The term Civil Engineering was introduced to identify non-military applications
- Nuclear energy illustrates this dilemma:
  - Developed (& used) as a Weapon of Mass Destruction
  - Then applied for peaceful purposes:
    - Nuclear power, medical & industrial applications
  - With a blurred boundary between the two:
    - Nuclear power stations & fuel reprocessing can produce weapons-grade material
    - Nuclear proliferation is of ongoing concern
  - Radioactive waste is inevitable & has to be managed

The energy conundrum

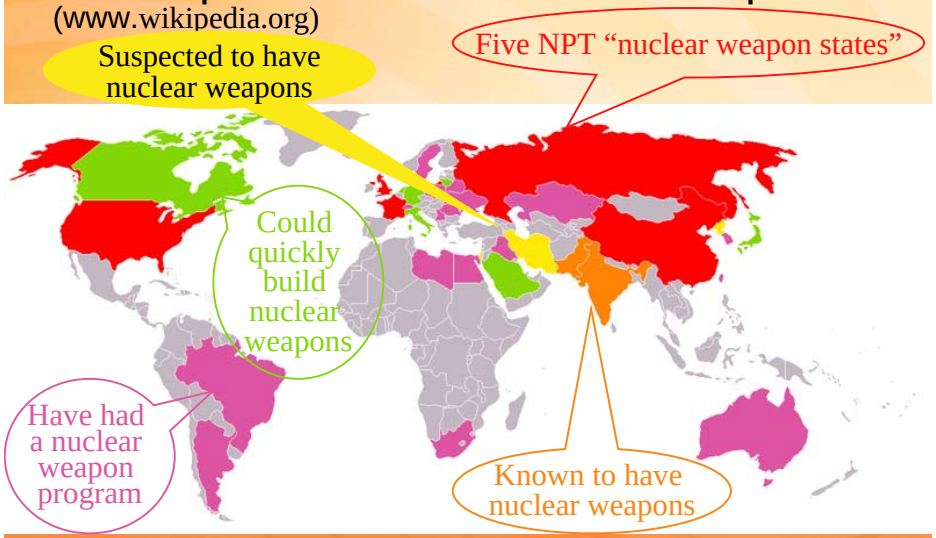
- There are no easy answers:
  - *"There is no energy production or conversion technology without risk or without waste…The use of nuclear power has created a number of concerns, such as the storage or disposal of high-level radioactive waste and the proliferation of nuclear weapons." (IEA, 2005, Energy Indicators for Sustainable Development, p1)*
- Why is nuclear power special?
  - *"Nuclear energy represents a special case in this context in that the scope of an accident could be potentially large…" (IEA, 2005, p38)*
  - *"A leak of highly radioactive nuclear fuel dissolved in concentrated nitric acid, enough to half fill an Olympic-size swimming pool, has forced the closure of Sellafield's Thorp reprocessing plant" (The Guardian, 9/5/05)*
  - *"…nuclear power stations are now a potential target for terrorist attack" (IEEE Power & Energy Magazine, May/June 2005, p 90)*

Opinions on nuclear terrorism & proliferation

- No worries (www.uic.com.au):
  - *"I anticipate that my children's, or perhaps my grandchildren's generation will come to look upon weapons as simply an initial aberration of the nuclear age, rather than a major characteristic of it."*
- Not so sure (web.mit.edu/nuclearpower):
  - *"Fuel cycles that involve the chemical reprocessing of spent fuel to separate weapons-usable plutonium and uranium … are of special concern,especially as nuclear power spreads around the world"*
- No thanks :
  - *"The existing [US] security regulations do not provide adequate protection [of nuclear power stations] against known terrorist threat capabilities."* (www.ucsusa.org)
  - *"…there's an emerging consensus between left and right, between Washington hawks and the peace movement, that the distinction between peaceful and military uses of nuclear energy is an illusion"* (www.abc.net.au/rn/talks/bbing/ Background Briefing, 22/5/05)

Global possession of nuclear weapons

(www.wikipedia.org)



