LISTED ASSETS

1 July 2005

The Committee Secretary
Inquiry into Developing Australia's Non-Fossil Fuel Energy Industry
House of Representatives Standing Committee on Industry and Resources
Suite R1 – 108,
Parliament House
CANBERRA ACT 2600

Submission to the Inquiry into the Development Of the Non-Fossil Fuel Energy in Australia

Dear The Committee Secretary

AMP Capital Investors Sustainable Funds Team (AMP CI Sustainable Funds) is pleased to provide a submission to the Inquiry into the Development of the Non-Fossil fuel energy in Australia (the "Inquiry").

Important Note: The position and opinions expressed in this submission are those of the Sustainable Fund team, representing investors in the Sustainable Future Funds and are not to be used other than in connection with the Inquiry. They do not necessarily reflect those of the rest of AMP Capital Investors or AMP Ltd or any of their related entities.

The AMP CI Sustainable Funds invests over 800 million in Australian listed assets. As part of the mandate for the Fund, there is an exclusion on investing in companies with material exposure to the uranium/nuclear power industry. A copy of the Sustainable Funds Position Paper on the Uranium and Nuclear Industry entitled "The Nuclear Fuel Cycle Position Paper", which can be found on our website at www.ampcapital.com.au/adviserproducts/sri/papers.asp.

The AMP CI Sustainable Funds submission gives a general view on the potential of the Australian non-fossil fuel Industry and specifically uranium, and focuses on two areas within the specific terms of reference:

- Whole of life cycle waste management assessment of the uranium industry, including radioactive waste management at mine sites n Australia, and nuclear waste management overseas consequent of use of Australian exported uranium; and
- The effectiveness of safeguard regimes in addressing the proliferation of fissile material, the potential diversion of Australian obligated fissile materials and the potential for Australian radioactive materials to be used in "dirty bombs".

In summary, the AMP CI Sustainable Funds believe that:

1. As a prerequisite to the further development of Australia's uranium industry that the long-term disposal of high level radioactive waste be addressed, including the operation of such facilities and the development of other facilities for the increase in nuclear waste as a result of the expansion of nuclear energy. Currently, this will postpone the further development until at least 2020.
2. To adequately address potential security issues and not be complicit in proliferation or tensions associated with varying standards with regard to the use of fuel reprocessing, Australia will need to work to strengthen the Non-proliferation treaty (NPT) and strengthen Australia's bilateral safeguards to exclude Australian uranium being sent to countries that reprocess uranium and/or act in a manner inconsistently with the implicit and explicit aims of non-proliferation and reduction of all forms of nuclear weapons. This will require a significant review and strengthening of the NPT, the AONM safeguards and recommitment to various Test Ban and nuclear disarmament treaties by the respective parties.

PO Box R227, Royal Exchange, Sydney NSW 1225
50 Bridge Street, Sydney NSW 2000, Australia
T +61 2 9257 5000 F +61 2 9257 1234
www.ampcapital.com.au
AMP Capital Investors Limited
ABN 59 001 777 591 AFSL 232497

3. The safe operation of all steps along the uranium nuclear power value chain remain an issue, as evidenced by the nature and number of the accidents and incidents at mines, power stations and reprocessing facilities. Human factors or errors have been key underlying cause of these accidents or incidents. Therefore, as a pre-requisite for the further development of the Australia's uranium resource, it will be essential that Improvements in employee training, maintenance and record keeping of all parts of the nuclear value chain, the independent verification of these systems and improved regulatory control are comprehensively addressed, well beyond that which is required by existing safeguards, across the whole life cycle of the Australian uranium, especially if further markets for Australian uranium are to be developed; and
4. Given the high cost of nuclear power generation and the high cost of carbon required to make it competitive, there would appear to be significant potential for the development of other cost comparable non-fossil fuel generation, both here in Australia and overseas. These alternatives do not have the inherent risks identified in the 3 points raised above.

Further discussion on the Terms of Reference and other issues identified is given in the Annexure attached.

