



COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

**HOUSE OF
REPRESENTATIVES**

STANDING COMMITTEE ON INDUSTRY AND RESOURCES

Reference: Developing Australia's non-fossil fuel energy industry

FRIDAY, 19 AUGUST 2005

MELBOURNE

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HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON INDUSTRY AND RESOURCES

Friday, 19 August 2005

Members: Mr Prosser (*Chair*), Mr Hatton (*Deputy Chair*), Mr Adams, Mrs Bronwyn Bishop, Mr Cadman, Mr Martin Ferguson, Mr Haase, Mr Katter, Miss Jackie Kelly and Mr Tollner

Members in attendance: Mr Adams, Mr Martin Ferguson, Mr Hatton and Mr Prosser

Terms of reference for the inquiry:

To inquire into and report on the development of the non-fossil fuel energy industry in Australia.

The Committee shall commence its inquiry with a case study into the strategic importance of Australia's uranium resources. The case study shall have particular regard to the:

- a) global demand for Australia's uranium resources and associated supply issues;
- b) strategic importance of Australia's uranium resources and any relevant industry developments;
- c) potential implications for global greenhouse gas emission reductions from the further development and export of Australia's uranium resources; and
- d) current structure and regulatory environment of the uranium mining sector (noting the work that has been undertaken by other inquiries and reviews on these issues).

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Committee met at 9.02 am**HILL, Dr Roderick Jeffrey, Group Executive, Information, Manufacturing and Minerals, Commonwealth Scientific and Industrial Research Organisation**

CHAIR (Mr Prosser)—I am pleased to declare open the second public hearing by the House of Representatives Standing Committee on Industry and Resources of its inquiry into the development of the non-fossil fuel and energy industry in Australia. The committee has commenced its inquiry with a case study into the strategic importance of Australia's uranium resources. The inquiry was referred to the committee by the Minister for Industry, Tourism and Resources, the Hon. Ian Macfarlane, on 15 March 2005.

I welcome Dr Hill. Thank you for agreeing to appear to give evidence at the public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament and I remind you that giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in private and the committee will then consider your request. I invite you to make a short opening statement before we go to questions.

Dr Hill—Thank you, Mr Chairman. I will comment on some particular extracts from the report I have given which should not take too long. The submission from CSIRO outlines the strategic importance of Australia's uranium resources and suggests strengths and weaknesses in the resource base and Australia's supporting research capability that could be applied for further development of these resources and the capture of further value from them. In particular, I draw the committee's attention to the fact that, based on 2002 rates of utilisation in the market context at that time, there was nearly 300 years of supply of uranium available in current reserves—proven reserves—but given recent trends in the energy market and in particular the significant rise in demand from China, it is unlikely that those rates of utilisation will remain unchanged. Indeed, there is a need to discover new resources of high-quality uranium reserves in Australia in order to meet this anticipated, significantly increased demand.

At the moment I am sure you are aware that the export of around 10,000 tonnes of uranium oxide comprises 42 per cent of the country's energy exports, although in tonnage terms it is dwarfed by our coal exports. We in CSIRO believe that the anticipated development of additional efficiency in the industry can come from four specific areas of the uranium value chain, in particular exploration—supporting the discovery of new resources; extraction—supporting the extraction of uranium from the ground; adding value—supporting the processing of uranium into a usable commodity; and contributing to the lifetime stewardship of the management of the uranium value chain, including waste, in terms of safe storage, reprocessing and/or recycling.

In this context you will note that the report from CSIRO makes reference to the research base in Australia, in particular that vested in ANSTO and CSIRO and the contributions those organisations may make in collaboration with other university partners to the value adding in those four areas I talked about. Indeed, in exploration and uranium mining, methods are changing and evolving on the basis of experience here and in Canada. There is an increasing

move towards low-impact, in situ leaching methods for uranium extraction that avoids the need for significant uranium mine tailings production.

In the adding value area, Australia currently undertakes no form of uranium processing or enrichment. If Australia wishes to extend its technological operations significantly along the uranium fuel value chain, there are indeed the necessary research skills to do so within the national innovation system of this country. In terms of sustainability, the inevitable discussion around the uranium industry leads towards the consideration of how radioactive wastes are managed and how nuclear assets are to be secured. I note, for the committee's attention, that Australia is currently developing and marshalling a number of resources and a strong capability in counter-terrorism initiatives, many of which might be suitable for application in protecting those strategic resources in uranium.

The other major issue that is inevitably linked to production and exploitation of uranium is the disposal of the wastes. Regulating waste disposal, as I am sure the committee is aware, requires an operator to meet safety criteria for very long time scales into the future. Coordination of existing skills around Australia would be necessary to establish a critical mass in support of the industry. At the moment it is quite fragmented. Indeed, no university in Australia has a school of nuclear science and engineering. There would need to be a significant enhancement of those capabilities into the future if we did desire to increase our involvement in the value chain.

The question has arisen in the terms of reference of whether production of a unit of uranium provides lower greenhouse gas emissions than a unit of fossil fuel. The CSIRO's report does indicate, as other reports do, that it is possible to save 10 times the annual carbon dioxide emissions that Australia produces in total from its coal fired power stations by avoiding the conversion to coal of the energy content of current uranium utilisation around the world.

Finally, I emphasise the part in the concluding section of CSIRO's submission relating to the energy transformed flagship activity in our organisation, in particular the energy futures component of that flagship which seeks to tap into the thinking of a broad range of stakeholders in the energy market, society and industry, and in particular the energy producers in the form of coal fired power generators, in the form of the public and in terms of the World Wildlife Fund—a whole range of 22 stakeholders—to determine a set of viable scenarios for the energy mix of this country out 20 or 30 years. Nuclear energy is an integral part of that scenario planning exercise. We expect to have some preliminary results out in the next 12 to 18 months that will inform policy, we hope, in this domain. With that I conclude my opening remarks, Mr Chair.

CHAIR—Thank you for that. I noticed you touched on the enrichment cycle. What are the potential benefits of Australia playing a greater role in the fuel cycle by the establishment of other fuel cycle industries such as in the enrichment of uranium? Would there be commercial interest in the activities from existing Australian uranium producers and utilities? How do you think this might be progressed?

Dr Hill—I think it is most desirable. The main barrier to that occurring is on two fronts. One of them is the lack of an integrated nuclear science and technology group of researchers in this country. It is very fragmented amongst CSIRO and ANSTO and, as I mentioned before, there are none resident in universities at the moment. The other impediment, of course, is public perception of the acceptability of us playing a role that is any more than digging out and

beneficiation and then export of the resources. I think that any company with an interest in this area would need to resolve those two issues—and they are very significant issues—before they would contemplate moving into value adding with processing and whatever.

CHAIR—I noticed you touched on this, but in one of the previous submissions that the committee has received an organisation submitted:

4.8.5 Global emissions from the burning of fossil fuels (coal, oil and natural gas) contribute some 9,000 million tonnes (Mt) of carbon dioxide into the atmosphere each year.

It argued:

Nuclear has no emissions of carbon dioxide ... releases less carbon dioxide to the atmosphere than coal, oil, natural gas and renewables on a life cycle basis.

And further said:

... the use of nuclear energy already avoids the release of some 600 million tonnes of carbon emissions or 2.2 billion tonnes of carbon dioxide annually.

Would you care to comment on that statement?

Dr Hill—From a strictly scientific point of view, of course, nothing emits no CO₂ because the cement, for example, used in the production—

CHAIR—I noted that point in your submission.

Dr Hill—Even hydroelectricity does not produce no CO₂ because you require the making of cement to build the walls; you have to cut down trees and they are prevented from growing and producing a sink for CO₂ et cetera. It is not true that nothing produces it. When one takes the full system into account there are some emissions and it is our understanding that would be about 40 kilograms of CO₂ per megawatt hour. It is very low by coal standards, of course; nevertheless it is not zero. Various calculations can then be made: if you say that is the emission of CO₂ from a kilowatt hour, one can go through the arithmetic, if that is the emissions from a kilogram per megawatt hour of nuclear energy, and then compare that to the variously accepted figures. There will be some rubberiness about these figures, but it is somewhere around maybe 800 kilograms of CO₂ equivalent per kilowatt hour of coal. There is various arithmetic. It does lead to a rough calculation that, if one avoided the conversion of all of the current production of electricity from nuclear energy being converted around the world, it would save 10 times Australia's total CO₂ emissions per year. I have done the back-of-the-envelope calculation myself and that appears to be about right. There is a bit of rubberiness, but the order of magnitude is right.

Mr HATTON—Following on from your answer to the chair, Dr Hill, the submission states that rough equivalence, or the ratio of 40 to 760. Looking at that, does the full fuel cycle basis include the carbon dioxide emitted in the mining enrichment plant construction and decommissioning phases, so that we are comparing apples with apples?

Dr Hill—My understanding is that it does. That is why it is not zero. If you start with a constructed plant, you might have a small amount for the fuel burnt in the trucks bringing the fuel to and from the facility and the staff going backwards and forwards, and the use of electricity from the grid or whatever it is, and other aspects of the running of the facility which would produce a small amount. My understanding is that that 40 kilograms represents the construction of the plant. There may be other additions in relation to the extent to which the decommissioning is a problem for a plant at the end of its life. One might expect that that would also contribute some. But you are not burning carbon, so there will be a substantial save, whatever that is.

Mr HATTON—Before I go to broader questions of fossil fuel alternatives, I want to stay with the comparison between uranium and carbon. In terms of Australia's efforts so far in trying to get cleaner coal—the work that CSIRO has done and other work also—how far advanced is that? What are the prospects for it? If Australia could produce a cleaner coal, how much would that contribute towards a lowering of greenhouse emissions?

Dr Hill—There are significant opportunities available to lower the greenhouse signature of current coal fired electricity power stations. We currently operate mostly on pulverised fuel, coal burning, and that is running at anywhere between 40 and 45 per cent efficiency. Using a supercritical and ultrasupercritical boiler, which means operating at higher temperatures, can increase that efficiency, we think, to close to 50 per cent. Then if you go to the new paradigm of coal utilisation for energy production—namely, coal gasification with combined cycle—the expectation is that the efficiencies could be of the order of 55 per cent or perhaps slightly higher.

There are also significant technologies that are being improved to dewater brown coal, which is the big problem with brown coal in the Latrobe Valley. Black coal is inherently more efficient because its water content is much lower. Australia has a number of research activities in place. What is called traditionally clean coal production is a very sophisticated washing process for removal of the ash. It allows very fine particles of coal, without the abrasive activities and inefficiencies of impurities in it, to be used in combustion. Those efficiencies can be in the order of those involved in gas turbines.

Coal gasification, as I said before, opens up a new paradigm. There are some plants operating on a semicommercial scale in the United States but the technology has not been proved on a broad scale yet. One of the major research efforts in CSIRO's energy transformer flagship is directed towards that new paradigm. That would open up opportunities for the hydrogen economy and also the production of by-product chemicals from the coals. You can use the hydrogen then directly to burn to produce electricity, or you can use it to produce chemicals. You can also use it to burn the hydrogen itself in a fuel cell to produce electricity. There are a number of opportunities available and Australia is at the forefront of that technology development to make its coal utilisation more efficient.

Mr HATTON—The past and future will be as diverse as they have been in the past. There has been some recent work done by CSIRO, I understand, to look at using hydrogen; not in a fuel cell sense, but combining hydrogen with diesel and other fuels to allow a much higher burn. This works only in its very early stages but the indications are that, properly used, diesel and other current fuels could be made much safer in terms of emissions. Are you aware of that work?

Dr Hill—I am not aware of the improvement in diesel, but I am aware of what is called solar enhancement of natural gas, where solar reforming is done by using solar energy and a shift reaction that produces a hydrogen content for enrichment of the energy content of natural gas. I am aware of that work but not the diesel work. The savings in coal gasification and combined cycle are inherently dependent upon a solution to the geosequestration point: you still burn coal at the end of the day, but the combined cycle coal gasification route allows you the opportunity to separate out the carbon dioxide and to sequester it in a way that is not as easily done with the existing infrastructure.

Mr HATTON—If you did a quick analysis of the current state of the development of non-fossil fuel alternatives and uranium in terms of dealing with our greenhouse emissions, how would you see the current state of play?

Dr Hill—There is no silver bullet to this issue. There will always be a place for the non-fossil fuels, including nuclear, in the traditional renewables area. The question is can renewable technology keep pace with the increasing need for energy? At the moment it does not appear that the technology is advancing at a rate and at a scale that allows it to replace existing fossil fuel and nuclear fuel based energy production. However, there is a huge amount of work going on and we are forever hopeful. The scenario planning that CSIRO has done so far projects out 50 years or so, and that has fossil fuel based sources of energy still in the mix at that point. At the end of the day, the models must take into account the economic situation as well as the demand situation. It projects increases in electricity production requirements of the order of two per cent growth a year, and we just cannot keep pace with that with any silver bullet technology that might come in.

Mr ADAMS—Two per cent?

Dr Hill—That is the Australian figure. Again, like all of these things, it varies. Some people will say 1.5 per cent, some will say 2.2 per cent et cetera.

Mr ADAMS—I think you answered this, Dr Hill, but in the submission it says the development of a hydrogen economy could in part be aided by nuclear power generation. Is that what you mean by the cleaning of coal process?

Dr Hill—No. The reference to hydrogen in the submission is the fact that large-scale nuclear energy production allows you an easy route to electrolysis of water to produce oxygen and hydrogen, without producing greenhouse gas emissions in any significant way and without the need, as you do in the similar production of hydrogen from coal, to sequester the CO₂.

Mr ADAMS—This process allows you to do that?

Dr Hill—Yes.

Mr ADAMS—In relation to alternative power sources, we do not really have anything at the moment that does anything approaching coal on what we call base load, do we? We do not have something like a base load power station. There is no alternative to those, is there?

Dr Hill—There are two ways of handling base load power supply. With the variable renewables, like wind and solar, there is a lot of effort going into energy storage devices. If one can store the energy at times of high insolation or high wind, of course you can then use that to provide a continuous power supply. In terms of the inherent base load, the only emerging technology of which I am aware is geothermal, which is available 24 hours a day with the right technology. That, at the right scale, gives some promise of providing some degree of base load power supply in the future. I refer in particular there to the South Australian initiatives around Moomba et cetera with Geodynamics and other companies.

Mr ADAMS—I have had a briefing on that. Also in your submission you say:

Future discoveries of uranium will require more sophisticated geochemical and geophysical technologies.

Could you explain that to us?

Dr Hill—Australia, with its natural mineral resources, is in the unique position in the globe of having had its major surface exposed and what are called ‘elephant deposits’—like Olympic Dam, Broken Hill and Century—discovered.

Mr ADAMS—Big ones.

Dr Hill—Yes. With the exception of Olympic Dam, they were all exposed at the surface. Seventy per cent of the Australian continent is covered by what is called regolith dirt, and that is often 300, 400, 500 metres deep. The obvious deposits—mineral deposits, by and large—are known now of the exposed variety, but that still leaves two-thirds of the continent where those deposits which we expect to be there in equal abundance per square unit area undiscovered. So we require new technologies for the discovery of the next generation deposits by enabling that top cover to be transparent to those technologies.

Mr ADAMS—Some of the work that is being done by Geo Australia now is in relation to some of the new methods of exploration?

Dr Hill—Absolutely, yes. CRCs, CSIRO and Geoscience Australia are all involved in that.

Mr ADAMS—What you are saying is that they will be found deeper.

Dr Hill—Yes.

Mr MARTIN FERGUSON—In terms of waste disposal, has CSIRO made any assessment of synroc, as developed by the Atomic Energy Commission?

Dr Hill—We have not made an assessment of synroc, but many people in CSIRO are aware of it. In fact, I have published a paper myself on the inclusion of particular radionuclides in zirconolite, one of the three phases that are inherent to the synroc process. No, we have not made an assessment.

Mr MARTIN FERGUSON—In terms of low-level waste—for example, that coming out of a hospital—there is some opposition to movement through suburbs. How would you compare the radioactive nature of that with an amount of yellowcake?

Dr Hill—I would have to bow to ignorance on that, I am afraid. I am not a nuclear scientist, so I cannot comment on that.

CHAIR—Dr Hill, I want to further look at the matter you raised in regard to the splitting of water on page 6 of your submission. You talk about hydrogen and oxygen. Is there an opportunity with the different technologies now, with the new generation nuclear reactors? In particular, given that a number of states in Australia are talking about desalinisation plants, is there an opportunity for not only power generation but the desalinisation of water with different types of nuclear reactors now?

Dr Hill—I am not quite sure I understand the question but, by way of comment, it has been said, ‘Wouldn’t it be lovely if we had a source of nuclear fusion which allowed us to desalinate water and distribute it over the land?’ Lo and behold, we have that! It is called rain. Back to the point, nuclear energy provides a way, without producing significant greenhouse gas emissions, of producing electricity that will enable the desalinisation of water. Whether different types of nuclear reactors have different efficacies in that regard, I do not know.

CHAIR—I was talking about the pebble bed technology that is now being designed.

Dr Hill—That, I understand, is making greater inroads technologywise in South Africa and it shows great promise. I am not sure that I am really catching your question. I do not believe there will be anything particularly unique about the pebble bed reactor that makes it more useful for desalinisation than a conventional reactor. It is just that it is a more efficient reactor. It is one of the next generation of nuclear reactors that may well be safer and easier to manage than conventional reactors.

Mr ADAMS—In relation to a skills shortage and having the skills in the future for nuclear energy in Australia, do you know the average age of people in the area of nuclear engineering and science? Is there an average age known of people?

Dr Hill—I am sure there is, but I am not aware of it.

Mr HATTON—Dr Hill, we have a number of other submissions, of course, with very varied points of view. Some of those submissions argue that we should not be looking at uranium at all because, in and of its nature, civil power generation is directly linked to being able to produce nuclear weapons and so on. In terms of your knowledge, if you have it, in relation to civil power programs, is it a reasonable assumption to argue that there is an absolute direct link between the two and that civil power generation can easily be turned into producing weapons-grade plutonium and uranium?

Dr Hill—I have to preface my comment by saying that I am not an expert in the field, so I am not able to comment in that capacity. However, it is my understanding that the link is not as obvious as some would make it and that there are inherent differences in the fuel cycle and the

fuel enrichment processes for civil power production that are inherently different from those required for military operations.

Mr HATTON—In terms of CSIRO's general approach in terms of nuclear power to produce electricity, do you think there is anything inherently wrong with that or inherently dangerous in and of itself?

Dr Hill—At the end of the day, we all make the judgment between risk and consequence, probability and consequence. Some things have a high probability and a low consequence—for example, you stumble, you break a thumb or something. Other things are very much less likely but have a large consequence. We will always be grappling with that difference in relation to nuclear energy, I believe. The fear is that, although terribly unlikely, the consequence in the public's view is significant. My understanding is that the new generation of nuclear reactors significantly reduces the likelihood of a high-consequence incident. I think that is all I can say on this, but one must balance that consequence of a potential accident, whatever form that may take, against the continuing, ongoing damage we are doing to our environment by the burning of carbon based fuels, unless we find a solution to that.

Mr HATTON—I would like to take that further because it is the core point for the generation of the inquiry. Say we do nothing else and there are no changes. The future demand for electricity worldwide is extraordinarily high and it will multiply greatly as countries such as China and India industrialise even further. If we just run down the same track we are at, just how dire could the consequences be in terms of greenhouse gas emissions unless we find multiple ways of addressing the problem?

Dr Hill—Nothing in science is certain, of course, but it seems that the overwhelming evidence that is coming in now suggests that there is an anthropomorphic origin to the temperature rises, the sea level rises and so on that we are seeing, and the carbon dioxide increase in the atmosphere. The overwhelming body of evidence suggests that it is anthropomorphic.

Mr HATTON—And that the rate of change and the time in which that change is strongly evident is much earlier than was previously predicted?