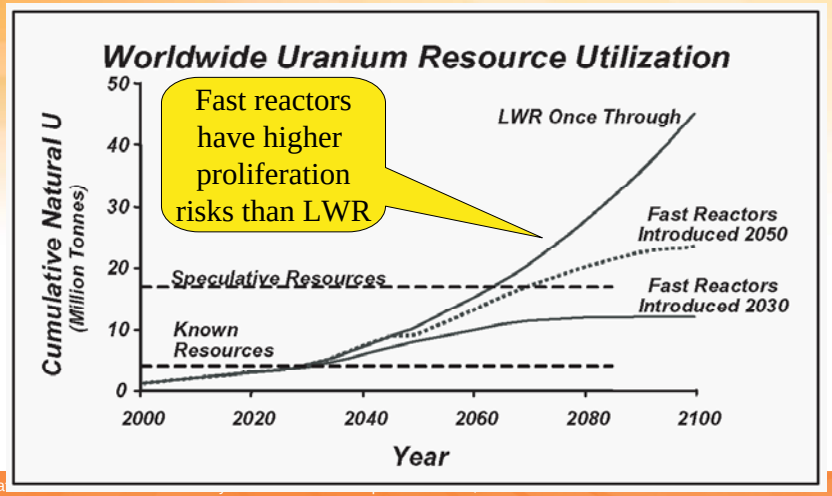
Failed discussions on the nuclear non-proliferation treaty (Reuters, 27/5/05)

- Mohamed ElBaredei, IAEA; 3 reasons for a treaty:
  - *"… the emergence of a nuclear black market, the determined efforts by more countries to acquire technology to produce the fissile material usable in nuclear weapons, and the clear desire of terrorists to acquire weapons of mass destruction"*
- Louis Charbonneau, Reuters reporter:
  - *"The danger of a nuclear holocaust may never have been greater, yet the 188 signatories to the global pact against nuclear weapons have rarely been more divided, arms experts and diplomats said."*
- 2005 Nobel Peace Prize to ElBaredei & IAEA :
  - *"For their efforts to prevent nuclear energy from being used for military purposes"* (nobelprize.org)

Nuclear terrorism
(Canberra Commission Report Part 1, 1997)

- "Using a simple, well-known design to build a weapon from this material [100 pounds of HEU], terrorists could have produced a nuclear blast, equivalent to 10,000 to 20,000 tons of TNT. Under normal conditions, this would devastate a three-square-mile urban area"
- "It is unlikely that terrorist threats involving a nuclear device or material can be eliminated by state-to-state cooperation, even where a terrorist group has the backing of another state. The logic of deterrence fails when one side does not have an easily identifiable or vital asset at which the other can aim."

Projected uranium use assuming nuclear retains market share (US Gen IV Roadmap, 2002)



The nuclear decision requires multi-dimensional societal choice

- MIT 2003 report on nuclear energy:
  - *"Our audience is government,industry,and academic leaders with an interest in the management of* ***the interrelated set of technical, economic, environmental, and political issues that must be addressed*** *if large-scale deployment of new nuclear power generating facilities is to remain an option for providing a significant fraction of electricity supply in the middle of this century."*
- Such decisions require broad societal discussion & informed consent:
  - The expert's role is to advise rather than decide