Again, thank you for the opportunity to make a submission to the inquiry and if you would like clarification on the issues raised, please do not hesitate to contact me on the number given below.

Yours sincerely

L. T. Wood

Dr Ian Woods
Senior Research Analyst,
Sustainable Funds Team
T (02) 9257 1343
F (02) 9257 1399
E ian.woods@ampcapital.com

Declaration of Interest:
As at the 1st July, 2005 AMP CI Sustainable Future Fund has an investment in BHP-Billiton. BHP-Billiton recently had a takeover of WMC Resources Limited, the owner and operator of the Olympic Dam Uranium and Copper Mine.

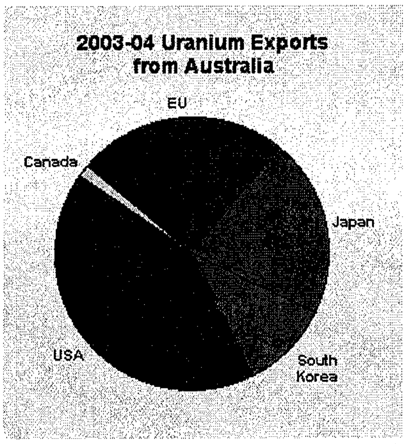
Annexure A

1. Whole of life cycle waste management assessment of the uranium industry, including radioactive waste management at mine sites n Australia, and nuclear waste management overseas consequent of use of Australian exported uranium

Current State of High-level Radioactive Waste Disposal from Australian Uranium

Long-term management of radioactive waste from the uranium/nuclear fuel life cycle is a major unresolved challenge facing the industry, including waste generated from the use of Australian sourced uranium.

The current destination of Australian uranium is given in the following figure.



Source, Uranium Information Centre , UIC Nuclear Issues Briefing Paper 1, 8th June, 2005, http://www.uic.com.au/nip01.htm,

Even though the first civilian nuclear reactor came into operation in the 1950's, none of these countries have yet to successfully develop a disposal facility for the long-term storage of high-level radioactive waste.

The table below summarises the initiatives proposed, or currently underway, to address this significant shortcoming, as reported in a 2003 MIT report[1].

Table A-7.A.1 High-level Waste Disposal Plans of Leading Nuclear Countries

COUNTRY	MANAGEMENT RESPONSIBILITY	PREFERRED/ SELECTED GEOLOGIC MEDIUM	EARLIEST ANTICIPATED REPOSITORY OPENING DATE	STATUS
United States	DOE	Volcanic tuff	2010	Site selected (Yucca Mountain, NV); application for construction license
Finland	Power companies (Posiva Oy)	Crystalline bedrock	2020	Site selected (Olkiluoto, SW Finland) — decision ratified by Parliament in May 2001
Sweden	Power companies (SKB)	Crystalline rock	2020	Searching for a suitable site
Switzerland	Power company coop (Nagra)	Crystalline rock or clay	2020 or later	Searching for a suitable site
France	Ind. Pub. Auth. (ANDRA)	Granite or clay	2020 or later	Developing repository concept
Canada	Crown Corp. (AECL)	Granite	2025 or later	Reviewing repository concept
Japan	National agency (NUMO)	Not selected	2030	Searching for suitable site
United Kingdom	Under review	Not selected	After 2040	Delaying decision until 2040
Germany	Federal contractor company (DBE)	Salt	No date specified	Moratorium on repository development for 3–10 years

Since the publication of this report, the proposed US facility in the Yucca Mountains, Nevada has been delayed and is unlikely to be ready until at least 2020. This will mean that for over 70 years, at the very least, the nuclear power industry has and will not have addressed its major life cycle waste issues. There

[1] pg158, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003

are also questions about the capacity of the proposed disposal facilities. For example, the proposed Yucca Mountain disposal facility in Nevada, has a proposed capacity of 77,000 tonnes. Currently, there is 44,000 tonnes of high level waste from nuclear power plants and 12,000 tonnes from military use are awaiting disposal[2], leaving capacity of only 21,000 tonnes, or less than half the current waste from nuclear power reactors, available for additional disposal.