Dr Hill—Yes. From a geological perspective, of course, there have been events like Krakatoa, for example, major volcanic events, that have in very much quicker time frames introduced huge volumes of CO₂ and other noxious gases—sulphur related et cetera—into the atmosphere, so it is not true that this is the fastest increase, but of the non-catastrophic sources of quick CO₂ emissions into the atmosphere, it appears that the rate of change in the last 150 years has been greater than that previously witnessed. There have been times, of course, in the past where there have been higher levels of CO₂ in the atmosphere than we currently have, but it had significant consequences, as far as we can gather from the fossil record, on life on earth.

Mr HATTON—And in terms of the base problem of ice ages and the discussion there has been, particularly over the last couple of years, about the fact that the next ice age may in fact have been forestalled by the work of humans producing greenhouse gases and therefore creating a hotter environment than there would otherwise be, do you have any comment on the discussion in relation to that?

Dr Hill—Yes, there is interesting debate around this whole issue of the impact of global warming. A colleague was at an international conference on global warming some time ago and presentations from countries like South Africa and Australia were all doom and gloom, because the rainfall drops off, or the distribution of rainfall changes in a non-advantageous way, the variability of rainfall changes et cetera. Other presenters, from eastern Europe, Canada et cetera, were delighted with the changes that occur in their environment from global warming, at least in the medium term, because the permafrost disappears and their growing season increases and so on. The local impact does vary across the face of the earth very significantly and some people are benefited and some are not. But overall I believe that most people consider that the negative impacts outweigh the positive ones. For example, I understand that significant parts of Bangladesh, the Pacific islands et cetera will be totally inundated. I would not want to play off that sort of impact against the longer growing season by three weeks in Canada. They are different orders of magnitude of impact. It is a very complex equation but, on balance, most people believe—I believe—that the impacts of global warming are negative for the globe.

Mr HATTON—There are still some people who are highly sceptical in that regard. The strongest voice in Australia is Dr Ian Plimer. He has a minerals background and argues from a geological perspective and a mineral exploration perspective, virtually. He has argued that there are precedents—not just what happened in Krakatoa but throughout past history—of significant sea level rises. If you look at the whole of the eastern Australian coast, you can see the geological evidence for the fact that there were extreme variations in terms of sea levels, that there have been periods of warming in the past that are comparable to this, and that we should be more sceptical in regard to the general argument about what is happening to the climate because of greenhouse gas emissions, and a corollary to that is his argument that the models developed to predict what will happen as a result of greenhouse gas emissions are in fact not properly based; the assumptions are too broad and the data is in fact too narrow. Would you care to comment on that from your perspective?

Dr Hill—It is a healthy debate when you have other views to what I think would be generally considered to be conventional wisdom on this. I think that is terrific. It puts us all on our toes—Ian Plimer himself, as well as protagonists of his. I would say, though, that it is true that the geological record does show periods of higher CO₂ levels, higher and lower sea levels, massive ice sheets retreating and advancing at various times across the globe. They had huge impacts on life at the time. It is all well and good to argue that it has occurred in the past. It has, but it had huge and disastrous effects on life at that time, and there were not anywhere near the number of humans on the face of the earth at those times in geological history, so the impact of that happening again, or something even remotely like that happening again, is far greater now on human life on this planet. I have no axe to grind against that argument at all, but the consequences are the thing that impact on me.

Mr HATTON—In the period of the hunter-gatherers, the impact was dispersed as they were dispersed, but it is a different game now?

Dr Hill—Yes. The hunter-gatherers could retreat from the rising coastline but nowadays what do you do with Surfers Paradise et cetera?

Mr MARTIN FERGUSON—Historically, the uranium industry in Australia grew up because of the needs to cooperate with Great Britain post Second World War. All of our scientists

et cetera had experience in Great Britain as part of their program. What research is currently being undertaken by CSIRO with respect to exploration, mining or the nuclear cycle? Secondly, historically now we are doing significantly well and are recognised internationally for nuclear medicine. Should we be devoting more resources, for example through a university, to a school of nuclear engineering?

Dr Hill—On the first question, I think our submission indicates that there is not a lot of expertise at all in nuclear science and engineering in any of the universities. In fact, there is none. The main resident expertise at the moment occurs in ANSTO and CSIRO in relation to, for example, radionuclide removal from mineral sands in order to meet market expectations, and the treatment of rare earth deposits to extract concentrations of those, some of which are radioactive. The ANSTO technology was much greater in the past, when the plans were to build a nuclear reactor in the Sydney area in the fifties, and that was put on hold, I understand, for a variety of reasons, one of which was the discovery of oil in Bass Strait.

Mr MARTIN FERGUSON—The concrete pad is still at Sussex Inlet.

Dr Hill—Yes. It came close. And, of course, the collaboration with Britain on the nuclear testing in South Australia in particular was another area where there was built up a significant expertise in Australia. That, to my knowledge, largely has disappeared and the resident expertise is in reactor operations at Lucas Heights, where of course there is a maintained expertise in reactor operations. There is also significant expertise, as you point out, in the medical area, where ANSTO has significant radiopharmaceuticals generation activity, and that is, as you say, of world class, and so it is an interesting suggestion that we might focus on that area.

Mr MARTIN FERGUSON—Do you think CSIRO would be interested in cooperating along such a path with ANSTO and the industry itself?

Dr Hill—Absolutely, yes. We would be delighted to collaborate with ANSTO. In fact, there are a number of areas of collaboration already with ANSTO, although not anywhere near enough, in a whole range of areas—in material science and other areas relevant to the uranium fuel cycle.

Mr MARTIN FERGUSON—In terms of the extraction, have you had a close look at the in situ process in operation at Beverley, which could apply at Honeymoon?

Dr Hill—I have not visited either of those sites, but have some arms-length knowledge of the process itself, given that I was chief of the division of minerals—which is mineral processing—and have some experience in chemical extraction methods and also biological extraction methods of metals. I think they are extremely promising. The advantage for them is that, provided you can contain the field of influence underground through appropriate wells and pressure fields and so forth, it is an extremely attractive method for extraction because you impact very little on the surface. You do not disturb biota of any sort. It is very benign. The waste is left underground. It is similar to hot dry rocks type work as well.

Mr ADAMS—The debate is about increasing the amount of uranium out of Australia to meet some of the demands in the world; the energy needs of countries like China, which is industrialising at a fast rate and trying to give a higher standard of living to its people. India is

another growth area. It is about trying to find alternatives. If it is not nuclear energy, would it be coal, or are there other alternatives? If so, what are the other alternatives? You must have thought about this to some degree.

Dr Hill—One of the alternatives is hydropower. Australia is more or less saturated there, so there is not a lot of opportunity to increase that. We would not only be running out of valleys and mountains and so forth but we have also run out of acceptability for damming rivers and things, I think. Solar, wind, tidal et cetera remain significant options for the future but are relatively niche local applications at the moment rather than large base-level continuous supply, which is needed for a highly industrialised modern nation. The most promising, perhaps, is hot dry rocks. We are not there yet but, as I mentioned before, it has the capability of producing base load levels. These massive granites are, unfortunately, five kilometres or so down, but the heat content of a granite of significant proportion sitting at about 250 to 300 degrees Centigrade is absolutely massive. It is decades of coal vested in the heat content of those. Funnily enough, the heat content is actually radiogenic in origin. It is because of the radionuclides present in the granite that the granites are hot. It is not that they are removed; it is just that they are producing heat at depth. They are the main alternatives. As I said before, there is no magic bullet, there is no emerging technology waiting in the wings to burst in on us.

Mr ADAMS—There is the other idea of the high tower. Have you looked at that?

Dr Hill—Those things are a kilometre high and about two kilometres wide. CSIRO has not made a detailed study. My personal view is that you would have trouble getting that through local approval processes, and I am not sure of the economics of building something that big. Again I would say that that would be relatively local. I am not sure of the economies of scale there and what something a kilometre high produces in terms of megawatt hours. Some people may well know.

Mr ADAMS—I was basically looking at other countries, the growth of China and India, and what they need for their energy futures. Do you think they have any alternative but nuclear power?

Dr Hill—Not in the short term, no. That is why China has a large number of nuclear power plants coming in train, as do a number of other countries. They are heavily invested in coal. They still purchase a large amount of our coal and they still collaborate in a research context with CSIRO in terms of making that coal-burning cleaner. There are fringe things happening. We have been trying for years to do nuclear fusion. That is still a gleam in our eye rather than a reality, so I think that is very much long term, again. There is also the opportunity to use solar concentration, with extensive mirrors; to use semiconductors to split water directly, particularly titanium oxide and other inorganic semiconductors that might be more efficient than traditional photovoltaic sources of electricity, but in this case it is used to directly split the water in situ rather than generating electricity as an intermediate product and then using that to split the water. There are some interesting things emerging in which CSIRO and others are engaged at the moment. There is certainly a significant research effort in these longer term technologies, but the reality of it is that we need to make the existing dependence on coal more efficient and we need to make sure that people feel comfortable about nuclear, because they are the short-term options.

Mr HATTON—Dr Hill, you might be interested to know that in terms of the tower of power—the one-kilometre-high process—there has been some extraordinary work done in Australia. We have been briefed and I think that group will be coming to the committee later in the year. It is an area to keep an eye on in terms of even the possibility of base load power. I want to take you, though, to the question of whether you know anything about the Silex laser enrichment technology and the research that has been done at Lucas Heights. In a later submission to the committee they note the November 2004 study by Greenpeace, *Secrets, Lies and Uranium Enrichment: The classified Silex project at Lucas Heights*. Are you aware of anything in relation to that?

Dr Hill—No, I am not familiar with that technology in any detail.

CHAIR—Dr Hill, thank you for appearing before the committee today. If the committee requires any further questions, the secretariat will contact you.

[9.51 am]

HORN, Mr Cedric Murray, Chairman, Southern Gold Ltd

CHAIR—Thank you for agreeing to appear and give evidence at the public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament. I remind you that giving false evidence or misleading evidence is a serious matter and may be regarded as a contempt of parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in private and the committee will then consider your request. I invite you to make an opening statement before we proceed to questions.

Mr Horn—Thank you, Mr Chairman, ladies and gentlemen. Thank you for providing the company with the opportunity to speak at this hearing. Southern Gold is a junior exploration company. We were listed on the stock exchange in April this year. The aim was to explore for gold and nickel and base metals in southern Australia, although not restricted to southern Australia. During the gestation period of the company, directors identified the evolving opportunity to explore for and develop uranium resources within our substantial tenement holding or tenement portfolio in South Australia.

The question is: why do we support uranium exploration? We see a general agreement within the international scientific fraternity that increasing global temperatures and serious climate extremes are attributable to increased CO₂ levels in the earth's atmosphere. We, the directors, believe that the world's energy generation industry will require serious adjustment through regulatory control, new technologies or alternative clean fuel sources in order to reduce greenhouse gas emissions and certainly to curb the global warming.

We see it as not just an issue for Australia's energy requirements but for the future of the world's energy requirements and particularly those of developing nations. Southern Gold understands and believes that there are some 31 countries currently relying on nuclear energy to generate substantial amounts of energy. Some 18 per cent of the world's electricity is generated by nuclear power stations. The global demand for uranium is currently around 80,000 tonnes per annum and 60 per cent of that is supplied from primary production, so there is an increasing shortfall. This has been responsible for a rapidly escalating price.

Southern Gold certainly envisages Aboriginal groups and regional Australia benefiting from the creation of employment, the provision of royalties and the establishment of new infrastructure. More particularly, in South Australia, where we have a very supportive exploration and development environment that is provided by the state government, and a very highly prospective, underexplored geological terrain, we are in a strong position, we believe, to further develop an already existing uranium industry.

We see a number of impediments to us, one being infrastructure. Mineral deposits commonly occur in remote parts of the continent and the localities in which Southern Gold is exploring are generally very difficult to access and that adds significant cost through the provision of roads, power, water, transport, accommodation and communications. We currently believe we have a

significant labour and skill shortage in the industry. Boom times in the mining industry have led to a shortage of geoscientists, technicians, mining engineers, drilling contractors; and this is a hindrance to progressing the industry.

We believe that there is a significant taxation regime that does have the ability to hold back the industry. We are competing for investment funds and when we are competing for those we are competing against countries which provide incentives for economic development. Other impediments that we see that impact on the industry are environmental, regulatory, trade barriers and obviously access to resources, so native title.

We see some strong positives for Australian uranium development, one being that we have a very conducive economic climate in general. The Australian economy is stable and attractive to business investment but governments must ensure that interest rates continue to be predictable and competitive, that inflation remains low and that there is a continuing strong capital market available. We see a very strong market demand for uranium at the present time.

Australia currently provides some 30 per cent of the world's production and we have about 40 per cent of the world's resources. South Australia has the world's largest uranium mine as I am sure you are aware: Olympic Dam. We see ourselves as being in a strong position to satisfy world market demand. Australia also has low sovereign risk, or is perceived to have low sovereign risk. It is certainly essential that we do not see government administrations and government legislative regimes changing dramatically.

We believe also there is a positive in that there is a need to reduce greenhouse gases or at least curb them, and electricity generation using fossil fuels is a major source of greenhouse gas emissions. We believe there is a growing demand for electricity and this provides a very real opportunity for developing a nuclear industry. Some of the benefits that we see from encouraging the uranium development in Australia are: increased employment; improved export earnings; development of regional Australia—we think that is pretty important; increased government taxation and revenues—it certainly benefits states; and a cleaner environment.

There are a number of challenges that face Southern Gold. One of those is inconsistent state policies, and that is one reason why we focus in South Australia. Another is limited capital funds; it is very difficult to fund exploration and mineral development and that requires governments in particular to provide a competitive economic climate and to encourage investors into the market. And, as I said, we have a skills and equipment shortage. That is brought about particularly by brownfields activity of majors in other commodities. We have an inability ourselves to participate in and fund collaborative government research in such organisations as CSIRO. We would strongly encourage government participation in that. And, as I said, there are the usual impediments: native title and environmental controls.

Industry and government probably need to look at some of the following suggested actions. We need to develop overseas markets, in particular in places like China and Egypt—countries that are considering building nuclear power plants to meet their energy demand. We need to provide uniformity of regulation between states and federal governments and to reduce duplication of legislative requirements. To make our products competitive overseas and on the world scene we need to ensure that the regulations are consistent and provide safeguards that the community insists upon and yet still encourage investment in the uranium industry.

Subsidies in the provision of infrastructure development in regional Australia would certainly assist the industry, as would the provision of high-quality geoscientific data and encouragement to the industry through programs such as operate in South Australia—for instance, the PACE funding concept, where the government subsidises drilling programs dollar for dollar. We believe there is a need for a further R&D commitment by government to safe storage and handling of nuclear products. Australia certainly needs to be in the forefront of technology for the safe use of nuclear energy. That requires significant government involvement.

We do need to see some change in government policy. Some of the states still operate under the regime of a three-mines policy. That discourages exploration. We also see a need for increased training in schools and universities and for training subsidies to universities to further the development of technicians and geoscientists and so on.

In conclusion, Southern Gold believes there is an urgent need for worldwide development of the nuclear energy industry as an alternative to the use of fossil fuels in power generation. We see nuclear energy as a clean energy source that can reduce greenhouse gas emissions to the atmosphere. We see it as being competitive costwise, certainly when you take into account greenhouse gas emissions. Southern Gold strongly supports the development of the Australian uranium resources and it encourages government to provide a consistent regulatory regime that will encourage investment in the industry while providing adequate safeguards to the community.

CHAIR—Thank you. Your submission expresses support, on pages 2 and 9, for the development of a domestic uranium enrichment industry or the nuclear power generation research and the return of high-level waste from countries to which Australia exports uranium. Would you explain what benefits you see these activities might have for Australia and how these proposals might be progressed?

Mr Horn—Could you repeat that? I am not quite sure I understood it.

CHAIR—In your submission you support the development of a domestic uranium enrichment industry for nuclear power generation and research and, you go on to say, for the return of high-level waste from countries to which Australia exports. Can you explain what benefits you see these activities might have for Australia?

Mr Horn—We could be developing a resource from the mining point of view. We can be further processing it, enriching it, selling the product and then obtaining waste products back for disposal in stable geological environments such as the Olympic Dam mine. This could provide revenue to the country through storage and ensure adequate safeguards, in that we are obtaining the waste and becoming a waste repository that is controlled by Australia. We see a benefit through revenue and a benefit through maintaining some sort of regulatory control over the industry.

CHAIR—If the government had that idea, what is your view of how it would be progressed?

Mr Horn—That needs to be totally controlled by the federal government. I do not think it is necessarily a state operation. The federal government needs to have total control or regulatory control over the disposal of waste.

CHAIR—Do you have an idea of which state would accept the waste?

Mr Horn—I know South Australia is very reluctant at the moment but I do not believe that should be a concern to us. I would see it put there so long as it is in a stable geological environment. It is really a matter of educating the public in general about how safe it can be. It does need a lot of R&D and a lot of research done on safe storage. I do not think we have quite got there yet, but we are close to getting there. Another area the federal government needs to address is how we can ensure that we are going to have safe storage of the products.

Mr HATTON—Mr Horn, you would like to dig it up, flog it overseas and then bring the waste products back here to create a new industry. Do you think Australia should have its own industry of producing electricity using nuclear power, if we are going to explore and export and then even create a new industry in terms of bringing back the waste?

Mr Horn—It would be very responsible for Australia to consider generating power. I think the directors of the company would support that concept. It is a clean form of generation of electricity. Yes, we would support nuclear power generation development in Australia.

Mr HATTON—Do you think it would be economically reasonable for Australian governments to look at that, in the cost of building those power stations?

Mr Horn—Nuclear power is competitively priced. When you take into account the effect on the environment of greenhouse gases and the amount that coal fired power stations put into the atmosphere, it can become quite competitive.

Mr HATTON—In a population of 20 million people?

Mr Horn—Yes. For base load power generation we would support nuclear power. Obviously it is not economic to put a power station out in the middle of Central Australia for small communities in the country, but certainly closer to major towns or cities it could be quite economic. I do not see it as entirely replacing coal or other forms of energy generation, but it has the potential to form some part of the base load power generation.

Mr HATTON—I would hazard a guess that almost all of the argument that we have heard and economic advice from the government would be that having a nuclear power station in Australia would be relatively uneconomic. You (1) are supportive of that and (2) suggest within the submission that the government should act to make coal based power generation much dearer by introducing a carbon tax, or by introducing other measures to make nuclear power more economic. Do you want to expand on that?

Mr Horn—There needs to be some control or serious regulation on the production of CO₂ into the atmosphere. Coal fired power stations obviously produce large quantities of CO₂ so we would see some form of carbon tax, or something that makes it less attractive to put that CO₂ into the atmosphere. It may be that new technology will solve that problem and it may not necessarily have to come to an economic consideration, such as putting on a tax, but there does need to be some sort of encouragement to reduce the amount of carbon going into the atmosphere from coal fired power stations. We would certainly see some form of tax being a discouragement, or an encouragement to look at new technologies.

Mr HATTON—You argued for predictability in terms of the government's approach to a whole range of things, in particular to inflation targets and also the level of interest rates and so on. I would hazard a guess that maybe governments face the same sorts of problems as the exploration industry and the reality is that we have fluctuations in variability, as we have seen over the last decade or decade and a half in minerals exploration. Indeed, in the last parliament, the committee's efforts were turned towards how to re-ignite minerals exploration in Australia through looking at R&D and other matters. The situation has greatly changed in the last year in terms of demand for minerals and so on.

I want to go to the related question and pick up on the availability of trained people. We heard in the previous parliament that trained geologists were acting as taxidriviers and going off into all sorts of other careers. Has it been your experience that the industry is drawing back in previously trained people instead of training new people? Or have we lost them because of the variability that has occurred within exploration?