Some decision-making procedures

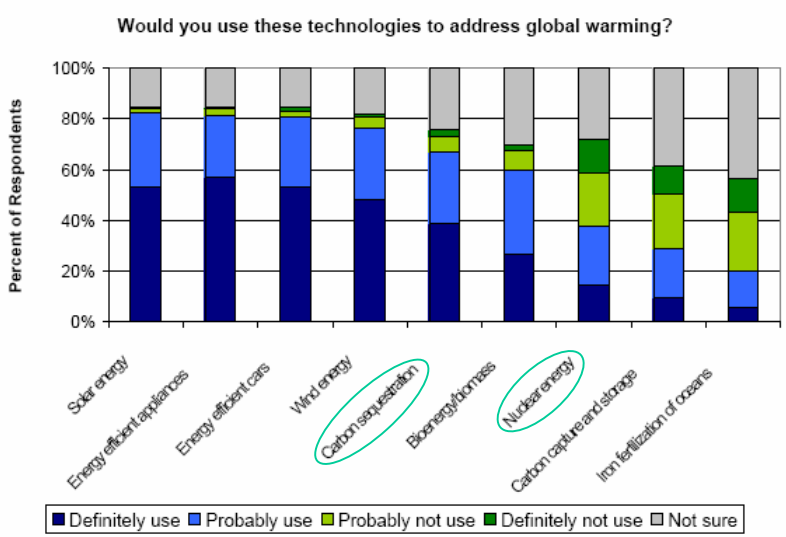
- Judicial:
  - Neutral, balanced, informed (in the ideal case) but forensic & fact-based in style:
    - More applicable to investigating the past than planning the future
- Commercial:
  - Decentralised self-interest subject to externally assigned (legal) accountability
- Political processes:
  - Compromise supported by a sufficient coalition
  - Often based on self-interest (what's in it for me?)
- Might makes right:
  - All too plausible with respect to nuclear energy

What decision-making procedures might be appropriate for nuclear power?

- Political compromise:
  - Too unstable to address long term issues, including nuclear fuel cycle risks & inter-generational impacts
- Commercial:
  - Difficult to achieve adequate accountability (the critical, high-impact risks are usually underwritten by the State)
- Judicial *(probably the best available option):*
  - The nuclear option has many serious caveats (MIT, 2003)
- Might makes right:
  - Totally inappropriate but all too plausible in this context

The public can be skeptical &/or poorly informed

Cambridge/MIT Study of US public views on climate change, 2004



So can governments…

(Australian Govt. 2004)

Table 2: Technology assessments

Market leader	Fast follower	Reserve
Play a leading role in international R&D efforts.	Strongly position Australia to follow international developments quickly.	Position Australia to monitor international developments and follow as needed.
Energy supply technologies		
Advanced brown coal	Advanced black coal	Hydrogen
Geosequestration	Natural gas	Tidal
Hot dry rocks	Wind	Large-scale hydro
Photovoltaics	Biomass	Nuclear
Remote area power systems	Wave	
Coal mining and extraction		
Energy demand technologies		
Solid Oxide Fuel Cells	Intelligent transport systems	Other fuel cells
	Energy efficiency	
	Advanced conventional vehicles	
	Hybrid electric vehicles	

Assessment criteria & process unclear

Comparing electricity generation options

(CO2 Coefficients & Costs: Securing Australia's Energy Future (most); Energy payback: Wind:www.windpower.dk; PV: www.eere.energy.gov)

Type	CO2 g/kWh	Egy Payback (yr)	Cost in 2010 ($/MWh)
Coal SC *(CCS)*	700-1100 *(150-200)*	<1 *(unknown)*	30-40 *(unknown)*
Gas CC *(CCS)*	450-660 *(80-150)*	<1 *(unknown)*	35-45 *(unknown)*
Solar	100-280	2-5	250-400
Wind	6-29	<1	50-80
Nuclear	9-21	<1	n/a (Aust.)
Hydro	3-11	<1	30-70

One possible comparison of energy options

Option	Risk scope	Cost	Social Extern	Enviro Extern	Resource (years)
Frugality & efficiency	Local	Low	Low	Low	Unlim
Renewable energy	Local	High	Low	Low	Unlim
Natural gas & CCS	Global	High	?	?	~100?
Coal & CCS	Global	High	?	?	~200?
Nuclear (LWR)	Global	High	?	?	~100

Conclusions

- Nuclear power is one of a number of imperfect energy options with its own particular concerns:
  - Cost, safety, waste, resource & proliferation
  - *These require very careful consideration of alternatives*
- A basic question asks *how can we do least harm?*
  - *To the global ecosystem including the human population*
  - *Considering risks from the near- to the very long-term*
  - *Assessed judiciously with an informed public debate*
- Given human frailties, risks & constraints, our first response should be frugality & efficient end-use of energy, not any supply-side option

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