This also means that all of the Australian uranium mined to date, which has ended up as high level radioactive waste, has yet to find an acceptable long-term disposal solution. Furthermore, it is unlikely that a satisfactory solution will be found until 2020, or in the case of the UK, not until 2040.

Potential Spent-Fuel Management Options

Different approaches have been used to manage used fuel rods around the world.

Up until recently, the US, due to concern of nuclear weapon proliferation, used an open, or once through, nuclear Fuel Cycle. In this case, the spent UOX fuel is treated as waste as required disposal.

Currently, Europe and Japan have focussed on reprocessing spent fuel, initially as part of managing fuel costs. Spent fuel reprocessing, where a mixed oxide fuel (MOX) is produced that is recycled back to a nuclear reactor, is also argued by some as a means to decrease the amount of high-level radioactive waste requiring disposal.

An analysis by MIT[3] concluded that: reprocessing (or once through thermal recycling as the MIT report describes it) has "an advantage in producing less material requiring permanent waste disposal, but this is balanced by greater transuranic (TRU) waste[4] produced during reprocessing. Furthermore, the fission product inventory is essentially the same. Most important, the thermal recycle case has a large amount of plutonium (Pu) separated each year."

In addition, the MIT study concluded that the reprocessing of fuel was uneconomic and also raised questions about the potential for nuclear proliferation and safety concerns with respect to reprocessing facilities.

Specific, Fast Reactors, ie those specifically designed to operate on a MOX fuel, have been proposed as a way to "burn" the most dangerous radioactive decay products (e.g plutonium), thereby closing the waste loop and significantly decreasing the amount and high-level radioactive waste generated. From an Australian uranium mining perspective, the use of such a waste disposal approach would lead to a 40% decrease in the quantity of uranium demanded. It would also require significant changes to the management of the chain of custody of uranium and nuclear fuel.

However, significant questions remain about the safety of reprocessing facilities and potential for nuclear proliferation. Therefore, the reprocessing of spent fuel would not appear to provide a solution to the disposal of the high level radioactive waste problem.

Future High-level Radioactive Generation Rates

The MIT Study estimated that the quantity of high-level nuclear waste generated per year if there was 1500 GWe of nuclear capacity. 1500 GWe, or 1500 1000MWe power stations, represents approximately a four-fold increase in world-wide nuclear generating capacity and where, in 2050, nuclear generation would produce of the order of 25% of the world's electricity.

The estimated quantity of high-level radioactive waste is of the order of 29,000 tonnes/yr, assuming conventional nuclear reactor technology is used. This would require a new disposal facility equivalent to the proposed Yucca Mountain every 2.5 years.

The cumulative quantity of high level nuclear waste requiring disposal by 2050 under this scenario would be 922,000 tonnes, or equivalent to 13.2 Yucca Mountain facilities. Advances in reactor may decrease the

---

[2] Source: News articles from www.msnbc.com/news: 'Life in a reactor's shadow' and 'Nuclear Waste: No way out?'

[3] pg 32-33, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003

4 TRU waste — non-high-level waste contaminated with significant quantities of long-lived transuranic radionuclides — which because of its longevity will likely be disposed of in the same facilities as high-level waste.

amount of high-level waste, but the quantity generated is still significant, 14,000 tonnes for 1500 GWe generation capacity or a new Yucca Mountain facility required every 5 years.

Looking forward, the main potential for growth in nuclear power, and Australian uranium resource, is in China, India and other Asian countries. Developing countries, ie India, China and Pakistan are predicted to represent at least a third of the growth in nuclear generation. With the exception of Japan, which currently focuses on reprocessing, none of these growth markets have plans for facilities to dispose of high-level radioactive wastes. This raises significant questions about the responsible long-term management of nuclear waste that may be generated from uranium mined in Australia.