Mr Horn—To a certain extent we have lost those people who went out and drove taxis. They are no longer there. They would need to go back and, to a certain extent, be retrained on new technologies and new geophysical techniques and so on. But it is not only the geoscientists or scientific fraternity that needs to increase; it is the simple skills. There is a distinct shortage of tradesmen who will go into the bush. Trying to get a driller now, or a good drilling contractor—or a drilling contractor at all—is very difficult. You have to wait in line. We have been waiting for some several months now to get a contractor.

It is easy enough to say, 'Let's go and buy our own drill rig,' but getting somebody capable of operating that drill rig is almost impossible. You have to pay extremely high wages and do it on a fly-in fly-out basis. We would see that some encouragement for training those sorts of technicians would be an advantage and essential to the industry.

Mr MARTIN FERGUSON—Mr Horn, you talked about trade barriers to the export of Australian uranium. What do you see those as being? Secondly, do you accept that Australia should only export uranium to countries that are party to the Nuclear Non-Proliferation Treaty and that also enter into a bilateral with Australia guaranteeing the peaceful use—that is, potentially China, but not India?

Mr Horn—We would certainly see exporting to countries that subscribe to weapon nonproliferation—

Mr MARTIN FERGUSON—To the treaty?

Mr Horn—as being essential, a prerequisite.

Mr MARTIN FERGUSON—You also accept the requirement for a bilateral with Australia guaranteeing the peaceful use?

Mr Horn—I believe that is essential, yes. We certainly subscribe to that. As far as trade barriers go, I guess it is about making the products as competitive as we possibly can to overseas markets. We are saying that we would not like to see any trade barriers there that limit the export of uranium, enriched uranium or yellowcake to the overseas market. We are just saying

governments should ensure there are no trade barriers or very few trade barriers. We do not have any particular gripes on that because we are not exporting. We are not doing anything at this point.

Mr MARTIN FERGUSON—The only barriers we have are requirements for a country to be party to the Nuclear Non-Proliferation Treaty and to enter into a bilateral, so there are no real trade barriers to the export of Australian uranium, are there?

Mr Horn—That is right. That is what I was saying. We are supporting the concept of Australia signing agreements and bilateral agreements. We would subscribe to that.

Mr MARTIN FERGUSON—What has your company spent on exploration to date? What do they propose to spend over the next five years? Have you had open encouragement from the South Australian government for such exploration? And, as a small to medium sized company, what incentives do you think the Commonwealth government should be putting in place to encourage exploration not just in uranium but across the mineral sector generally?

Mr Horn—In South Australia the government is extremely supportive of uranium exploration; in fact, all exploration. As I said, we have a PACE scheme which provides funding for drilling. That can be for uranium, any particular mineral or all minerals. South Australia has a very supportive mineral exploration regime; not so in some of the other states which currently either prohibit or restrict exploration.

As far as the federal government helping the industry, the provision of high-quality geoscientific data, which happens to a certain extent at the present time although at a cost, is essential. We see Geoscience Australia providing that kind of information but generally we would see—

Mr MARTIN FERGUSON—That is for industry generally? We have to do more on that front for the mining industry generally?

Mr Horn—Yes.

Mr MARTIN FERGUSON—That is where you see the role of the Commonwealth?

Mr Horn—That is right.

Mr MARTIN FERGUSON—And your budget for exploration over the next three to five years?

Mr Horn—Our budget just for uranium exploration?

Mr MARTIN FERGUSON—Yes, in South Australia.

Mr Horn—This year we are proposing to spend about \$500,000. We would spend a lot more if we had the money available but we still have to go out and raise more money. We only raised \$4 million this year. We are going to spend \$1 million of that on uranium exploration and we are

looking at raising further capital to increase that. Over the next five years we would be spending probably \$1 million a year.

Mr MARTIN FERGUSON—The potential sites due to isolation are potentially fly-in fly-out such as Beverley?

Mr Horn—Yes.

Mr MARTIN FERGUSON—Which actually reduces the requirement for infrastructure provision by the Commonwealth or the state or local government, doesn't it?

Mr Horn—Certainly states need to consider ways and means of increasing accessibility to these isolated regional areas, yes.

Mr MARTIN FERGUSON—So potentially the biggest problem we have confronting the industry at the moment is the skill shortage?

Mr Horn—The skill shortage is a major impediment to the industry at the present time, yes.

Mr ADAMS—Do you think the industry should play a role in training people?

Mr Horn—Certainly the majors can play a role. I think it is very difficult for a junior like ourselves to become involved. We just do not have the funds available; our funds need to be committed to dollars spent in the ground. I would like to think that we could provide funding for training, but maybe there is, just off the top of my head, some sort of a levy that needs to be—

Mr ADAMS—We had that. The problem we get into is: who trains people? It is all right to buy people off the shelf, but if somebody is training down the road and someone else is poaching the people that are getting trained, the country does not go forward. I am involved in another inquiry that is dealing with training, so it is good to bounce that off you, thank you. You were dealing with what your company was going to do. You intend to mine in South Australia in the future?

Mr Horn—Providing we can demonstrate economic resources, yes, our intention would certainly be to mine. At present that is still restricted. Given that there was some change in policy or change in the three-mines operation, then certainly we would—

Mr ADAMS—You would go into production?

Mr Horn—Yes.

Mr ADAMS—The issue you talk about is the need for infrastructure in areas of isolation—everything, I take, it from supplying energy sources to manpower, to people. Those are costly things. How much do you think royalties should be to help meet the costs that government would supply to end up with the uranium?

Mr Horn—We see royalties as being fair and equitable at the present time. Certainly in South Australia the royalty regime is pitched at the right level and we believe it is equitable to the

industry. We would not see it necessarily increasing, but, with more mines and more operations put into active operation, we would see the royalties to the governments increasing substantially—and certainly taxation.

Mr ADAMS—In your submission I see that Olympic Dam has contributed \$147 million between 1997 and 2004. You do not know what the wage bill would be for Olympic Dam, do you?

Mr Horn—Offhand, no, I could not tell you. I know there are 2,400 people there at present but not necessarily employed there; that is at Olympic Dam. I am sorry, I could not tell you that.

Mr ADAMS—That is all right. In your submission you mentioned a figure which I just wanted to clarify with you. You said that 20 per cent of the world's energy now comes from nuclear energy.

Mr Horn—Yes, we believe it is about 18 to 20 per cent.

Mr HATTON—Mr Horn, it sounds as if Southern Gold is not only looking for uranium but for whatever you can find. Is that the case?

Mr Horn—Southern Gold certainly started its life as a gold and nickel based metal exploration company when we first thought about it. As we progressed the company we found that there was a considerable amount of uranium exploration potential on our tenements. We have now formed a wholly owned subsidiary which we believe we can possibly use to raise capital through an IPO to explore specifically for uranium deposits in southern Australia, but more particularly in South Australia, which has that supportive regime.

Mr HATTON—Geologically the Gawler Craton is very interesting and its exploration history is very different to that of the rest of Australia. You have particularly given evidence at page 7 of your submission regarding Prominent Hill:

The Prominent Hill mineral discovery in 2000 revealed new geological and exploration parameters that have opened up the potential of the Gawler Craton for more significant discoveries.

Can you tell us just what those processes are and whether there is a wider significance for the general exploration industry, both in uranium and more broadly, that the Prominent Hill discoveries throw up. To your knowledge, is there any connection—I suppose you hope there would not be—with Coronation Hill and the fact that there were native title claims in regard to that that meant that gold mining could not go ahead there because of the government decision?

Mr Horn—The Prominent Hill discovery clearly showed us how the deposits formed, where the deposits formed and where you would look for copper, gold and uranium oxide deposits. These are a relatively new type of deposit, coming out of the Olympic Dam discovery initially. We now recognise the ability to find them in all kinds of areas; a Mount Isa block and other parts of Australia. Certainly, the Curnamona Craton is just as prospective in South Australia. Overseas, the same types of deposits are now being recognised.

As far as the Gawler Craton goes, we now recognise that we can find these deposits at shallower depths around the perimeter of what we call the Gawler Range volcanics. These things have a particular geological setting there that we have been able to demonstrate with the discovery of Prominent Hill. Just recently there was another deposit discovered through this PACE scheme that I was talking about—a funded scheme—called Carrapateena, and they discovered a very wide intersection of something like 60-odd metres of three per cent copper, with some gold and some uranium.

That has now opened up a much bigger area for the prospectivity of these types of iron oxide, copper, gold and uranium deposits. They are polymetallic. They are a range of materials, but we see them as being very important and we see a lot more of them being found—in South Australia, in particular, but also in other parts of Australia and the world. There is certainly exploration being undertaken for the same sorts of deposits in Sweden, Norway and Finland.

Mr HATTON—Is it a recognition of the particular confluence of those kinds of deposits and the fact that they could be ore bearing? Was there a realisation that that could be the case where there was not before?

Mr Horn—One of the main techniques for finding those was not really recognised before, and that is the use of gravity surveys. The South Australian government is now undertaking detailed gravity surveys over much of South Australia and providing that data for free—gratis—to exploration companies who hold the ground. Those gravity signatures are quite subtle. You do not necessarily see them on a very broad spaced gravity grid, but you do when you do a detailed gravity survey. That has been the key to unlocking the search for these types of deposits.

Mr HATTON—Is that being done from the air?

Mr Horn—Not at the present time. It is being developed so that it can be done from the air. That is one of the new technologies that are becoming available for us. It is a very promising new technology.

Mr HATTON—We had evidence last time regarding magnetic resonance and how useful that was and the fact that, in prospective areas, developing a grid and then being able to develop that is pretty important. I imagine the particular nature of what you are looking for is why you have advanced two or three times in your evidence the importance of the availability of data from Geoscience Australia; the fact that that is critical to your exploration activities.

Mr Horn—Geoscience Australia is providing excellent data, both on seismic traverses and transects, so we are getting a better understanding of geological structures—deep structures in particular. Gravity and new magnetics has aided the industry tremendously, but we need a lot more of it, of course, and at a low cost.

Mr HATTON—You said that this is relatively low. Dr Hill's evidence was that with much of Australia in terms of what has been found already, given the nature of the regolith or the dirt that is on top, we have to go a fair way down, so the techniques go to looking underneath and using the more modern techniques to do that. How far down are you looking for these deposits? Do you really have to look through the regolith and craton or are they more surface based?

Mr Horn—Certainly, the Gawler Craton is a prime example of exploring below the regolith. Again, Geoscience Australia are helping us a tremendous amount out there in providing new technologies for getting below the regolith. The new discovery that was made a few weeks ago is something like 600 metres depth. Some of these targets on the eastern side of the Gawler Craton, for instance, are down around 800 to 1,000 metres in depth. That is bordering on being non-economic at this point in time.

What we have shown is that the western side of the Gawler Range volcanics, which we now believe is equally prospective for IOCGU deposits, has a shallower cover. It still has a cover of some 30 to 40 metres, but we are able to strip that with these technologies, such as magnetics, gravity and mobile metal ion geochemistry. They are very important to us, and any new technology that can be developed in that area is exactly what the industry requires.

Mr HATTON—Thank you, Mr Horn. That is very interesting.

CHAIR—Mr Horn, thank you for appearing before the committee today. If there is any further information the committee wants, the secretariat will contact you.

Proceedings suspended from 10.30 am to 10.40 am

HAWKINS, Ms Dimity, Executive Officer, Medical Association for Prevention of War

RAYNER, Mr Lindsay, Student Intern, Medical Association for Prevention of War

RUFF, Associate Professor Tilman Alfred, President, Medical Association for Prevention of War

CHAIR—I welcome representatives from the Medical Association for Prevention of War. Can I ask you to make a short opening statement before we proceed to questions.

Prof. Ruff—We thank the committee very much for the opportunity to appear before you. My colleague Bill Williams had hoped very much to be here but, with two doctors down in the clinic, there was no reprieve for him today.

We have provided each of you with a small package of additional materials which we commend for your attention and review. These are mostly materials that have appeared since the submission we put in. The first is an international study that looks at long-term cancer risks in nuclear industry workers, which shows risk estimates that are consistent with—if anything slightly higher than—those that were expected, but confirms that even for low doses of radiation closely monitored in occupational settings there is an increased cancer risk.

There are two papers that I would particularly commend to the committee's attention. The first relates to the proliferation consequences of separated civil plutonium. This is of particular relevance to Australia's current uranium exports and particularly to any expansion thereof. There is a second paper from the Oxford Research Group—Frank Barnaby—about the risks of radiological, so-called dirty, weapons and terrorist construction of a primitive nuclear weapon, and two additional papers from our sister organisation in the United States, Physicians for Social Responsibility, that address the same issue, as well as a study on nuclear terrorism that was published in the *British Medical Journal* a couple of years ago.

I would particularly like to make a couple of brief remarks, if I may, in relation to the aspects that are of most concern to us, in relation to what we see as substantial and inherent risks that are related to nuclear fuel cycle activities: the first, proliferation of weapons, and the second, the use of nuclear materials in terrorist attacks either of a radiological or of a nuclear explosive nature.

Since this submission was drafted the key development internationally, in terms of proliferation of nuclear weapons and control thereof, has been the review conference of the Nuclear Non-Proliferation Treaty parties in May, in New York, which unfortunately and highly regrettably ended with essentially no agreed outcome. At this crucial time, with the nonproliferation regime internationally in serious jeopardy and in danger of unravelling, it was a particularly unfortunate time for lack of progress. We certainly welcomed that the Australian government has recognised a need there and has become party to the seven-nation initiative that seeks to introduce and gain wider support for some key disarmament and nonproliferation measures in the world summit next month.

We see nuclear technology as inherently different from any other technology that we are called upon to make decisions about and to manage, both in terms of its quantitative potential for harm—either as weapons or otherwise—and in terms of its qualitative effects, in particular the hereditary, mutagenic, carcinogenic and very persistent nature of the materials involved. Some of these risks are inherent, some are manageable, clearly, but it is the considered position of my association—and it has been the case for close to 20 years now—that these risks are really inherently too high to be acceptable.

Any activities that increase the number of and the dissemination of facilities at which nuclear materials are handled and increase the volume and dissemination of nuclear materials do increase, we believe, the risks of accident, terrorism, proliferation and waste that are the inherent problems associated with the nuclear cycle. The Nuclear Non-Proliferation Treaty mandate and the International Atomic Energy Agency implemented safeguards that certainly can reduce a significant part of those risks, but they are clearly leaky and unreliable.

There is the recent experience in Iraq, in North Korea, in Libya's undeclared and undetected program, the ended uncertainty around developments in Iran—clearly in breach of its IAEA obligations—even activities related to uranium enrichment in South Korea that were not reported to the agency and, most significantly perhaps, currently a very substantial leak of 83,000 litres of highly radioactive liquid containing about 30 kilograms of plutonium at the Sellafield reprocessing plant in the United Kingdom, where some Australian origin uranium no doubt is reprocessed, that was undetected for months and resulted in the closure of that facility in April. It was not detected by the International Atomic Energy Agency. So the current nonproliferation regime following the collapse of the NPT review conference is, at best, slipping off the knife edge and, at worst, has irrevocably begun to collapse.

Australian safeguards involve accounting that is virtual. There is no way of distinguishing an atom of uranium from one place from an atom of uranium or plutonium from any other place. Accounting is virtual and notional by its nature. Even if material could be guaranteed not to end up in weapons, it can displace and free up material available from other sources. In some countries—including countries to which we export, such as France—the civilian and military aspects of the nuclear cycle have historically been linked. It is impossible to disprove that Australian uranium might have been used in the test explosions that France conducted in the Pacific that aroused such understandable and justifiable and widespread opposition in the Australian population.

Australia currently does not discourage reprocessing of spent fuel derived from its uranium. In terms of the secondary prevention aspects of reducing proliferation, we see this as a key shortcoming. We had a number of discussions in Canberra last week with the Nuclear Safeguards and Non-Proliferation Office and with senior people in the department of foreign affairs, as well as the parliamentary secretary Bruce Billson. This issue came up repeatedly. Australia maintains that reactor-grade plutonium derived from the reprocessing of spent reactor fuel to separate out the plutonium—that essentially makes the waste easier to manage and creates the possibility of plutonium being used for other purposes, including in power reactors, or for weapons indeed—is unsuitable for use in nuclear weapons.

This is clearly fallacious. It has been demonstrated not to be correct, because both the second Totem British tests that were conducted at Maralinga in 1953 were in fact made of close to

reactor-grade plutonium, and the United States has conducted similar explosions using bombs made from close to reactor-grade or reactor-grade material in the 1960s, so this is clearly fallacious. Not allowing the reprocessing of spent fuel derived from Australian uranium seems to us to be one of the sharpest priorities for secondary prevention. But, of course, the primary approach here that we would support and that makes good public health sense in terms of minimising the health and environmental risks of what we believe to be an unacceptably dangerous technology is primary prevention: we turn off the tap and reduce the risk at source.

I want to make a few remarks, if I may, about terrorism. Nuclear terrorism via an attack on a nuclear facility, a plant, a fuel storage facility or a reprocessing plant is a highly attractive terrorist target. We believe that on the balance of the evidence of direct efforts of acquisition by various terrorist groups of fissile materials and a number of credible threats to nuclear facilities that have been documented, as well as some substantial instances of smuggling of nuclear materials—the largest documented one of 40 kilograms of weapons-grade material in the Ukraine some years ago was sufficient for a couple of nuclear weapons—the risk of nuclear terrorism via a dirty bomb, a primitive nuclear explosion—one or more—or attacks on nuclear facilities is inevitable. There is really no question, to us, about that. They are an extremely attractive terrorist target.

Again, increasing the range of possibilities, the number of facilities, the volume of materials, the number of places in which it is dispersed, increases the potential for that risk. Any such risk clearly can be catastrophic in a major urban area—particularly if a multiplicity of events simultaneously timed were planned—but also it could be very difficult to interpret, particularly for nuclear weapon states that have a high proportion of their weapons on hair-trigger alert. Thousands of nuclear weapons in the United States and in Russia remain on hair-trigger alert, ready to go, with decisions needing to be made on receipt of a perceived threat in time scales of about 15 minutes, so you can envisage a number of scenarios where conflict could escalate that is then unpredictable and potentially uncontrollable and that raise the spectre of wider use of nuclear weapons. For us, these two risks alone really make this technology far more trouble and risk than it is worth.

I conclude with two comments. The main one is that when the risks are so high the threshold for decision making should err very substantially on the side of safety, and precaution should be applied to a very high degree. Even if Australia makes decisions today about the likely compliance or the documented compliance of countries with their safeguards obligations, either multilateral or bilateral, even if Australia makes assessments now about the weapons interests or aspirations of countries to which it may export nuclear materials, those assessments may be valid this year or even next year, but they are not valid in 10 years time, in 50 years time, in 100 years time, in 1,000 years time, in a couple of hundred thousand years time. You are talking about materials whose physical inherent nature involves time frames of hundreds of thousands of years of toxicity.

Plutonium has a half-life of 24,400 years, so it will not materially be reduced in terms of toxicity for hundreds of thousands of years. These are time frames that are simply beyond any human institution, any history, any organisation, any technologies, and indeed make even geological events and extraterrestrial events unpredictable over that time frame. These are, in our view, simply materials that should not be added to the human environment where they can pose such a long-term risk.

CHAIR—Thank you for that. I should advise you that, although the committee does not require you to give evidence under oath, the hearing is a formal proceeding of the parliament and I remind you that giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. I further remind you that the committee prefers that all evidence be given in public, although at any stage you may request that your evidence be given in private and the committee will consider your request.

Professor Ruff, in your submission on pages 11 and 12 there is an observation about the possible health effects of the Chernobyl accident. The submission asserts on page 12 that there were at least 6,000 deaths as a result and goes on to say that there has been a 34-fold increase in the rates of thyroid cancer, but the UN Scientific Committee on the Effects of Atomic Radiation says that there were only 31 deaths immediately as a result of the accident and, while there has been an increase of some 800 cases of thyroid cancer diagnosed in children, most of which are curable, about 10 of these have been fatal. How can you account for the wide variation between the UN stats and your own claims?

Prof. Ruff—There is a wide variety of sources of information about this, and I am certainly happy to provide references or additional material should the committee desire. It is clear that those instances that are most formally documented are those of the radiation workers that were involved in the clean-up, and there are some tens of those, and a number of deaths, as you—

CHAIR—Have you read the UN report?

Prof. Ruff—Yes, I have read several UN reports.

CHAIR—And you dispute that?

Prof. Ruff—I dispute that, yes. Epidemiological surveillance in Ukraine and Belarus would suggest an increase of cases of thyroid cancer of the order of thousands to tens of thousands. Using the current best UNSCEAR data or even the BEIR VII data—the latest US biological effects of ionising radiation assessment that the US National Academy of Sciences released just last month—and applying those estimates for radiation-associated cancer risk to the known release from the Chernobyl accident, simply on that basis one is looking at an excess of cancer deaths in the Northern Hemisphere from fallout of between 24,000 and 40,000. To look at small numbers of cases directly attributable to the accident means there are lies, lies and statistics. I think those data are not credible. The data that I can refer you to that is published in the international peer-reviewed medical literature certainly suggests deaths of the order, projected over a significant period of time, of tens of thousands.

CHAIR—But your submission says 6,000 deaths resulted—not in the future.

Prof. Ruff—Those were documented from some Ukrainian Ministry of Health sources which I am happy to provide further detail on should the committee require.

Mr ADAMS—You will give us the references?

Prof. Ruff—Sure.

Mr HATTON—First of all, you talk about potential carcinogenic effects. What is your attitude towards Lucas Heights as a research reactor? Do you think we should have it? Do you think we should have had it in the past? Do you think the new one should still be there?

Prof. Ruff—The association's position is that the replacement reactor at Lucas Heights is not warranted. There are a couple of reasons for that. The major one, from our perspective is that, apart from involving all of the risks that I have described of terrorist attacks, of waste management, of accidents, of leaks, there is simply the fact that there is no need for a new reactor. The association conducted an investigation last year and published a report in November that looked at the primary public justification for the reactor, which has been that it is required to produce isotopes for industry, and in particular for medical purposes, diagnostic and therapeutic.

We analysed those claims in some detail and with peer review by a number of nuclear medicine physicians and our conclusion unequivocally is that that is not the case, that Australia does not need a new reactor to provide isotopes that are required for nuclear medicine purposes. This is because the world is awash with capacity to generate isotopes. There is one small nuclear reactor in Canada that produces 60 per cent of the world's medical isotopes. The world has more than 450 operating power reactors much larger than that reactor. There is simply, by orders of magnitude, more reactor capacity in the world than is required to generate isotopes for industrial and medical purposes, so there is no need to add to those risks in Australia.

There have been periods of time, including for up to several months, when Lucas Heights has been shut down for maintenance and there has been no shortage in any hospital in Australia. In fact, most of the clinicians around town that I talk to say they did not even know that it happened. I know a number of hospital nuclear medicine departments around this city whose preferred source of isotopes is not Lucas Heights or ANSTO but is in fact overseas suppliers, that are sometimes more price favourable and generally more reliable in terms of delivery.

There is a whole range of medical imaging diagnostic technologies—advanced CT scanning, PET scanning, use of shorter lived isotopes that are cyclotron generated, sophisticated ultrasound—supplanting many of the diagnostic uses of traditional nuclear medicine. Clearly, nuclear medicine does have a continuing important place, but we simply believe that the need in Australia can be served more safely and probably more effectively without a research reactor.

The other particular concern to us about the reactor—for which I value the opportunity to bring to your attention because it concerns me greatly—is that in the publicly funded facility at Lucas Heights there is ongoing research that has evolved out of research initially conducted under the Australian Atomic Energy Commission. It is now conducted under a private company, Silex, which is researching laser enrichment methods to enrich uranium and possibly other substances. But the main interest of Silex seems to be in uranium. This research is, at this stage, experimental.

According to the public pronouncements of the company, they are now at the stage where they are looking at construction of a pilot enrichment facility. Essentially what this technology would enable, if further developed, would be the enrichment of uranium on a smaller scale, much more cheaply, without the huge industrial infrastructure, high energy demand, large-scale plant facilities, high-level technical sophistication and manufacturing capacity that is required to produce traditional gas centrifugation or other enrichment plants.

One could envisage that if this technology is further developed—and I should mention that this Iranian involvement in this technology has been one of the concerns about whether Iran is in compliance with its NPT safeguards—it could make it possible for a terrorist group or government, in a space probably a quarter of the size of this room, without huge high-voltage power lines and large industrial scale, visible, detectable infrastructure, to enrich sufficient material for the production of a couple of nuclear weapons per year.

For Australia to be allowing this highly proliferation sensitive research—which is the only privately held research, to public knowledge, that has the highest security classification from the US Department of Energy—to be conducted in a publicly funded facility at Lucas Heights, utilising the facility and presumably the safety waste management and other infrastructure at the plant, is entirely incompatible with Australia's nonproliferation objectives and should be closed forthwith. It is the potential for the reactor to be the basis for other nuclear related activities, as well as the reactor per se, that is of concern and has led the association to the essentially unanimous view that the reactor is not needed and poses a significant health and environmental risk in a pretty populous and rapidly growing area on the outskirts of our largest city.

Mr ADAMS—You are against the new reactor. Were you against the old reactor?

Prof. Ruff—The old reactor was established a long time ago, before the association was formed. The association has not taken a view about its initial establishment, but for the purposes for which—

Mr ADAMS—In terms of the period the reactor was in operation, is it your view that we should not have had a reactor during the decades that it operated; that it served no useful purpose?

Prof. Ruff—I do not think that Australia has had any discernible net long-term benefit from having had that reactor.

Mr ADAMS—Point 2, should a single atom of uranium oxide be exported from Australia? Should it have been exported in the past? Should it be exported now or exported in the future to countries that generate electricity from nuclear reactors?

Prof. Ruff—The short answer is no. There is simply an inextricable link between nuclear cycle activities for power generation and unacceptable health and environmental downsides. I have just touched on the proliferation and the terrorist aspects, but there are clearly others.

Mr ADAMS—And that is the core of your argument to the committee.

Prof. Ruff—Yes.

Mr ADAMS—That there is that inextricable binding; that you cannot ever think that any country will use nuclear technology to produce electricity without the possibility being there or the probability—indeed, almost the certainty or the inevitably of what you would argue—that they would produce weapons-grade plutonium.

Prof. Ruff—That potential is there and is impossible to take away. We see the danger of nuclear war as continuing to be the greatest immediate threat to the health and survival of humankind. Clearly, the imperative for nuclear weapons abolition is the highest public health need in global health terms. I work in lots of other areas of international health and I cannot see a bigger and more important issue. It is simply impossible to get to a nuclear-weapons-free world while we use nuclear power to generate a substantial proportion of electricity.

The risks of proliferation and terrorist attack and all of the problems of waste and safety mean that it is not possible to achieve a nuclear-weapons-free world while nuclear power generation is a major source of electricity. It is not going to happen overnight. There are lots of things that we can do in the short term to make it safer while we move slowly and progressively to that stage, such as stopping reprocessing of spent nuclear fuel and safeguarding it much more effectively. In our view there is an inevitable association between nuclear power generation and proliferation, and terrorist and other unacceptable health and environmental risks.

Mr ADAMS—Given your response to the first and given your response to the second, is that why in the submission to the commission you say the third part of that is the committee should not be looking at this question at all?

Prof. Ruff—To be honest with you, I was pretty disappointed. Australia is in an excellent position to make a real difference domestically and internationally in terms of moving us to a sustainable energy future. Australia is a big place with huge resources of all types, not just uranium but solar energy, a highly skilled work force, a technically very innovative work force. Australia was leading the world in many respects in terms of solar technology development in years gone by. Australia has enormous potential to move to a sustainable renewable based energy future, coupled with energy conservation and efficiency measures which are much quicker wins and have no downsides.

Nuclear power, even if it is substantially expanded, can only ever meet some proportion of one-third of the world's total energy consumption, which is related to electricity generation. If you exclude very low-grade reserves, then uranium is only going to be around, even at current rates of consumption, for a couple of decades. It is not a sustainable solution to the clearly important problem of global warming and greenhouse gas production. In an inquiry that is addressing the question of non-fossil fuel energy sources, the priority ought to be: how can Australia best move to a sustainable energy path that involves energy efficiency and energy conservation and a really robust, diverse and substantial investment program in renewable technology development and deployment? Instead we are focusing on this dangerous old technology—

Mr ADAMS—No, instead we have a case study on uranium. We are looking at the whole gamut of non-fossil fuel alternatives. Part of the reason we are doing that is that millions of people have died because we have used fossil fuels. Not far from here in Williamstown, near the port, there is a street that has been subject to study recently. The cancer rates within the street leading to the port have been absolutely massive and they are the result of diesel particulates. The fuels that we have been using, the fuels that dominate the way in which we conduct modern industrialised societies, are killing people. It is not only that but also the particulates from using coal fired material.

That has driven the committee to look at alternatives, and the fact that it is demonstrable that there is a significant effect on the whole world's climate because of greenhouse gas emissions, and that there will inevitably be a massive increase in the demand for electricity. How you address that is why we are open to looking at all of those aspects of it and not closing ourselves to one particular part of it.

I understand that your approach and the approach of others is—very directly stated here—that we should not be looking at it at all. But it is the gravity of the situation, the effects of what we have been using for the last couple of hundred years, that should give us pause in terms of trying to look at what inevitably will happen if we keep doing it. That might be a response to the third part of that, and the fact that there is a direct attack on us even being willing to look at this as a case study, which is part of a much broader approach. We have already had evidence and private submissions, which will be coming through to the public later, in terms of the other fossil fuel alternatives which can save lives and can clean up the environment effectively. The question is how effectively can it be done and how much can we advance that in terms of the time we have to deal with those significant problems?

You spoke about the laser enrichment with Silex, and I want to take that up later as well. Are you relying exclusively on the Greenpeace work done in relation to this? The argument that you put forward is that primarily this is all about uranium and applying that enrichment technology to uranium. You note that there may be some work done in carbon and silicon. What is the significance of the basis of what you are relying on here? Is it work that you have done, or referred work where you have just looked at what Greenpeace has done? Where are the sources of evidence for what is happening?

Prof. Ruff—The Greenpeace report is an excellent and important document. Certainly, that is the primary publicly available source of information. I have heard nothing that discounts or discredits the veracity of the factual basis for that report. I have had correspondence and personal discussions about its contents with Frank Barnaby, who is a distinguished nuclear physicist. He worked for the UK Atomic Weapons Research Establishment at Aldermaston and then for the Medical Research Council in the UK. He directed the Stockholm International Peace Research Institute. He now works with the Oxford Research Group and is a major authority on nuclear weapons and proliferation risks. He wrote the foreword to the Greenpeace report.

I have discussed this with Frank on a couple of occasions, and he is profoundly concerned and sees it as entirely inconsistent with Australia's opposition to proliferation of nuclear weapons. We should not be supporting the development of technology that might make it easier—more concealable—for people, particularly with non-legitimate motives, to enrich uranium.

Those are the primary sources but I think there is widespread concern about laser enrichment. There is a detailed discussion of the state of laser enrichment and other enrichment research, for example, in the Carnegie Endowment recently released second edition report, *Deadly Arsenals*, which has just become available. That comprehensively reviews the status of nuclear, chemical and biological weapons threats globally, and I commend that report to the committee's attention. It certainly draws attention and raises concerns about laser enrichment technology. I mentioned the specific example before in relation to Iran. This was one of the key sticking points with the IAEA.

Mr ADAMS—I noted that in your report. You argue that it is the ability to hide it and the fact that it is on a much smaller scale and that it can be taken up and used. If Australia was to export uranium to China, a country that has already indicated that it will be putting new nuclear reactors into place, and we were to export that uranium for purposes of electricity generation there, given that we would be exporting to a country that already has a significant nuclear arsenal, do you think that that would be wrong; that there could be a diversion of that material to add to China's existing arsenal? Is that the core of the problem, or that it might go elsewhere, or is it something else?

Prof. Ruff—I think on all of those counts. I have no specific detailed knowledge of the situation in China in a number of respects, and it has been an intense frustration to us in International Physicians for the Prevention of Nuclear War. We have had discussions with Chinese colleagues for years about establishing an affiliate of our organisation there. We have worked with a number of Chinese colleagues on these issues. We held our world congress in Beijing last year, at which there was zero participation from Chinese physicians. The level of transparency and public accountability in relation to China's nuclear programs, both power and weapons, is very poor. I would have the gravest reservations about the ability to monitor and to be informed about what is happening there.

China clearly is a nuclear weapons state. To its credit it is probably one of the least belligerent of the nuclear weapons states. It has a relatively small arsenal, which it is increasing relatively modestly. It is the only nuclear weapons state that currently sticks by its 'no first use' commitment and its commitment to not attack non-nuclear-weapons-armed states. China has clearly exercised some restraint in relation to its nuclear weapons developments and its policy around their use, which is commendable, but it still is a significant nuclear weapons state. I simply do not know, and I am not sure whether anybody does, or how confident one can be in terms of what is assessable and verifiable in the public domain about the potential linkages between China's nuclear weapons program and its nuclear power program.

They have their own indigenous uranium resources from quite a large number of mines, I gather. One hears the argument pretty frequently that, 'They've got it already; what's it going to do?' The horse has bolted, in a sense. But if one adds nuclear material into that system, then it clearly must free up Chinese local resources to use for weapons or other purposes. It increases the total pool of materials—

Mr HATTON—Now that we have got to that point, let me go to the broader argument. There is a massive stockpile worldwide of nuclear warheads, with the capacity to destroy the world hundreds of thousands of times over. Why do you keep a central nexus between nuclear weapons and nuclear power generation? You cannot uninvent the past. Since its development in the United States during the war, we have had the problem of how to deal with the fact that this stuff has been invented and nuclear weapons are there—not just in small numbers but in vast numbers and with tremendous killing capacity—so why is your approach still coupled to the notion that there are not many weapons out there or that the availability of civil power generation could dramatically add to the existing problem, when it is of massive proportions to start with?

Prof. Ruff—I agree with you, but that is all the more reason not to add to the problem. There are two developments I would want to comment on in response. The first is in the direction of generation III and IV nuclear reactors. Generation III reactors use mixed oxide fuel, so-called

MOX fuels that mix uranium dioxide and plutonium dioxide, in a sense using some of the spent fuel from earlier generation reactors. Generation IV reactors are fictional at this stage but fast breeder reactors that run essentially on plutonium, where the additional uranium input that is required on an ongoing basis is pretty minimal. That is in fantasy land essentially at this stage, as far as I understand the science of it.

What both of those do is increase the amount, the transport, the handling and the number of facilities that handle very large quantities of plutonium. We are not talking kilogram quantities here, we are talking tonnes, and plutonium that is highly suited for use in weapons. The potential direction of reactor technology in terms of generation III and IV reactors would take us much further in a dangerous direction from a plutonium hazard and proliferation point of view.

The second point, I think, is simply that if nuclear power expansion were to make a major contribution to displacement of carbon based sources and reduce greenhouse gas emissions, then it would need to increase on a pretty substantial scale. That inevitably increases the amount of fuel that is required, the number of facilities that are handling it, the amount of stuff that is being transported, fuel fabrication, the number of reactors and the number of spent fuel storage ponds. So it increases the volume of material, the number of facilities and the amount of material that is in transit, where it is much more susceptible to being hijacked, sabotaged or stolen than a much smaller program.

I do not doubt that we currently have a major problem dealing with the legacy that we already have. Even if nuclear power reactors that currently exist were shut down tomorrow, and the Fissile Material Cut-Off Treaty were signed and enforced next year, we are still going to have a major problem to deal with. I do not deny that at all, but I think the scale of that problem does not reduce the need not to add to it further. That would be my main argument.

Mr ADAMS—In your submission you state:

In some countries where Australian uranium is exported, such as France, some nuclear facilities serve both the nuclear power industry and military purposes.

You evidently are trying to say something with that statement. Would you like to elaborate?

Prof. Ruff—Not in great detail. It is my understanding that it is pretty well documented and it was not the primary focus for the submission, which is why I did not go into it in any great depth. But clearly in France there has been a close linkage between the civil and military components of their nuclear industry, to the extent that plutonium that is used in the French nuclear weapons program has historically been produced in facilities that include nuclear power reactors.

Mr ADAMS—Do you have any proof to put to the committee that Australian uranium is being used for military purposes in France, or are you just inferring it?

Prof. Ruff—No, I do not.

Mr ADAMS—You are inferring it but you do not have proof to back up the statement. Either you have or you have not.

Prof. Ruff—I could certainly provide documentation of the concurrence of facilities. I cannot do that chapter and verse right now, but it relates to the point I was trying to make earlier on: that there is nothing that flags an Australian uranium atom as being different or identifiable from uranium from any other place.

Mr ADAMS—I understand that.

Prof. Ruff—It is simply not possible, and that is why the accounting is virtual.

Mr ADAMS—But it is easy to say something might occur. You use words like, ‘You can’t disprove’—interesting words to use—and ‘hair-triggers’, but we are a committee that wants basic facts. We want proof and science. I am asking you whether you have any proof to put before us as a committee that can prove that France has used—you infer that France has used—Australian uranium in its military weapons system. That is what you infer. Do you have any proof of that—not what somebody has written in some document somewhere else in the world that you are going to pull together and say, ‘This person has said this.’ Is there any proof of that?

Prof. Ruff—With all due respect, this is semantics. This is, frankly, semantics.

Mr ADAMS—I know it is. I have it written in front of me, in your submission.

Prof. Ruff—If Australian uranium goes, with other sources of uranium, into a program which then has both civilian and military applications conjoined, linked within it, then it is completely irrelevant in my view to fastidiously try to see whether you might have proof. The whole point is that you cannot prove it, you cannot disprove it, but that the possibility is created. That is the point, I think.

Mr MARTIN FERGUSON—You were in China recently for that political conference.

Prof. Ruff—Yes.

Mr MARTIN FERGUSON—Do you accept China’s growth rate at the moment is 8½ per cent and, whether we like it or not, they are going to potentially go nuclear?

Prof. Ruff—China already has some reactors and has a relatively modest program to expand that number.

Mr MARTIN FERGUSON—And you accept that there is every likelihood that they are going to increase that network of nuclear power stations?

Prof. Ruff—It seems likely, yes.

Mr MARTIN FERGUSON—You have talked about Australia correctly playing a significant role in the international discussions about nuclear nonproliferation, and you welcome that. That is not unrelated to the fact that we, as an exporter of uranium, are taken seriously in those debates. Do you accept that?

Prof. Ruff—Not entirely, no.

Mr MARTIN FERGUSON—It is a contributing factor, isn't it? If we were not a player in the debate, we would not have a real seat at the table in those discussions.

Prof. Ruff—I would dispute that. I think that there are countries that do not export uranium, such as Sweden, which—

Mr MARTIN FERGUSON—But about 60 per cent of Swedish energy needs, if I remember correctly, are from nuclear power. It is a major importer of uranium, hence the seat at the table.

Prof. Ruff—With a plan to phase it out completely.

Mr MARTIN FERGUSON—The seat at the table is related to the fact that they are a player in nuclear power.

Prof. Ruff—I do not believe that there is any intrinsic need to link Australia's contribution to safeguards or nonproliferation to being a player in uranium exports or in nuclear power.

Mr MARTIN FERGUSON—Whether we like it or not, China is going to buy uranium and you would prefer, for example, that it be bought from a country of the old Russian Federation, with less of a commitment to the Nuclear Non-Proliferation Treaty and the absolute use of uranium for peaceful purposes, in a real world?

Prof. Ruff—No, that is a misrepresentation of my position, which is that I would rather there were no exports.

Mr MARTIN FERGUSON—The facts of the matter are that there are going to be, aren't there, because China is going to go further down the nuclear power path?

Prof. Ruff—There may be.

Mr MARTIN FERGUSON—And we are irrelevant to those decisions.