Other Waste Issues

There are a number of waste management issues that need to be resolved. Identifying locations for even storage for low and medium level nuclear waste is problematic, as evidenced by Australia's inability to find an acceptable solution for the relatively small amount of low-medium level waste.

In summary, as a responsible nation, it is difficult to see how Australia can encourage the further growth of an industry while the significant current waste liability remains unresolved and the expansion of the industry would create even greater challenges to be resolved.

6. The effectiveness of safeguard regimes on addressing the proliferation of fissile material, the potential diversion of Australian obligated fissile materials and the potential for Australian radioactive material to be used in "dirty bombs"

In 2004, Australia was the second largest producer of uranium, producing 25% of the world's uranium. Australia also has the largest economic, or 43%, of the world's uranium resources[5]. Therefore, Australia has a major responsibility for the use, and potential misuse, of Australia's and the world's uranium and nuclear resources.

The current safeguards with respect to the control the use of fissile material have been relatively effective to date, in part due to the limited expansion of nuclear energy and previous commitments on nuclear states to disarm. Additional Australian safeguards, through Australian Obligated Nuclear Material safeguards, have provided an additional level of security to Australians that uranium from Australian mines has been used only for peaceful nuclear energy purposes.

However, both the international treaties and additional Australian safeguards, are and will continue to be under significant stress.

The current issues surrounding Iran reflect one aspect of the challenges facing the IAEA safeguards and non-proliferation of nuclear weapons. The current Non-Proliferation Treaty (NPT) encourages the use of nuclear energy, in part, to stop countries developing nuclear weapons. The reprocessing of spent–fuel and the subsequent production of material for use in nuclear weapons are significant issues facing the NPT.

Widespread use of spent-fuel reprocessing will add significantly to the inventory of separated plutonium. The above mentioned MIT study estimated that if 1500 GWe of thermal recycling generation would produce a separated plutonium inventory of "167 metric tons. A nuclear weapon of significant yield can comfortably be made with less than 10kg of Pu, so this amount represents the potential for thousands of nuclear weapons."[6]

Therefore, there is an inherent tension between encouraging countries to develop nuclear energy and yet limiting the use of fuel reprocessing, due to concerns over proliferation, especially given that some countries, with nuclear weapons, reprocess spent-fuel. As concluded by the MIT study,

---

5 Source "Developing the World's Biggest Uranium Resource", WMC Resources Limited presentation dated 20th April, 2005, sourced www.wmc.com.au, 9th June, 2005

6 pg 33, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003

"The current international safeguards regime is inadequate to meet the security challenges of the expanded nuclear deployment contemplated in the global growth scenario. The reprocessing system now used in Europe, Japan and Russia that involves separation and recycling of plutonium represents unwarranted proliferation risks"[7]

The second aspect of NPT is the obligation (implied or explicit) of current nuclear powers to disarm and not expanding their nuclear arsenal. The actions, or proposed actions, of some countries that are current signatories, contrary to this obligation raises additional questions about the effectiveness of the NPT.

A further challenge when considering the issue of proliferation and security is the time frames that need to be considered. Given the long-term nature of radioactive waste, appropriate safeguards and security need to be effective not only in the current political environment but also for any changes that may occur in the future. As a result, any long-term waste disposal facilities need to provide security and environmental safeguards. Given the political changes that have occurred around the world, for example in Europe in only the last 15 years, this will be a significant challenge and one that will be magnified with the wider use of nuclear energy.

Therefore, to adequately address potential security issues and not be complicit in proliferation or tensions associated with varying standards with regard to the use of fuel reprocessing, Australia, prior to further developing Australia's uranium industry, will need to ensure the NPT and nuclear disarmament treaties or commitments are strengthened and strengthen Australia's bilateral safeguards to exclude providing Australian uranium to countries that reprocess uranium and/or act in a manner inconsistently with the implicit and explicit aims of non-proliferation and reduction of all forms of nuclear weapons.