Prof. Ruff—I do not believe that is the case. I think Australia as a repository—not through anybody's planning but simply our good fortune to have a significant proportion of the world's uranium resources—means that decisions that are taken in Australia can have a major influence. For example, if Australia decided not to expand and indeed to phase out its uranium exports on the basis that, if nuclear power was not a sustainable solution to global warming and that the risks associated with nuclear technology—

Mr MARTIN FERGUSON—You accept the issue of global warming, do you?

Prof. Ruff—simply did not warrant the long-term risk, I think that would send an extraordinarily powerful signal and would make a major material difference, given that Australia has such a substantial proportion of known reserves.

Mr ADAMS—Do you think nuclear energy in the world would then stop?

Prof. Ruff—Of course it is not going to stop overnight. There are countries that—

Mr ADAMS—But you believe that, if Australia stopped mining and exporting uranium, that would affect the world's use of uranium in nuclear energy?

Prof. Ruff—I do.

Mr ADAMS—You believe that?

Prof. Ruff—I do. You can make the same argument about heroin. The world is awash with heroin. There is a lot of money to be made in heroin. Why don't we do that? Why doesn't Australia engage in human trafficking? Why isn't Australia involved in a variety of arms exports? Why doesn't Australia do a whole lot of things that are unsavoury from a moral point of view? Because there are decisions about what is acceptable and what is not, and the risks and the benefits. I think the fact that others will do it or it is already out there or the genie is out of the bottle simply does not address our own responsibility for making positive decisions about the directions in which we want to head and what is in the long-term interests of future generations.

Mr MARTIN FERGUSON—But you accept the problem of global warming. Should we export coal to China? It is making a fairly big impact on global warming, isn't it?

Prof. Ruff—The reality is that the world is not going to be able to move very quickly to a non-fossil fuel based energy future. Clearly, there are current needs and there are future needs, but I think what we should be doing—where we should be investing our priorities, our efforts and our technical, human, legal and financial resources—is in the development and the implementation of sustainable and renewable technologies: wind power, solar power, geothermal energy—

Mr MARTIN FERGUSON—I have no problems with that. We should be doing both, shouldn't we?

Prof. Ruff—That is our priority. Clearly, global warming is a major health issue and a major issue for all of us. My argument is simply that expanding nuclear power is not the way to do those things.

Mr MARTIN FERGUSON—In terms of nuclear medicine waste, how do you think we should store that? Whether we like it or not, we have the waste.

Prof. Ruff—The waste that is generated by medical use is important, particularly in relation to the fact that it is fairly widely dispersed.

Mr MARTIN FERGUSON—There are a number of storage points in hospitals in metropolitan Melbourne, aren't there?

Prof. Ruff—There are. My view in general about the waste, particularly the lower level waste that is generated from industrial and medical applications, is that it is best stored in above-ground secure facilities which involve as little transport as possible, so as close as feasible to site of generation. There is a real issue about the security of medical radiation sources. Indeed, I have heard unconfirmed reports that I cannot attest for the veracity of about a recent incident involving a caesium source in Newcastle. There have been hundreds of instances around the

world of radioactive sources being lost, stolen, sold or otherwise disappearing. Clearly, it is a major issue, especially in terms of a terrorist dirty bomb.

Mr MARTIN FERGUSON—You effectively believe that every state or territory ought to have a storage unit rather than a national depository?

Prof. Ruff—I think that is the most sensible approach for the relatively small quantities of low- and intermediate-level waste generated by industry and medicine. I think it is also appropriate to say in that context that we should seriously try to minimise the number of sources and find alternatives for the uses that we can find alternatives for, both in an industrial and a medical context. That is already happening. There are a whole lot of medical procedures—nuclear scans—that were standard when I was working in hospitals that are no longer the case. People have PET scans or a whole range of other technologies that involve much lower risk for the patient as well as for the amount of residual radioactivity in the environment.

Mr ADAMS—I wanted to come back to that energy source in China. I say China, but there are other countries as well which are industrialising at an enormous rate and therefore endeavouring to build a quality of life for their people higher than it presently is, to improve its medicine, but use its energy—and it needs energy and it is using more and more and that is why it is seeking our uranium, I suppose.

The West—Europe and the United States—produces energy from nuclear energy. I think 16 per cent of the world's energy at the moment is produced from uranium, from nuclear energy. Isn't it a very elitist view to say that we will deny giving China access to our uranium to produce energy, especially if it has a program to try and reduce its coal usage and meet global standards in stopping greenhouse gas emissions?

Prof. Ruff—I hope it is not necessary, but perhaps I should say that even though we seem to have focused on China, I certainly have no particular view that Chinese people have any lesser status or lesser right to anything than anybody else.

Mr ADAMS—No, quite.

Prof. Ruff—I do not think that is an elitist view. I think the danger about Australia's position of continuing, and potentially expanding, uranium exports is, in fact, more in that direction, in the sense that we are saying, 'We will sell you our uranium for nuclear power generation. We do not need nuclear power generation in Australia, but we're happy to export the material with which we export substantial risks offshore.' I think that is a real moral dilemma, in the sense that we are creating problems in somebody else's backyard that we are not then directly accountable for, although the risk globally is—

Mr MARTIN FERGUSON—But are you going to stop exporting coal too? Are you aware that 20 per cent of Australia's export earnings are currently related to the export of energy products—coal, gas, uranium, the lot?

Prof. Ruff—Sure, I appreciate that.

Mr MARTIN FERGUSON—It would be a big decision for Australia to get out of coal exporting too because it is contributing to global warming, wouldn't it?

Prof. Ruff—Yes. That is not what I am arguing.

Mr ADAMS—No, but you can see where we are coming from. We represent the parliament. The parliament has to come to grips with some of this stuff. You have a view which says, 'It is too much, we don't like it.' You can be an isolationist. That is simple. That is an easy question. I know where you are coming from, but it is an isolationist approach to say, 'We don't like it, so we're not going to touch it.' That is basically what your organisation is saying.

Prof. Ruff—No. Our organisation is saying that we believe that the risks of this technology are too great and that that is applicable—

Mr ADAMS—You are saying that the atom should never have been split. That is what you are saying.

Prof. Ruff—No, of course not. Scientific discoveries, I think, are quite separable from their technical application and how they are used and applied on a large scale in society. I do not think there is any inevitability about nuclear weapons existing in the world or nuclear reactors existing in the world just because we know about the physics of how to do that. I do not think that is a valid argument.

We are not just talking about another energy technology. This is not a matter that is subject to the same sorts of economic and social considerations over time scales of years or decades. If we export uranium, it inevitably generates plutonium. It generates plutonium in very large quantities. The world currently has about 1,500 tonnes of plutonium. An advanced weapons designer can make a reliable nuclear weapon with about three kilograms of plutonium. You are talking about material that has extraordinary risk, and research and power reactors have historically been the way that proliferating countries have acquired nuclear weapons: India, Pakistan, probably North Korea, South Africa and others that may well be on the way.

We are talking about risks that are of an order of magnitude and persistence that they put this technology in quite a different league from any other. We are talking about material that is dangerous, essentially, forever—for hundreds of thousands of years. That does not apply to anything else, so I think there are standards of safety and caution that really require a shift in mind-set, in decision-making, because those risks are quantitatively and qualitatively so different from anything else—

Mr ADAMS—But aren't we learning that about coal? There is a lot of argument that says that coal is destroying the world; that carbon is destroying the world.

Prof. Ruff—There is no doubt that global warming is a very serious issue. In fact, some years ago I was among the first public health people in Australia who were really trying to get people concerned and interested in this issue, because I saw the major risks. But to look at that serious issue and try and deal with it responsibly by looking at a major expansion of a technology that has very considerable inherent risks and that is not going to do the job—that can never do the job

fully in terms of replacing a major part of energy needs on an ongoing basis—is simply trading one set of problems for a different, and potentially worse, set of problems.

That is my argument. It is not to belittle the importance of global warming, the importance of getting very serious about energy efficiency, about energy conservation and about renewable technologies, but I think that is the clear direction that we need to go in. The possibilities are abounding. There are countries—Germany and others in Europe, for example—that are making very important inroads. If you look at the technically sophisticated countries, Europe has had one reactor order in the last 15 years, which was in Finland. The US has not had one since 1978. Sweden and Germany have decided to phase out their nuclear power operations. These are not technically backward countries.

Mr ADAMS—But that is not going to happen. The word that I have heard is that all of those reactors are going to be renewed with new technology. Even leading world conservationists are saying that we have to have this break; that we need nuclear energy. You do not accept that.

Prof. Ruff—I do not accept that, no. There is clearly a strong incentive on the part of those involved in the nuclear industry to sell its benefits. I am sorry, I have lost my train of thought.

Mr ADAMS—We were talking about the energy renewing of Europe and the United States. That is what I have heard. We have not received any evidence to that effect, but that is what I have heard talking to colleagues in other parliaments in Europe. They believe that there will be renewal of their energy; that they need to have that renewal; they cannot do without renewing their nuclear facilities to do the next generation. There is nothing to replace that energy source at the moment. I agree with you that we should be doing all we can in relation to renewables and the research, but we do not have a base load power station that can meet a coal fired power station's output. I think that is where you lost your line of thought.

Prof. Ruff—My primary expertise is not in the energy arguments here. Clearly, I have a view and the association has looked at these issues. We presume that the committee will have input from a range of other organisations and individuals expert in these issues, but our reading of the situation is that it is technically feasible to meet long-term energy needs without expanding the role of nuclear power. Our fundamental position is that, from a safety, health and environmental point of view, expanding nuclear power is simply more trouble than it is worth.

Mr HATTON—If we abolished civil nuclear power as of today—if none of the existing capacity and use existed—what would be the impact of that in terms of world demand for energy now and prospectively? And how could energy be met in terms of other available sources and other technologies that we have? First up, if we just said, 'Bang, let's dissolve what's there,' what shortfall would there be in terms of current use?

Prof. Ruff—Currently, nuclear power provides around 16-odd per cent of world electricity demand, which accounts for about one-third of total energy consumption. You are talking about roughly six per cent of global energy usage derived from nuclear power, so it is not a major proportion at present. Clearly, it will not disappear overnight. There are very substantial investments in programs and facilities—

Mr HATTON—But I want to posit the situation if it did.

Prof. Ruff—If it did, the world would not stop.

Mr HATTON—If that 16 per cent or six per cent globally was not being supplied from that source, currently it would have to come from fossil fuels, whether it is coal gasification or from alternative energies, which is the key focus of what we are looking at. In terms of what you know, do you think that right now, this day, that 16 per cent of use could be replaced by alternative energy sources?

Prof. Ruff—No question. Not immediately, but within the space of several years, absolutely.

Mr HATTON—What is several years? How many?

Prof. Ruff—That is probably beyond my direct expertise but I would have thought over the time frame of five to 15 years.

Mr HATTON—But what is germane here is the fact that that 16 per cent is being supplied by a type of energy you do not want. We could take it out of the equation and said, ‘Okay, how can we then provide for that and provide for future growth?’ but we are looking at something like a doubling in terms of world energy demand by 2050. I do not think anyone thinks that that energy demand is going to go away. If we took nuclear out, the key question then, as members of the committee have alluded to, is how much you could develop those alternative energy sources and, fundamentally, how do you provide for an alternative in terms of base load power capacity?

No-one yet, seemingly, has come up with any solution to that, or an alternative, except for nuclear. There are some technologies that are being developed in Australia that may provide that solution, hopefully, given the fact that things have been invented in the past and may be invented in the future. The particular conundrum the world faces is a doubling of energy demand, at least. How do you provide for that? It will probably be fossil fuels rather than anything else, given the difficulty of expanding the non-fossil fuel alternatives that are currently available to us.

Prof. Ruff—I do not pretend that this is quick or easy. This really needs a major social rethink about how we produce and use energy, but clearly driving energy efficiency much more strongly than we have in the past, reducing energy consumption per capita in countries like Australia where that can be done quite easily without a major decline in living standards—or a substantial decline in living standards at all—and a serious push to renewables I think has to do the job.

There is physically enough incident solar energy in substantial areas of the world to meet all of the world’s energy needs. The technology to harness that efficiently is still in development but the potential to do that exists. One of the reasons why nuclear power has survived to date is because states have had a lot of other reasons for wanting to develop it—great power status, regional rivalries, domestic politics, nuclear weapons development—and it has only been economical because it has been highly subsidised in terms of its infrastructure and in terms of the waste management and the insurance.

British Nuclear Fuels and British Energy, which ran the 12 Magnox first generation reactors, both recently went bust. The British Nuclear Decommissioning Authority that has recently been established to deal with the legacy of those soon to be decommissioned reactors has an initial budget of £48 billion, recently increased to £56 billion—initially £2 billion per year, increasing

incrementally—to deal with the waste, the decommissioning and the insurance issues related to those facilities, all of which will end their useful working lives within the next five to 10 years. You are talking about some pretty major costs at the far end, because reactors do not last forever. Reactors have a useful life of a maximum of 40 years before the heat and physical and chemical stresses, that are intense, that those materials are subject to become too contaminated or too failure prone to safely continue.

This is an issue that we are only beginning to deal with as reactors reach the end of their useful lives, but it is a very substantial continuing cost. I am sure that if all of those costs were factored in, that would make nuclear power look much less favourable than it has in the past.

Mr HATTON—Using your own terminology, is it impossible to disprove that, given future energy demand from the underdeveloped world—in particular, from China, India and the other major users coming forward—the probability is that without other more expensive sources of energy being available—other than deciding to take those more expensive ways—the probability is that they will choose the cheapest route to providing for their energy demands, and that route currently, given the cost, would be a fossil fuel alternative.

Prof. Ruff—That would currently be increasing energy efficiency, but my understanding is that currently gas fired and other fossil fuel burning stations are cost competitive—indeed, favourable with nuclear power—particularly if you factor in those—

Mr HATTON—But the history of the development of this has generally been in the West and then, after that, elsewhere. Cheap and dirty has been the way it has gone. Advanced industrialised societies have been trying to move down the path of increasing efficiency, but industrialising societies have not taken that into account: China and India and, prior to that, the Soviet Union. The amount of environmental damage, pollution, waste and destruction that was done because they went the cheap and dirty routes is a significant problem and will be in the future.

Prof. Ruff—I think that is true, with some notable exceptions like the major ethanol fuel program in Brazil, but that is a reason to get serious about sustainable technologies, about conservation, about efficiency and making a substantial impact domestically and globally, I think with significant economic potential for Australia. It needs to be addressed urgently. We are really barking up the wrong tree with looking at expanding nuclear power, in my view.

CHAIR—We are well and truly out of time. Thank you for appearing before the committee. If there are any other questions that the committee has, the secretariat will contact you.

Resolved (on motion by **Mr Hatton**):

That the documents presented to the committee from the Medical Association for Prevention of War be received as evidence by the committee.

[11.54 am]

MUDD, Dr Gavin Mark, (Private capacity)

CHAIR—Thank you for appearing before the committee to give evidence at the public hearing. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of the parliament. I further remind you that the giving of false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in private and the committee will give consideration to your request. I would invite you to make an opening statement before we proceed to questions.

Dr Mudd—I would like to thank the committee for the opportunity to appear before you today. The first point I would like to make is that the debate at the moment, and the purpose of this inquiry, is really about what is a legitimate supply of energy for the long term future. That is a key question. What does form legitimate supply of energy is one of the questions. One of the false premises that that debate is currently based on is that energy will continue to grow long term into the future. That is a very dangerous premise. Ultimately, we know there are a lot of impacts from energy production. My PhD was on the impacts of brown coal ash disposal in the Latrobe Valley, so we know there is a lot of impact from that energy production.

I have worked in the coal industry. I have also done some research for a uranium company. When I was working in Brisbane, 50 per cent of my research position was funded by a uranium company. My personal position is that I do not see nuclear or coal as long-term answers. They are bridges. At the moment we have current reactors and current coal fired power stations, and they should be a bridge to a renewable system, whether that be wind efficiency or all sorts of other things. They are bridges. We should not be building more of them.

Another factor in that is that both coal and nuclear are non-renewable. We are somewhat blessed, or cursed, in Victoria with an abundance of brown coal that could last for many hundreds of years at current rates, but if you look at the current expansion of things like black coal mining, we will run out sometime over the next 100 or 200 years. As a nation, we should be able to make the courageous decision to say that we need to find a long-term answer beyond that time scale, not just for the next 10, 20 or 50 years but beyond the next 100 years.

If we are looking beyond that 100-year time frame, we have had 200-years-odd of significant coalmining in Australia. If we have 200 years of the nuclear industry in Australia, and if we could come back and compare the impacts, I think we ought to be able to see that the nuclear industry and uranium mining will have a significant impact over that time frame if it is allowed to expand and continue. In my submission I have documented some of what we know of the impacts to date from uranium mining in Australia. Until the 1980s we were a fairly small producer, but it was used very potently politically. We know that the environmental cost from the original mines, from the fifties and sixties, was significant; sites like Rum Jungle, Radium Hill and so on.

One of the things that has been underestimated, certainly in the current debate, is that the environmental impacts of the current operating mines are significant. I placed evidence before the 2002 Senate inquiry that, when it comes to the Beverley uranium mine and the proposed Honeymoon mine, there is no scientific evidence on the public record that the company has released that backs their claims with a good scientific basis.

I have also done a lot of work looking at issues at Ranger and Jabiluka. Looking at Olympic Dam particularly, the environmental cost of any future expansion will be extremely significant. That sort of stuff is not being factored in significantly enough. One great example of that at the moment is that—on Wednesday when the referral was made for an environmental impact assessment—they are now proposing to put a new bore field right by the springs yet again.

We are going to repeat the mistakes of the past, where we add to the impacts. Rather than come up with better options which actually look long term for a legitimate supply of energy beyond, say, 100 or 200 years, we are doomed to make the same mistakes of the past. We need to be courageous. We need to think and we need to have good science behind the debate, informing things so that we can have accurate debate, not debate based on blind faith.

CHAIR—Thanks for that. On page 13 of your submission you argue that it is important to note the greenhouse gas produced from the mining of uranium. Wouldn't you agree that, on a full cycle basis, nuclear power saves the emissions of a vast amount of greenhouse gases as opposed to coal? In fact, in one of the previous submissions we received, it was indicated that if you add coal, oil and natural gas, they contribute some nine billion tonnes of CO₂ to the atmosphere each year and nuclear power avoids the release of some 2.2 billion tonnes of CO₂ annually.

Dr Mudd—If you look at Olympic Dam, both its current operations and its future operations, and Ranger et cetera, there will be at least one millions tonnes of CO₂ released a year. If those operations expand, that figure will obviously increase. One of the issues is that to get the uranium out in the future is going to require more energy, so there will be more relative CO₂ emissions. I agree, CO₂ is a massive issue. In a lot of ways, we do not replace that with what is another massive problem in terms of nuclear waste. You do not replace one problem with another bad solution. You find a good solution, not a bad one.

Mr ADAMS—We do not disagree. I do not think many people disagree. There is a fair bit of looking at renewable energy. If the world did that, the Americans would be very pleased to get away from oil economies as well. I think they are dropping a fair bit of money into alternatives, but we do not have any, do we? How do we replace a coal fired base load power station? What is to replace that at the present moment?

Dr Mudd—The way our industry works is based on efficient distribution and inefficient use. Everything is hardwired so that we need that base load power. We are not going to be turning off reactors or coal fired power stations today. That is a complete nonsense. Therefore, over the long term we have a few decades to translate the way our current systems work. We can look at redesigning our energy efficient buildings. We can look at distribution.

Mr ADAMS—I do not disagree, Dr Mudd. We are doing that. There has been academic work done. There are buildings in Sydney and in Tasmania where we have done work. We have got

wind operating. Are you talking about improving the inefficiencies in energy distribution and in buildings like this? We have a lot of lights on in here. Is that going to solve the problem?

Dr Mudd—It is a long way to go towards the answer. I do not know the perfect answer. I do not think anyone has a perfect answer, which is why we are here, but ultimately I know what is a bad solution. Long term, coal is not a good solution. Economically, if Australia does not make courageous decisions now, we are going to pay in the future.

Mr ADAMS—But I am trying to get to what is the courageous decision. Tell us what the courageous decision is, other than having a vision—

Dr Mudd—Putting a lot more money into renewable research, efficiency and all those types of things.

Mr ADAMS—Resources. We need more money going into research.

Dr Mudd—Absolutely. If we look at the development of commercial nuclear reactors, it took 2½ decades to go from the first reactors that were built for the Manhattan Project, through to the commercial reactors that were then built in the late sixties and seventies. It is not exactly a new problem, in the sense that it does take time to develop technology. We used to have some of the best research in the world for things like solar cell technology. We are not funding that to anywhere near the same degree we used to. There are a whole lot of things there. There are some countries in Europe that have more export earnings from selling wind turbines than we do from our uranium.

Mr ADAMS—Sure, but they own the technology; of course they do. We use their technology here in Australia. It is German and Danish technology. We do not have the technology. If we could develop new technology, that would be tremendous.

You were talking about the efficiencies, but I lost my train of thought about what I was going to take up with you. I wanted to come back to another point that you make in your submission. You have some pretty solid words against state regulators. You don't think state regulators are doing the job?

Dr Mudd—No. There is a fundamental conflict of interest for a department of mines type of agency, whether it is in South Australia or the Northern Territory, to be both the active promoter and developer of the mining industry and its environmental regulator. They need to be separate. There are heaps of examples of that in terms of Ranger, and also in South Australia and elsewhere. I can talk more generally in terms of coal mining. There are lots of mines in the Bowen Basin that are producing acid mine drainage. You could also make the same analogy with things like HIH Insurance, where the regulators are too captured. They are not independent enough and they do not have the freedom to really do their job properly.

Mr ADAMS—But they must be professional people.

Dr Mudd—Even so, if they do not have the legislation to back them up, they can only go so far. If they are legislated to be both a promoter and a regulator, that is a fundamental conflict of interest. They cannot do their job properly because in one sense they want to promote the

industry but in the other sense they cannot regulate it to the extent that it really needs in order to meet legitimate community expectations. Olympic Dam is a good case study because most of the powers for normal regulation of most types of mining do not apply because of the Roxby Downs Indenture Act.

Mr ADAMS—Do you have any proof or do you just say these things?

Dr Mudd—Proof for what?

Mr ADAMS—You infer that these people are not regulating properly.

Dr Mudd—You only have to look at the environmental problems that are left behind. You could look at Mount Todd in the Northern Territory, where the regulator actively signed off on a rehabilitation bond just so that the company could keep going. They have a financial interest in things producing, because it gets them royalties and things like that. They signed off on that and now the Territory government is facing a \$30 million liability and clean-up because the company went bankrupt and walked away. It is a great example of where the regulator was trying to both promote the industry and regulate it, and it failed.

With Ranger, the regulator has said that under the existing arrangements the rehabilitation bond is somewhere in the order of \$30 million, but the total rehabilitation cost to do a decent job on that is somewhere in the order of \$180 million. Why has the regulator allowed that situation to develop? Because they are both the promoter and the regulator. It is a fundamental conflict of interest. I could quote heaps of other examples like that.

Mr ADAMS—\$180 million?

Dr Mudd—That is what ERA is now saying it will cost to rehabilitate the Ranger mine.

Mr MARTIN FERGUSON—Which they have to meet the cost of.

Dr Mudd—Yes, they will have to pay for that, assuming they will be around.

Mr MARTIN FERGUSON—That clean-up is locked into all the mining approval processes, and ERA does not deny their responsibility, putting aside what the potential figure is. You accept that, don't you?

Dr Mudd—At present what ERA is legally required to do is to provide \$30 million. That is the current system. What ERA is planning to do and what the regulators are allowing to happen is to say that ERA in theory will be around for the next six to eight to 10 years and in that six to eight to 10 years is when they will pay the full \$180 million. If they go bankrupt tomorrow, that \$180 million is not available, only the \$30 million in the bank is, which means taxpayers—

Mr MARTIN FERGUSON—I do not think Rio is going to go bankrupt tomorrow.

Dr Mudd—It is not Rio. It is ERA who owns and operates Ranger.

Mr MARTIN FERGUSON—Come on, it is Rio! They assume responsibility—ERA—including Jabiluka. Let us not create furchies with respect to responsibilities to clean up Jabiru.

Dr Mudd—We should also, therefore, not ignore the possibility that Rio will sell out and someone else will have to take that on.

Mr MARTIN FERGUSON—Mount Todd is more a problem for government trying to pick winners, rather than the market operating, isn't it? It would be the same if Methanex fell over.

Dr Mudd—I do not think it is a simple—

Mr MARTIN FERGUSON—The government should not try to pick winners.

Dr Mudd—When it comes to things like uranium mining in a World Heritage area, governments should not be trying to pick winners. They should let markets drive things. They have to make sure that standards in operations are met. Those standards are not being met because the regulator is also the promoter.

Mr MARTIN FERGUSON—That goes to environmental approval process, in which there is a role for government.

Dr Mudd—It does not mean that people in the community have to accept everything that goes with that. We can still criticise and have a legitimate role in terms of public policy.

Mr MARTIN FERGUSON—I understand you have a view about future energy being related to coal and uranium. What do you say about gas?

Dr Mudd—Gas is exactly the same type of situation. Gas has less environmental impact than coal or nuclear in the short term, but in the long term it is not an answer either. There are limited resources of gas throughout the world.

Mr MARTIN FERGUSON—Victoria has an emerging base load energy problem not unrelated to the growth in the number of airconditioners switched on during the summer period. What should Victoria do to overcome its base load energy problem? It is a decision that has to be made in the foreseeable future.

Dr Mudd—There are a number of different strategies. One is to provide some funding to help retrofit a lot of buildings. We could provide all sorts of things to look at energy efficiency in the same way that, with the water debate, governments are now funding things like solar hot water systems and rainwater tanks. Those types of things are being put in because we have hit that limiting problem in terms of water supply. Therefore, we should be able to use the same capacity and the same power that government has to be able to deal with it. We can predict the problem far enough in advance that we should be smart enough to plan for that.

Mr MARTIN FERGUSON—The truth is we have not. We should be looking at how we economise with respect to our energy use in the same way in which we are focusing on better use of our water.

Dr Mudd—Absolutely.

Mr MARTIN FERGUSON—The truth is we do have a base load energy problem in Victoria that we are going to have to confront in the foreseeable future. You cannot achieve that change in energy use overnight.

Dr Mudd—Part of the solution for Victoria in the short term, in the next two to three decades perhaps, is gas—not brown coal, not nuclear.

Mr MARTIN FERGUSON—In terms of alternative energy I have no problems with us, as a nation, focusing on that. We should, because it is potentially an export earner, a job creator et cetera. You just said to throw more money at it. What particular hard and fast incentives or changes in policies do you think are required at Commonwealth and state levels to encourage such developments? Everyone can say, ‘Give us more money.’ We want some examples of policy initiatives that should be seriously thought about.

Dr Mudd—That is not a specific question that I have thought about exactly, so I will have to—

Mr MARTIN FERGUSON—It is pretty important. As an academic, you start focusing on real policy options rather than emotion, don’t you?

Dr Mudd—All of my evidence is basically good scientific peer review work in terms of the impacts of mining. It is perfectly legitimate for a human being to get emotional about protecting something, so I do not like the premise from which that is coming. To come back to the question, there are a number of things that could be done, whether it is through subsidies, whether it is through looking at an issue such as carbon tax, whether it is helping facilitate processes to make sure that we can get new sites up, whether it is wind power, whether it is solar facilities, whether it is looking at ways that we could have retrofits for buildings in the same way that there are a lot of initiatives at the moment to look at retrofitting urban areas to make them more water efficient. Governments could do a lot, at Commonwealth, state and local level, to help achieve those types of things.

Mr MARTIN FERGUSON—You say your submission today is based on your work and you have questioned the in situ leaching process at Beverley. What do you say about the CSIRO research which says it is a pretty good process from an environmental and scientific point of view? Why do you dismiss that?

Dr Mudd—There are two aspects to that. Firstly, you can use in situ leaching for things other than uranium, and I will come back to that question. Secondly, in terms of what they are doing there, if you look at the evidence that is on the public record, you need to be able to look at what the long-term impacts are on the groundwater system. There is an extremely remote possibility that Beverley could affect the Great Artesian Basin, but what is the big game? The real issue is what it is doing to the aquifer that it is mining. In terms of the scientific evidence, there is no public data that demonstrates and proves that their claims of scientific processes actually occur.

Mr MARTIN FERGUSON—That is CSIRO?

Dr Mudd—The CSIRO in the same report when they did the review. I was involved on the steering committee and I made these comments at that time as well to the steering committee and through the process. There is still no public data to back up those claims. Although the CSIRO has done the review, the company has very carefully left off that data. I have had this checked with senior professors and other academic colleagues around the place, and people still agree with the basic premise of my arguments that there was no data to justify their claims that there would be no long-term impacts on groundwater.

When I have looked at the data, when I have looked at the processes, when I have looked at the evidence from sites overseas, where you can get a somewhat similar analogy—whether it be the US, the Czech Republic or Kazakhstan—there is good evidence to suggest that what they are saying at Beverley is not true.

Mr MARTIN FERGUSON—Have you written a paper on this?

Dr Mudd—I have had papers presented at two international conferences and I have had papers accepted in international journals, where these criticisms have been made, and they have only ever been heartily supported by my academic colleagues. I have never had anyone disprove those scientific criticisms.

This has been going on for seven years now, and the company has still not released any data that disproves my scientific criticisms. If they have that data, and if they can give me good scientific data, I will take that and accept it for what it is, but they have never released that and they have never shown any willingness to. Even during the process where we had the CSIRO review in South Australia under the EPA, they still refused to engage in releasing that data publicly so that, in terms of good scientific peer review, it could be analysed and the claims could be assessed.

I have gone through that process myself. I have done all the work and I have stood before colleagues at international conferences on uranium mining and the mining industry, and I have only ever been congratulated for the quality and the thoroughness of my work. I have never had anyone disprove my arguments.

Mr MARTIN FERGUSON—What was the CSIRO's reaction? Its report suggested that waste disposal was more cost effective and environmentally responsible and it recommended that the acid leaching disposal of waste by injection be allowed to continue. What has their response been to your alternative work?

Dr Mudd—They have completely ignored it. They have not taken the basic criticism seriously, which is why those criticisms of the CSIRO work are still valid. What it comes down to is what value you put on water. What value do you put on the groundwater system? That is an extremely arid region. You have a whole bunch of mining projects there. It could be copper, it could be gold, it could be all sorts of other things which are potential projects. When you have an aquifer that can be pumped in terms of its hydraulic characteristics, it is suitable as a potential water supply. If you look at what happens in the mining industry, whether it is Western Australia or elsewhere in South Australia, or wherever, they use water that is sometimes 10 to 20 times more saline than the water at Beverley.

That is used directly. It has an economic use. That is not thinking about the environmental cost, about what are the long-term risks in terms of where that damage to the groundwater quality is going. There is an intrinsic economic use for water of any quality. To damage that quality puts burdens on future generations. What they are doing is not just copper and it is not just gold, it is actually uranium, so it is a much higher risk. I have presented all of these arguments, as I said before, and they have never been accepted.

It comes back to one of the arguments we were talking about before. Part of CSIRO, in a way, is funded by the mining industry, so they do not want to criticise. Although there are good independent scientists in there who understand the basic principles and the processes and the data you need to answer scientific questions like that, they are not allowed to do it publicly.

Mr MARTIN FERGUSON—Do you have any evidence to suggest that because CSIRO receives private funding they are doctoring their research outcomes?

Mr ADAMS—That is what you just said.

Mr MARTIN FERGUSON—That is what you have just suggested.

Dr Mudd—I know exactly what I just said.

Mr MARTIN FERGUSON—This is pretty important. If you have that evidence, it needs to be made available to us as government representatives, because we need to go to the minister about it.

Mr ADAMS—That is right.

Dr Mudd—The evidence is that report. I was involved in the steering committee. These criticisms were put to them. They understood. They agreed that these issues were significant, that that data was needed to be able to answer that scientific question and then the report basically sidestepped it. It did not actually look at it, and the data that is in there is not sufficient from a scientific point of view to answer those questions.

CHAIR—But you are only saying that because you do not agree with the report.

Dr Mudd—I do not agree with the report because the report is not based on good science.

CHAIR—Do not cast aspersions on the CSIRO because you do not agree with their view. They are a very respected organisation.

Mr ADAMS—And you do not like uranium mining.

Dr Mudd—As I said, I would apply the same logic in terms of impacts on groundwater resources, whether it be copper, whether it be gold, and I would also make a lot of the same arguments in terms of the potential long-term impacts from, say, cyanide use in in situ leaching for gold. If there is good scientific evidence that the damage that is being done can either be remedied or will naturally attenuate itself, why wasn't that in the report? If the data exists, why wasn't it in that report?

Mr ADAMS—They might not think you are worthwhile answering. Have you ever considered that?

Dr Mudd—Why am I accepted internationally then?

Mr ADAMS—I do not know.

Dr Mudd—Why am I given so much respect internationally?

Mr ADAMS—I do not know that.

Dr Mudd—Why is my work peer reviewed and published in credible, strong international journals?

Mr ADAMS—I do not know that.

Dr Mudd—And then they do not answer the question.

Mr ADAMS—Yes, they have.

Mr HATTON—I am at a bit of a loss, Dr Mudd. You have worked in two industries, I understand, uranium and coal. Is it ever safe to work in those industries?

Dr Mudd—I think there are better alternatives we can find as a society. We used to mine asbestos. We still have plenty of asbestos resources around the place, and yet we do not do that now. One of the questions that I have always come from in terms of my own understanding of toxicology and issues like that—because it is part of what I do and it helps inform the work I do as an environmental engineer—is why are cancer rates continually going up? There is only one form of cancer that is going down, and that is lung cancer, basically because smoking is becoming less prevalent. There has to be some cause and effect there. What is causing the increase in cancer rates? It is not demographics and it is not the increasing age.

Mr HATTON—In Williamstown it is diesel particulates, not smoking.

Dr Mudd—Absolutely, PAHs and other things. There are whole bunch of things in there—benzene and so on—absolutely. There are a whole lot of things out there that are causing this increase in cancer. That is part of it and, obviously, nuclear can cause cancer. There is a huge debate about the exact rates at which it does cause cancer. But ultimately I think there are better alternatives that we can use that can have good public health outcomes, good environmental outcomes and lead to a more sustainable long-term legitimate energy supply.

Mr HATTON—Your academic career is largely based on the two industries that you have been involved with as an environmental scientist, looking at those industries and looking at the deficits in terms of how they go about their business, so your PhD on ash and brown coal and the other work you have done in relation to mining processes and uranium. Essentially, you are standing against that and looking for ways to criticise what is happening. That has been your experience in terms of your published academic work. It seems to be down that road.

Dr Mudd—A lot of the work I have done is trying to understand a lot of the scientific processes going on—whether it is brown coal ash disposal, whether it is acid mine drainage at Rum Jungle—doing some of the field work, laboratory work, modelling work or review work and critical thinking about how significant some of these issues are.

Overall, a lot of my work is done in my own time; a lot of the work is done as part of my professional career. That has led me to the point where I think both coal and nuclear are not long-term answers. They both intrinsically lead to global warming, waste problems, proliferation problems, and there are health issues. Certainly down in the Latrobe Valley there was an historic issue with that. It is probably not as bad now as it used to be many decades ago. But in the long term, if we keep mining brown coal in Latrobe Valley, what are we going to have? A basin that is two kilometres deep by 10 kilometres wide. Some of these things get a bit ridiculous. At some point we need to change and choose a different path about how we generate our energy and go about living our lives.

Mr HATTON—I may have misunderstood. Did you say the uranium cycle, if you use uranium to produce nuclear energy, will add to the greenhouse gas problems?

Dr Mudd—Certainly in terms of Olympic Dam it will create an increase. Any expansion of Olympic Dam will lead to an increased rate of greenhouse emissions. BHP Billiton, or WMC — before they got taken over by BHP—were looking at ways they could offset that. Gas is part of the solution that they were trying to look at. I think they are looking at other options as well but ultimately it will lead to some increase.

Mr HATTON—It will lead to some increase in CO₂.

Dr Mudd—The actual mine production of that uranium, yes.

Mr HATTON—I would not think it was of the order of magnitude of the problem we have from other technologies, but can you specifically tell me about the nature of the brannerite at Olympic Dam and why you think there will be that increased production of CO₂ and what level it would be? You argue that it is hard to dissolve the uranium out and they will not get as much as they think. Could you give us a bit more information on that?

Dr Mudd—Uranium exists in a bunch of different minerals. There is pitchblende, which is basically just uranium oxide; davidite, which is basically a titanium/iron/uranium mineral that was mined at Radium Hill. Some minerals are easy to dissolve with chemicals such as acid or alkali; others are not. Brannerite is one of the uranium minerals that is extremely difficult to dissolve. From my understanding, the bigger geological resource of Olympic Dam actually contains more brannerite than at present. At Ranger, where it is mostly a pitchblende mineralisation—that is, uranium oxide—they get about 90 per cent of the uranium out when they mill.

At Roxby they have only generally been able to average around 65 per cent of uranium extracted and that is because roughly about one-third is brannerite mineralisation, so it is very difficult to dissolve in a conventional mill. My understanding is that for the future resource—if they expand—it goes up to around 50 per cent. That means they have to either accept that they will only get a reduced uranium extraction efficiency in the future—that is, somewhere in the

order of 50 per cent—or they have to use different types of processing than they have at the moment.

When Radium Hill operated it had to go to extreme conditions which were pretty much unheard of at the time: super-high-strength sulphuric acid and boiling conditions—very rare in terms of any mineral processing at the time in the fifties and sixties and never been used again for uranium. Now they are starting to apply that type of technology for things like nickel and it is proving very difficult, even with a lot of the modern technology that we have. Also part of the work I am doing in terms of a lot of the sustainable mining research is trying to pick those trends.

Nickel is an example of the same type of thing. It is requiring more and more energy to get out the same amount of nickel. Therefore, in the long term, if we keep these trends up we are compounding all these problems. It is not really providing a long-term solution about efficiency, whether it is resource efficiency such as recycling aluminium, recycling steel, concrete or any other types of material. It is the same thing with uranium. We do have a limited resource base and the cost of getting it out is going up.

Mr HATTON—It interesting that you have been placing a lot of emphasis on the scientific approach to it and the fact that your work is scientifically validated and peer reviewed. Do you think it is possible for two different scientists to look at the same set of data and come to different conclusions?

Dr Mudd—That is the scientific process.

Mr ADAMS—Like lawyers.

Mr HATTON—Like lawyers, yes.

Dr Mudd—Science exists within our society in that sense. We cannot separate that from our human values. It is fine to have legitimate scientific debate. That has been going on for thousands of years. There is nothing wrong with that. But we also have to be able to say, ‘The public has a right to be able to choose which scientist they believe, which scientist they feel is correct.’ That is something for the public to decide.

Mr HATTON—You would agree, would you not, that a public that is not scientifically literate—and most of the public worldwide generally could be taken to be that—would find it difficult, without a background in terms of the methodologies and the analytical approaches and so on, to gauge between that? We do not really have a completely peer reviewed group that we can say is the standard. We do not have that in CSIRO in Australia. The American authorities do not have one central place people can go to and feel completely comfortable. It exists nowhere else in the world and so it is part of disputation, though it is possible to have a Ptolemaic system for 1,000 years and Copernicus completely disagree. In fact, we would say that he was right and they were wrong, despite people being convinced. Do you think all of your work is based on absolutely rigid, scientific, logical reasoning?