Other Issues

Safety of Nuclear Fuel Cycle

An additional life cycle issue associated with the further development and use of Australia's uranium is public safety.

The modern engineering design of nuclear reactors are designed to represent a very low risk to the public and therefore to date there has only been one major nuclear accident that led to death of the public. While the safety record is encouraging, it is to be expected and doesn't necessarily provide evidence that nuclear power is "safe". For example, if nuclear reactors are designed to have an offsite fatality frequency of less than 1 every 10 million years, the calculated probability that there has been any accident leading to an offsite fatality from any of the commercial reactor, with a total of 11,000 reactor operating years, is approximately 0.11%.

On the contrary, the number and nature of the incidents that have occurred, such as, the Davis-Besse reactor vessel near miss incident in 2002[8], the Three Mile Island incident in 1979, numerous accidents at reprocessing plants in Japan and the UK, including the recent closure of the Thorp reprocessing plant at Sellafield due a radioactive leak, the admitted falsification of reprocessing records by BNFL[9] and the problems of accounting for plutonium at Sellafield[10], reflect some significant issues and highlight that good engineering design is not sufficient to ensure appropriate control of nuclear facilities and that human factors and errors are key underlying causes of accidents and incidents. Improvements in employee training, maintenance and record keeping of all parts of the nuclear value chain, the independent verification of these systems and improved regulatory control, are all required to a level well beyond that which is required by existing safeguards.

---

7 page ix, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003

8 pg 47, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003

9 "Fatal accidents damage Japan's nuclear dream", The Observer, August 22, 2004

10 "Missing" plutonium is just clerical error, says Sellafield" The Guardian, 18th February, 2005

As a pre-requisite for the further development of the Australia's uranium resource, it will be essential that these issues are comprehensively addressed across the whole life cycle of the Australian uranium, especially if further markets for Australian uranium are to be developed.

Greenhouse Gas Emissions

The primary benefit in further developing Australia's uranium resources is the potential for the low greenhouse gas emitting generation of electricity, thereby contributing a solution to the climate change problem.

Within the context of the broader role of the Inquiry, it is worth considering the overall cost of electricity generation and greenhouse gas abatement.

Estimates of the cost of nuclear power generation from new plants would vary between US$60[11]-70[12]/MW-hr. This is based on the current US waste management levy of US$1/MW-hr. This does not cover the economic costs of the proposed Yucca Mountain facility and therefore the real costs will be higher than this, with the exact quantum depending on the final cost of waste disposal.

The MIT study estimated that the cost of carbon needed to increase the cost of traditional US coal fired power stations would need to be of the order of US$27/tonne CO2-e (US$100/tonne C), before nuclear generation was of a comparable price. For nuclear power to be a comparable price with advanced gas power generation the capital costs for nuclear generation would need to decrease by 25% and the cost of carbon is US$27/tonne CO2-e.

Based on the nuclear power generation costs given above, nuclear power in Australia would be 2.2-2,5 times the cost of conventional coal-fired power generation and 1.7-2.0 times more expensive than combined cycle gas turbine (CCGT) generation.

The cost of carbon required to make nuclear energy cost comparable with conventional fossil-fuel generation is:

- Brown coal generation – US$30-40/tonne CO2-e
- Black coal generation – US$37-48/tonne CO2-e
- CCGT generation – US$58-80/tonne CO2-e

Given the high cost of nuclear power generation and the high cost of carbon required to make it competitive with traditional low emission generation technology, e.g. CCGT, there would appear to be significant potential for the development of other cost comparable non-fossil fuel generation, both here in Australia and overseas. In addition, these solutions would not have the issues of high-level radioactive waste disposal, security concerns or nuclear weapon proliferation.

---

11 Source , The Old Reliables – Coal, Nuclear and Gas in 2003", Industrial Focus, Global Equity research, Deutsche Bank, 2003

12 Chapter 5, Nuclear Power Economics, The Future of Nuclear Power: An Interdisciplinary MIT Study; MIT, 2003