Dr Mudd—To the best of my ability, absolutely. If it was not, certainly it would not get peer reviewed and published like that. There are two aspects I can comment on. The public does not

need to be scientific experts to be able to make informed decisions. It is perfectly legitimate for society—whether it be ours, the Chinese, the Indians—to make a decision on public policy based on a moral position. That is a perfectly legitimate aspect. What we need to make sure of is that what is—

Mr HATTON—So moral or ethical, rather than scientifically based.

Dr Mudd—Yes. That is a perfectly legitimate thing, that we can debate issues about whether it is genetically modified organisms, greenhouse impacts—all sorts of things like that. We can say that it is still legitimate for the public, even though they may not necessarily have a PhD in the impacts of mine waste to be able look at Mount Lyell and say, ‘That’s wrong.’ That is perfectly legitimate thing.

I can go as a scientist and quantify the acid mine drainage potential of the waste. I can look at the impacts on the water quality. I can look at what concentrations kill certain types of fish or algae. I can start to go through all that science and I can explain where the uncertainty is on all of the measurements in part of that, but the public still has a right to say, ‘Okay, we don’t care whether you have quantified the impact as one in a thousand, we don’t want that one in a thousand.’

Mr HATTON—Or people could start from an a priori position and make a priori assumptions or suppositions, and make a decision on that basis. If they take a moral approach it is not necessarily scientifically based or on any other sort of basis. They can just decide they will take that approach.

Dr Mudd—Yes. You can think of a range of different issues where that happens, where science can go down a certain path and science can do certain things but morally society chooses not to do that.

Mr HATTON—In the evidence you gave us in terms of waste and proliferation, you argued, ‘It is illogical to assume that there is no swapping between civilian and military nuclear regimes,’ and then went on and talked about how waste and so on was being reprocessed by others. How scientifically based is that, or is that based on illogical supposition?

Dr Mudd—If you look at the history of where we have exported a lot of our uranium to, whether it is France or other countries, it is very clear to me that if you look at China’s internal uranium resources—and I do look at all of these reports in the IAEA and the OECD and so on where it is part of the scientific evidence you need to go through—what China would be wanting to do is to say, ‘Okay, if we have our own uranium, our own internal uranium, we use that for our weapons program and we buy on the international market for our commercial program.’

Mr HATTON—You are making a supposition, an a priori assumption about that. You cannot validate that in any particular way.

Dr Mudd—There would only be one group who could and that would be the Chinese themselves. But you can look at it in that there are similarities in the way the French have done that, in the way that other groups have done that. Basically, when I look at different reports, my

reading of them and my understanding of them and bringing to bear the intellectual capacity that I have leads me to that conclusion.

Mr HATTON—Because you are a normal human being, the arguments you can put forward can have a whole series of bases to them and a number of drivers. Let me go to the question of how we get from here to there. You started your address to us basically saying that to get from here to there we just really need to look at ‘there’ 100 or 200 years down the track. If the approach was that easy, we probably would have done it prior to the Industrial Revolution. As you would appreciate, the variability in terms of use of energy resources, and the decisions that people have made as they have stumbled through history, conditions where we are at now. It also conditions it in terms of a costs basis so that the industries that you worked in—uranium—admittedly the simple energy coming from that provides 16 per cent of the total.

But by and large the dominant form of energy use is in fossil fuels, with all of the ramifications of what has happened there. Some people have argued that we should be going to a hydrogen based economy. The key question then becomes, ‘Well, how do you get there?’ because to produce hydrogen you need to produce electricity. A possible simplistic approach or maybe the easiest way to do that is to use nuclear energy to produce the hydrogen that would then drive a hydrogen economy, which of course would then need a whole range of other attendant things. How do you see that? Is the end run probably a hydrogen economy? It may, in fact, be something that we have not even thought of. Is that where the committee is heading?

Dr Mudd—That might be part of the energy answer in the future. One of the things that I think I can comment on there is that, if we look at things like the Industrial Revolution, we thought we could disperse a lot of the pollution. When we started mining asbestos, we thought we could do it safely; we did not think there were any problems. Sometimes these things take time and, historically, when a lot of our industries have been developed we have not understood or been aware of the long-term consequences. It has only been in the last 30 years that we have started to understand the impacts of global greenhouse emissions. Things like chlorofluorocarbons are another example: they seem to be completely innocuous, a wonderful chemical, and yet quickly we were able to move out of them internationally.

Mr HATTON—But after it was conclusively demonstrated scientifically and the world’s governments signed up and said, ‘Yes, we can see this is absolutely the case and, yes, it is possible to use other refrigerants’—which may have their own problems; there is some evidence to indicate that. You are arguing the same sort of approach to it.

Dr Mudd—In that sense, the same logic. We know now that the majority of scientists in the world, the thousands of scientists that form the IPCC, categorically state that climate change is happening and it is caused by human activity. That is absolute. How do we get from here to the hydrogen economy? BHP Billiton have already looked at switching their whole Pilbara operation to hydrogen. Shell have finally recognised the legitimacy of the oil depletion argument and are now actively planning; they are well advanced in their planning to move beyond that. Another company is BP, British Petroleum. Some companies are way ahead in the game of thinking of ways to do that.

A lot of the technology is there, but the economic and political infrastructure to help facilitate that pathway is not. That is what I think is really missing at the moment. We are sitting on the

fence and we can choose to go either way. We can choose to go down the path of things like nuclear, which we know does have risks. Nuclear is not zero risk, and neither is hydrogen. Look at things like LP gas in cars. People were saying it would be too dangerous. Sometimes there is a fear about new technology, but these days we would hope that we are a lot smarter in the way that we go about predicting the long-term consequences—not five or 10 years, but 20 years or longer—because we know a lot more these days. For instance, we have a better ability to do research on what causes cancer, although most cancer research is directed to cures not cause. If we are thorough, we should be able to say, ‘Okay, from a public policy point of view, from both a moral point of view and from the weight of scientific evidence, let’s look at things like hydrogen, let’s look at renewables, let’s look at efficiency,’ and make sure that we do that in a way that gets from this point now to that point in the future.

Mr HATTON—From where we are now—producing base load power and particularly with the introduction of gasification; changes by which those coal fired plants are operating now—what do you think is the most sensible thing to do? Are companies doing the right thing in trying to make improvements there? Do we need to do a lot more in terms of our clean coal, particularly given the dirty coal nature of Yallourn and the fact that brown coal is particularly difficult. Given that is your area of expertise, what major steps need to be taken in terms of cost and efficiency and availability of resources and the fact that they are so important in terms of exports? Is fixing coal the most important intermediate thing we can do, or is switching more to natural gas a better way for us to go?

Dr Mudd—Looking at some of the impacts of coal mines—whether at the Bowen Basin, the Hunter Valley or Latrobe Valley—coal is not really a long-term solution. Natural gas, I think, has to be a big part of the intermediate solution over the next 20 to 30 years. I think Australia should be keeping that gas for itself so that we can keep our own industry going. Once we have more efficiency in our building design, once our cars become more efficient by switching to hydrogen or fuel cell technology—there are a bunch of things there—I think gas is probably one of the key answers for base load power. But it is only a short-term solution; it is not long term. We do not have the resources for gas in the long term, but it is a bridge.

I have heard some people in the environment movement in Victoria say, ‘If you have to build a new brown coal fired power station in Victoria, don’t build it at Hazelwood.’ At least build a new generation gasification one that will be a 20-year facility to help bridge the gap; not the existing 50-year-old technology that is a dinosaur and has much higher greenhouse emissions per energy produced.

Mr ADAMS—Do you think we should deny the rest of the world our gas? You just said that, I think.

Dr Mudd—It is a political and moral decision, really.

Mr MARTIN FERGUSON—It is a big decision.

Dr Mudd—I know it is a big decision. It is not something I would say lightly. As you can probably tell, there are a lot of things I do not say lightly. They are quite considered.

CHAIR—What about our trade account as a result of not selling gas?

Dr Mudd—Again, it is a decision that we can make.

CHAIR—What are we going to give up?

Dr Mudd—If we look at Australia in 50 years time, our own oil reserves are being depleted—things like that—so that will have a big impact in the future. We can start to plan for some of these things. We are smart enough to recognise some of these things, so we should be able to come up with ways to develop new technologies or new industries so that we come up with exports that should be able to replace those.

Mr ADAMS—Some people would argue that the Second World War might not have happened if the Japanese had not been denied some oil in the thirties. One decision can cause a lot of others.

Dr Mudd—History is a good teacher. That is why I often go back to mining history from 100 years ago. It can sometimes help to form current thinking.

Mr ADAMS—Simplistic views about not being able to do X because it fits my political argument is not, I do not think, the right way to look at some of these things.

Dr Mudd—I have thought about these issues for a long time and I have discussed them with lots of different people from all sorts of political persuasions. The majority of people believe that we should be doing a lot more in Australia to promote renewables, to make other alternatives to coal and nuclear.

Mr ADAMS—Regarding renewables, we have gone down a certain line with solar energy, but there seems to now be a stoppage in that area, or a slowdown. The price does not seem to have come down; we have spent a hell of a lot of public money in the area. Have you had a look at that in relation to renewables?

Dr Mudd—I have not looked at that specific aspect. I have only noticed generally and I thought prices were still coming down. Maybe the rate of that decline has slowed. I am not sure of that.

Mr HATTON—In terms of renewables, I will use one example. The member for Lyons comes from Tasmania; they have a lot of wind down there. They can produce a lot of energy as a result of that, because the wind is constant, as can South Australia, Western Australia, right through the Bight and down into Victoria. One of the problems is that where you generate is not where you use. We know that there is a loss in terms of line transmission and a significant loss in efficiency. In terms of developing wind power, how do you see that happening and how much of a substitution is it, given those fundamental problems?

Dr Mudd—That fundamental problem is why I think we need to have decentralised power, rather than centralised base load power. In that way you have a fuel cell, you have hydrogen, or you have some other sort of energy which you burn and you create the energy at the source where you use it. Given that, and given our current technology and projected technology over the next two decades, we still need these bridges. Gas is part of that, wind is part of that, as are solar and other technologies. I think there will still be a need for things like that for some

decades. You can have quite significant scale wind farms in places where you can generate. We already accept our current system that has that inbuilt inefficiency. We can tweak that a bit as engineers; we can improve the efficiency somewhat. But you eventually hit the barrier of what is the limit for that type of technology.

The internal combustion engine is a classic case. We are basically at the limits of what we can do with that technology, so any new types of technology, whether they be hydrogen, fuel cells, the hybrid type cars that we have at the moment, are part of the way we are starting to develop the technology to break through and actually do that. The easy policy is to build a big power station somewhere and then distribute the power. The harder solution is to help change human behaviour and decentralise generation, rather than having a centralised generation.

Mr HATTON—And part of the problem is that if you cannot do it, if you cannot push people to do that and you cannot push it in the right ways, and they act as they have historically in fundamentally different ways, you then have to cut your policy cloth in order to deal with it. My last question: are you aware of any technologies currently available, in terms of fossil fuel alternatives, that could provide us with a way forward—Australian-produced ones in particular—to providing base load capacity, where we could say, ‘Maybe that is one we did not realise was there a year ago or two years ago, but this could be a way through the morass’?

Dr Mudd—Geothermal is one that is coming up on the radar that I think we could be looking at a lot more. I do not think geothermal is zero risk but I have always been quite favourable to things like geothermal. But you suffer that same problem: that where the geothermal energy is is not where the use is. I think, long term, what is a more sustainable energy system is one that is decentralised and allows people to take small amounts of power and generate it where they use it.

I currently sit on the Great Artesian Basin Coordinating Committee, the Commonwealth-state committee looking at management of the Great Artesian Basin. When I was talking with one of the regulators—one of the departmental people from Queensland—he was really impressed with the way that Victoria has gone about its water debate recently, and how that is helping to change people’s behaviour. He was saying he really wishes that Queensland could follow the same line.

There are ways in which governments can provide that policy lead and sometimes communities have a legitimate and an important role in that sense. Other times it is professional societies that need to be part of that debate. There are all of those sorts of things where we can do that and say, ‘What do we need to do? We need to change people’s behaviour. We need to rearrange the way we design our buildings.’ As engineers now, one of the things that we are doing is teaching our students, ‘When you are designing a building, make sure it’s energy efficient, look at your resource efficiency, all of those things.’ That sort of stuff is starting to become very well entrenched in the broad civil industry. All of those things are what we can do.

Mr HATTON—Part of the answer to that is that you need all that behavioural change. Are you aware of the work that has been done with the solar tower and the way in which the original German technology has been modified in Australia and has the capacity to be used in very diverse locations in relatively small scales? Are you aware of that work?

Dr Mudd—Only very vaguely. It is one thing that I am interested to dig into, but I just have not had time to really look into it yet. That is another technology that could work. I am not sure.

Mr HATTON—It might be a case of ‘Watch this space’ as our inquiry continues. Thank you, Doctor.

CHAIR—Thank you for your appearance before the committee today. If there are any further questions, the secretary will contact you.

Proceedings suspended from 12.45 pm to 1.01 pm

GREEN, Dr Jim, National Nuclear Campaigner, Friends of the Earth**STUBBS, Miss Michaela, Nuclear Campaign Coordinator, Melbourne, Friends of the Earth**

CHAIR—Thank you for agreeing to give evidence before this committee, the public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearings are a formal proceeding of the parliament and remind you that the giving of false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. I also remind you the committee prefers that all evidence be given in public. However, at any stage you may request your evidence to be given in private and the committee will then give consideration to your request. I invite you to make a short opening statement before we proceed to questions.

Miss Stubbs—Friends of the Earth is a non-profit non-government organisation, which is committed to social justice and environmental sustainability. We recognise that these two issues are inextricably linked. Friends of the Earth believes that social impact assessment, consultation and approval processes with traditional owners and affected Aboriginal people is inadequate. This issue needs to be addressed within the structure and regulatory environment of the uranium mining sector. There need to be corporate codes of conduct which are taken up by government at national and state levels.

The current situation is unacceptable, where there are people with legitimate concerns who are being excluded from any negotiation or consultation process. There is a demand for empirical improvement in existing operations which include clear recognition of the rights of Indigenous communities and traditional owners. We travel regularly to meet with traditional owners and Aboriginal communities affected by uranium mining.

Many have expressed disapproval at the activities of mining companies on their land and they have raised serious concerns about the damage being done to their country and sacred sites and the inadequacies of the consultative process. Companies go into communities that do not necessarily have independent expertise in those fields and the ability to translate that information into language or culturally appropriate material. Friends of the Earth is extremely concerned that this happens without an independent observation of this process.

When a community does say no, it is not acceptable for these companies with power and influence to keep pressuring that community, whether by offers of various opportunities—be they financial, access to employment or health and education services—or by threat of legal action. People should not be in a position where they have to support uranium mining to get economic benefit. These should be the interests of the government and not a trade-off for allowing companies access to mineral wealth.

We have seen mining companies frequently involved in establishing small Aboriginal groups who are willing to support their activities, and providing financial support. These groups are then regarded by the company as the official representatives and they proceed to consult with them.

This gives the appearance that they are going through the correct process whilst ignoring others with legitimate interests. These divisive tactics used in the past have been well documented.

The division in communities and ongoing damage caused by companies has not been addressed. Open and inclusive community consultation and negotiation processes should be established and administered by an independent body. Mining companies must not have control of these processes or have veto over who is considered a stakeholder. There are many other ways in which mining companies impose on the rights of traditional owners and Aboriginal communities, including manipulation of the Native Title Act, excluding participation at the environmental impact statement stage in various ways and overriding the Aboriginal Heritage Act. These situations are not unique to one particular project. They have occurred in every community where uranium mining occurs.

I would like to refer to the opening statement made by Mirrar senior traditional owner Yvonne Margarula to this inquiry. She points out that the community overall has not benefited from uranium mining and that the mining royalties have not improved their quality of life. The traditional owners have been pushed aside by people in government, mining companies and Aboriginal organisations who do their bidding. Once these people get their project up and running, the problems of the communities are ignored. She expresses concern for long-term environmental contamination and toxins entering the food chain. These concerns are echoed everywhere that uranium mining has occurred.

The Mirrar right of veto for the Jabiluka mineral lease is a good example of a positive outcome for an Indigenous community opposed to specific projects. This came about by the Mirrar traditional owners' struggle and public pressure on the company, but these rights of veto should be available to all with legitimate interests and should be upheld at a Commonwealth government level.

Mining is a privilege, not a fundamental right. It involves the Commonwealth and a private company undertaking a project for commercial gain. The company must therefore prove that it can manage its operation in a responsible and just way. If the government has the capacity to approve or disallow a project, it is appropriate that it is fully aware of the impact of these projects. There needs to be a thorough independent investigation of past dealings of mining companies with traditional owners and Aboriginal communities which have been seriously flawed. A comprehensive plan for future engagement in processes should be designed, in consultation with Aboriginal people, and implemented before further developments occur.

As a final note, I would like to point out the inaccessibility of inquiries such as these to those traditional owners and Aboriginal communities that are most directly impacted by uranium mining. There has been no attempt to make this an inclusive process.

CHAIR—Thank you. Can you explain to the committee how you obtained the figure on page 5 of your submission which claims that a doubling of nuclear power by the year 2050 would only result in a five per cent decrease in greenhouse emissions?

Dr Green—That is based on numerous reports. I am happy to provide the references to the committee on request. I can summarise them here. Friends of the Earth UK's 2004 report looks at a doubling of UK nuclear output and arrives at a reduction of eight per cent in greenhouse gas

emissions vis-a-vis fossil fuels. For various reasons, that is somewhat of an overestimate because it inadequately reflects growing energy demand and various other factors.

Feiverson, a scientist, calculates that if global nuclear power grew at just over two per cent per year until 2050 to an installed capacity in that year of 1,000 gigawatts, which is slightly under three times the current output, total cumulative carbon emissions projected during this period would be reduced by about eight per cent. That Feiverson report is certainly worth looking at.

The Nuclear Information and Resource Service says that if nuclear power was to account for 70 per cent of electricity by 2100, 115 reactors would have to be built each year. That is 10,000 new reactors, so that is one of the issues that arises when you are looking at a nuclear solution to climate change. It is totally impractical. Even if we were to have over 10,000 nuclear reactors by the end of the century, that would still result in emission reductions relative to fossil fuels of just 16 per cent. If the committee would like the references, I am happy to provide them.

CHAIR—Following on from that, a number of prominent environmentalists—namely, James Lovelock, Patrick Moore, the Greenpeace founder, and, relevant to your organisation, Hugh Montefiore—have stated that the rapid expansion of nuclear energy is necessary to avert an environmental calamity. How do you respond to that?

Dr Green—Very simply. You could name a handful of people. You have named a couple there. I could name a couple of others. There is also an organisation called Environmentalists for Nuclear Energy. It has a web site which you can easily find. It claims to have 6,000-odd supporters and members.

CHAIR—So what? They are wrong?

Dr Green—I am just saying that is what they claim.

CHAIR—All right.

Dr Green—But there is no vetting of people who want to join that organisation. You join by simply filling out a brief web site form, at no cost.

CHAIR—These are fairly significant people who have been involved in the environmental movement. To now come out and make a statement like that is significant, wouldn't you say?

Dr Green—No. I do not think when two or three or four environmentalists say something and the other 99.9 per cent of the environmental movement says something else that you can say it is a significant split. Also, it does not really matter. The essential issue is whether the arguments they are proposing have some validity. If you look at Lovelock, many of his arguments are simply promulgating the familiar propaganda that we get from the nuclear industry. Some of his arguments are quite absurd. He seriously wants to have high-level nuclear waste in his house for home heating and food irradiation.

CHAIR—And Patrick Moore?

Dr Green—What about him?

CHAIR—Why would you say that he has the view now? He is the Greenpeace founder.

Dr Green—I would like to finish with James Lovelock first. As well as that absurd statement about having high-level nuclear waste in his home—and he insists that that is a serious proposition—he also wants to use high-level nuclear waste to protect fragile ecosystems, on the supposition that people are not going to intrude into fragile ecosystems if they are protected by high-level nuclear waste. Can anyone imagine a more absurd method of protecting fragile ecosystems?

CHAIR—And Patrick Moore?

Dr Green—We take the arguments on their merits. Too many of the arguments are simply restating the propaganda of the industry. One thing I noticed with Lovelock, and to a lesser extent with Moore, is that they are simply not up to speed with the central and the unresolvable problem of the nuclear industry, which is the contribution to the proliferation of nuclear weapons. Lovelock has said absolutely nothing on that topic.

CHAIR—What about Hugh Montefiore, who was for two decades trustee of Friends of the Earth?

Dr Green—He is more interesting; firstly, because there is no question of his environmental credentials and his honesty and his integrity. Also, his arguments are somewhat more moderate than those put forward by people like Lovelock. But still, he is sceptical about the capacity for renewables and energy efficiency to meet the challenges that we face. There is no doubt that those challenges are immense and it is going to be difficult to move towards a clean energy future. That does not mean it is impossible and it does not mean that we need a nuclear fix, since nuclear cannot do the job anyway and since nuclear is the only form of energy with a direct connection to weapons of mass destruction. Perhaps I could summarise that problem in just a little bit more detail.

The nuclear power industry has resulted in the production of 1,600 tonnes of plutonium. If we allow 10 kilograms per bomb, that is enough plutonium for 160,000 nuclear weapons. Each year nuclear power reactors are producing enough plutonium to build 7,000 nuclear weapons. Let us say we can indefinitely safeguard 99 per cent of the existing stockpile of plutonium against military use. That still leaves one per cent of the plutonium, which would suffice for 1,600 nuclear weapons. That is an immense challenge and that is going to get far worse if we are looking at a nuclear fix for climate change.

It is also a matter of historical record that of the 60 countries which have developed a nuclear industry to any significant extent, including a power and/or research reactor, over 20 of those countries have used their supposedly peaceful nuclear facilities and materials for weapons research and/or production. That is a strike rate of one in three. In some of those cases the weapons work was short-lived and small-scale but in other cases the peaceful nuclear facilities and materials have led directly to the production of arsenals of nuclear weapons.

The cases in point there are Israel and India, which have used so-called research reactors to produce plutonium for their arsenals of nuclear weapons. Pakistan and South Africa have used supposedly peaceful enrichment plants to produce highly enriched uranium for their arsenals of

nuclear weapons. North Korea claims to have produced highly enriched uranium weapons and also has a so-called experimental power reactor which is implicated in their weapons program. As I say, over 20 countries have made some level of progress towards weapons capability using their supposedly peaceful nuclear materials.

Mr MARTIN FERGUSON—I understand the importance of consultation with the Indigenous community. I can see a dramatic improvement in the performance of the resources sector generally in recent times. Do you think the process is worse with respect to uranium mining than mining generally in Australia, including gas et cetera? If so, on what basis do you make that suggestion? This is an issue of major interest to me.

Miss Stubbs—I clearly have not suggested that by the comments that I have made. Since the terms of reference of this inquiry are specifically about uranium mining, that is what I have addressed here.

Mr MARTIN FERGUSON—That is why I wanted to know. I cannot see any difference in the process of consultation between the particular resource sectors.

Miss Stubbs—If that is so, then the consultative processes with other industry sectors are also flawed. These improvements need to be made clearly across the mining sector.

Mr MARTIN FERGUSON—Do you therefore believe, for example, that Aboriginal organisations such as the Northern Land Council, the Central Land Council and a whole host of other land councils around Australia are letting the Indigenous community down in terms of their representation and negotiations with mining companies?

Miss Stubbs—That is not what I am saying at all. What I am pointing out—and this is from experience of speaking with people involved in these communities—is that the concerns are there; that the consultative processes have been seriously flawed. This includes by people who are still involved in those processes. But in many cases there have been parties with legitimate interests that have been excluded from these consultative processes by a range of different means.

Mr MARTIN FERGUSON—In Kakadu there was a view amongst a lot of Indigenous people that they have been excluded, and the only people consulted were the Mirrar people, and that they ought to be consulted because it is also their backyard.

Miss Stubbs—This points out that there does need to be clear consultation with all interested parties. We also need to recognise that there have been many cases where mining companies have chosen who they are going to deal with. They should not have control over saying, ‘Okay, we’re going to speak to these people but not somebody else.’ As long as the mining companies have veto over who they consider—

Mr MARTIN FERGUSON—The people identify themselves as traditional owners, don’t they? Therefore, they have to be consulted.

Miss Stubbs—Yes, absolutely. They should be. It is not just a matter of them being consulted; there are flaws that remain within those consultative processes. Often that is, like I expressed in

my initial statement, that they do not necessarily have adequate tools to deal with this information and to translate that into language and culturally appropriate material that is accessible for everybody involved.

Mr MARTIN FERGUSON—Despite the fact they are generally represented by highly paid non-Indigenous people, including lawyers, accountants et cetera?

Miss Stubbs—Exactly. Sometimes these processes have also been funded by the companies themselves. That does not show a clear independent interest.

Mr MARTIN FERGUSON—In terms of social good, I agree there is an obligation on government to do whatever it can on health, education and infrastructure. In terms of royalties, they tend to go directly to traditional owners with no obligation to invest in some of that infrastructure; to build on the foundations. Do you think there ought to be a review of government policy that would require some of those royalties paid by companies to go to improvements in health, education, job creation and training, rather than just monetary payments?

Miss Stubbs—To begin with, these traditional owners and Aboriginal communities should not have to rely on the royalties of mining companies, for those basic reasons.

Mr MARTIN FERGUSON—But I did not say that. If the Indigenous community actually decides—and they are on a regular basis deciding that resource development is to their advantage—do you think governments should think through, also, policy with respect to royalties not just being paid in monetary payments but certain proportions potentially being allocated to assist in the improvements of health and educational facilities and training?

Miss Stubbs—I think that you are really getting away from the central points here. The government does not say where the mining company has to spend their profits from these operations and, like I said before, they should not have to rely on royalties from these moneys to provide those services.

Mr MARTIN FERGUSON—I accept that.

Miss Stubbs—Those services should be provided already.

Mr MARTIN FERGUSON—It is about building on existing services that ought to be provided by government. I do not question that.

Dr Green—Or existing lack of services.

Mr MARTIN FERGUSON—I do not question that. In terms of Jabiluka, if the Mirrar people decided to approve the mining of Jabiluka, and you say it is principally their decision, should that go ahead?

Miss Stubbs—Obviously we respect the rights of traditional owners to make a decision over what developments they want to occur on their land, but we would still oppose those developments and the environmental impacts of those, both locally in Australia and globally.

Mr ADAMS—That is pretty elitist.

Miss Stubbs—It is not elitist at all.

Dr Green—In what sense do you make that assertion, Mr Adams?

Mr ADAMS—She made the statement. I am saying that it is elitist.

Dr Green—In what sense?

Mr ADAMS—You are saying, ‘We have a view which is above the traditional owners.’

Dr Green—We are saying that we respect their rights and their decisions.

Mr ADAMS—‘But we are smarter. We know better.’

Dr Green—No. We have a range of other concerns to do with weapons proliferation and to do with the high-level waste around the world.

Mr ADAMS—You are saying, ‘We are smarter than you. We know better.’

Miss Stubbs—Absolutely not! That is totally opposed to the view that we are expressing. I would like to know upon what grounds you would make such insinuations.

Mr ADAMS—You are saying that the traditional owners have made a decision but you do not accept that they have a right to make that decision.

Miss Stubbs—No, we do. I said we respect their right to make that decision.

Mr ADAMS—But you think they are wrong.

Miss Stubbs—But our opposition to uranium mining and its global impacts, as well as those environmental impacts on the site, are our concern also.

Mr ADAMS—I say that is an elitist view.

Dr Green—I say that you are verballing the witness and that Mr Prosser should draw you into line for doing so.

CHAIR—If you do not carry on with the hearing, I will pull you into line.

Mr ADAMS—Who do you think you are? Where do you come from?

Dr Green—I come from Friends of the Earth Australia.

Mr ADAMS—Yes, Friends of the Earth.

Mr MARTIN FERGUSON—I want to go to the issue of international safeguards. You raise questions about the management of Australian obligated nuclear material. What suggestions do you have in terms of how we can improve that management? That is what I am looking for from your raising of that issue.

Dr Green—Where do you start? I could rattle off half a dozen examples of the Australian Safeguards and Non-Proliferation Office making false and misleading statements.

Mr MARTIN FERGUSON—I want that material. We need to be informed of this.

Dr Green—Do you want it now—

Mr MARTIN FERGUSON—Yes, please.

Dr Green—or do you want it in writing?

Mr MARTIN FERGUSON—I want it now, and you can follow it up with a further submission if you want to. If there are weaknesses—that is why we are having this inquiry—we actually want to find out.

Dr Green—Argument 1: root-and-branch reform of the national Safeguards and Non-Proliferation Office for systematically making false and misleading comments. I will give you six examples. Carlson, the head of the Safeguards and Non-Proliferation Office, says:

... in some of the countries having nuclear weapons, nuclear power remains insignificant or non-existent.

Yet, as he knows, nuclear power exists in all but one of the nuclear weapons states—formal or informal weapons states—and in most of the nuclear weapons states there is a significant nuclear power industry. In fact, the five declared nuclear weapons states account for 60 per cent of nuclear power output. That is no coincidence. The civil nuclear programs provide vast pools of expertise from which the military programs draw. Argument 2, Carlson says:

If we look to the history of nuclear weapons development, we can see that those countries with nuclear weapons developed them before they developed nuclear power programs.

That is just false. In Israel, India, Pakistan and South Africa, civil nuclear programs clearly did pave the way for the successful development of nuclear weapons. In Israel it was more the stated interest in developing nuclear power than the development per se.

Argument 3: ASNO, the Safeguards and Non-Proliferation Office, and Carlson make statements about the weapons useability of reactor-grade plutonium, which are clearly out of step with the vast majority of scientific opinion. The Safeguards and Non-Proliferation Office also implies that the United States is lying when it says that it carried out a test using reactor-grade plutonium in 1962. To the best of my knowledge, the Safeguards and Non-Proliferation Office has not had the courtesy to explicitly state that to the Americans. Carlson says:

One of the features of Australian policy ... is very careful selection of our treaty partners. We have concluded bilateral agreements only with countries whose credentials are impeccable in this area.

Yet Australia sends uranium to weapons states which pay lip service to their NPT disarmament obligations. South Korea has just been caught carrying out a whole raft of secret nuclear weapons research projects from the early eighties to the year 2000. They could hardly be said to be impeccable. The Japanese industry could be said to be in disarray because of a series of safety data falsification scandals covering all of the nuclear utilities in Japan.

And one final example: Carlson says that weapons-grade plutonium is not produced in the normal operation of power reactors. That is simply not true. In the normal operation of power reactors you do get the generation of weapons-grade plutonium but it is then converted within the reactor to fuel grade and then reactor-grade plutonium. Carlson's statement is also misleading in that he ignores the possibility of abnormal operations, which is very simple. You simply irradiate the fuel for a shorter period of time and you get a high grade of plutonium.

Also you will hear statements from ASNO and from people like Hore-Lacey from the Uranium Information Centre that power reactors have never been used to produce plutonium for bombs. It is unlikely to be true. The 1962 American test is a case in point. India and possibly also Pakistan may well have used power reactors to produce plutonium for bombs. But, more to the point, they are just simply misleading the public yet again because it has been research reactors which have produced the plutonium for the arsenals in both India and Israel and possibly also North Korea.

Mr MARTIN FERGUSON—I would like you to expand on that and follow it up with a written submission. Can you also identify how we, in terms of pursuing the implementation of our bilaterals, can tighten up with respect to the policing of those processes? It is a condition of our exports that we enter into bilaterals.

Dr Green—Yes. You would need to totally revise all of the treaties, I think. For starters, there are totally unjustifiable secrecy provisions within the treaties. We know how much separated plutonium exists in a whole range of countries—it is about 600 kilograms—but we do not get country by country breakdowns. Can anyone begin to imagine why we should not know how much separated plutonium Japan holds of Australian origin? Can anyone imagine the justification for that?

Mr HATTON—Can anyone imagine Japan going down the track for developing nuclear weapons?

Dr Green—Yes, they can.

Mr HATTON—You can, and you think they will, despite Hiroshima and Nagasaki?

Dr Green—I did not say I think they will. Can you list the countries which neighbour Japan, Mr Hatton?

Mr HATTON—I know what countries neighbour Japan. I know that China and North Korea are significant problems—

Dr Green—China is a nuclear weapons state. North Korea claims to have nuclear weapons. South Korea has just been caught carrying out a raft of secret nuclear weapons research programs.

Mr HATTON—Is there any extant evidence—

Dr Green—North Korea firing a missile over Japan some years ago.

Mr HATTON—Is there any extant evidence of Japan going down the track of developing a nuclear weapons program?

Dr Green—Yes. There are numerous statements from Japanese politicians, some of them high ranking, and also from people outside the political establishment, such as military people, saying that Japan should develop nuclear weapons or Japan should consider developing nuclear weapons.

Mr HATTON—Is there any extant evidence that they have so far?

Dr Green—Has anyone suggested that they have?

Mr HATTON—No, I am asking the question. What you said was that they had significant stores of plutonium that were effectively weapons-grade plutonium; that would have been developed, I imagine your argument is, from Australian—

Dr Green—I did not say weapons-grade plutonium.

Mr HATTON—Okay, just separated plutonium.

Dr Green—Separated plutonium which could be used in weapons.

Mr HATTON—Which could be used in weapons, right, and that uranium was supplied by Australia or supplied by elsewhere.

Dr Green—Yes.

Mr HATTON—What is the point of your argument: that they would provide it to someone else to make nuclear weapons or that they would actually make their own program?

Dr Green—There are two problems. One is the risk that Japan will go nuclear and that is certainly a serious possibility because of the regional tensions. The other issue—and this is the most troubling of all in some respects—is that even without going down the nuclear path in a formal sense, Japan's plutonium stockpile creates significant regional tensions. I might dig up a relevant quote there because it is quite an important issue. The quote comes from an American ambassador to Japan who was writing in 1993—Secretary Armacost—and diplomatic cables 1993-94 from US ambassadors in Tokyo. US ambassadors in Tokyo—not Friends of the Earth in Tokyo—described Japan's accumulation of plutonium as 'massive' and questioned the rationale for the stockpiling of so much plutonium, since it appeared to be economically unjustified.

A March 1993 diplomatic cable from US Ambassador Armacost, in Tokyo, to US Secretary of State Warren Christopher, obtained under FOI legislation, posed these questions:

Can Japan expect that if it embarks on a massive plutonium recycling program that Korea and other nations would not press ahead with reprocessing programs? Would not the perception of Japan's being awash in plutonium and possessing leading edge rocket technology create anxiety in the region?

The answer is yes, it does create anxiety in the region. You can easily draw a line between Japan's plutonium program and what South Korea has been doing for the last 20 years, secretly and in violation of its NPT obligations. You can draw a line between North Korea and China and Japan. It is all an absolute mess. As Professor Broinowski says, North-East Asia is a disaster waiting to happen, and we are providing the raw materials.

Mr HATTON—Given the North Korea situation where we know they have developed that capacity in secret, we know that China is an existing weapons state, that Japan—having stores of plutonium—is really a driver for China to be significantly concerned. Although they have no nuclear weapons, they just have stores of plutonium, that should drive China to be really concerned and think they might be attacked as a result of that.

Dr Green—Put yourself in the position of someone in the Chinese military state. You would obviously be framing your decisions as to your nuclear arsenal with some thought given to Japan's situation and Japan's status as a break-out or threshold nuclear state, would you not?

Mr HATTON—How is it a break-out or threshold nuclear state?

Dr Green—It has the raw materials, the technological and industrial infrastructure and expertise to build nuclear weapons in a very short space of time.

Mr HATTON—Is it a break-out state? Has it broken out? I think you have said it has not, but you would still regard it as a break-out state because of its potential, not its actuality?

Dr Green—Using the terminology, by convention when we say 'a nuclear break-out state' we are talking about a state with the capacity to produce nuclear weapons in a short space of time and, in Japan's case, using feed stock supplied by Australia.

Mr HATTON—I might start where I wanted to come from, and that is ground zero for you is that you are against any nuclear use at all in any form?

Dr Green—No, not at all. We are totally pro nuclear when it comes to solar power—biggest fusion reactor you will ever see.

Mr HATTON—You mean the sun.

Dr Green—Absolutely. It can supply more power than any of us could ever want and, best of all, it is 150 million kilometres away, so there is zero risk of it contributing to nuclear weapons proliferation and none of those other problems such as radioactive waste. We also support the use of accelerator spallation technology for medical and scientific applications.

Mr HATTON—Using accelerators but not using research reactors like Lucas Heights?

Dr Green—That is right.

Mr HATTON—The sun does have some attendant problems and risks in terms of the gamma rays it puts out and all the rest of it. It does not come free of problems and difficulties, but your fundamental approach is that the mining of uranium, civil use of power and all the rest of it is that you are completely against that?

Dr Green—No, not as a matter of principle but because the safety and proliferation problems have not been resolved, the waste management problems have not been resolved—

Mr HATTON—So if all those things were resolved—

Dr Green—and this whole history of radioactive racism persists. I was surprised to hear Mr Ferguson say that there have been improvements in this regard, because I would have thought Jabiluka was one of the most outrageous and disgraceful examples of radioactive racism in Australia, and that was only a few years ago.

Mr MARTIN FERGUSON—Just so you know, I am in regular consultation with resource companies across a whole range of sectors. Any fair-minded person would acknowledge there has been improvement with respect to the attitude of mining companies to the Indigenous community in terms of consultation and trying to get long-term outcomes of benefit to the Indigenous community. To put your head in the sand and deny that is undermining your credibility.

Dr Green—I am not commenting on that broader statement of yours, Mr Ferguson. I am saying that if there is an improvement more generally, it is certainly not evident in the nuclear field, and Jabiluka is one of the most striking examples of radioactive racism ever. You only have to go back a few more years to the mid-nineties and you had WMC sidestepping Arabunna to get a pipeline across Arabunna land to Roxby Downs; again, one of the most outrageous and disgraceful examples of radioactive racism. That is just one decade ago.

Mr MARTIN FERGUSON—Why don't you go and talk to a few land councils about the approval of the processes relating to the Darwin-Alice Springs railway or the proposed gas pipeline through Wadeye to Gove? There were absolute endeavours to properly consult the Indigenous community, including looking after sacred sites. The world has moved on. It is about time people in the Australian community understood that the resource sector is generally absolutely committed to doing the right thing by the Indigenous community.

Dr Green—Including the uranium mining industry?

Mr MARTIN FERGUSON—It is interesting that it was Rio, through ERA, that made the decision that Jabiluka will not go unless the Indigenous community approve it.

Dr Green—I know. Let us make that the norm rather than the exception and let us have that as the norm without the Mirrar having to fight long and hard—

Mr MARTIN FERGUSON—Also, the other side of that coin is if that is to be the case and the Indigenous community in a given area approve uranium mining, then that is also the norm and it should go ahead.

Miss Stubbs—There has also been no move on the part of these mining companies, that have caused these divisions in the past, to rectify the problems they have caused. The division, damage and distress they have caused to communities continues on today.

Mr MARTIN FERGUSON—I would have thought damage and distress is more related to problems generally with respect to alcohol and drugs and a whole range of issues. We have created an unholy nightmare for our Indigenous community with respect to not problems created by the mining industry but us generally, as a society.

Dr Green—Do you think it caused something other than distress when Yvonne Margarula got arrested for walking onto her own land?

Mr MARTIN FERGUSON—There are a lot of other people in Arnhem Land who support uranium mining. Perhaps they ought to be consulted too.

CHAIR—We are getting off the track a bit.

Mr HATTON—Something I struggle to understand is proliferation risks. You argue that civil nuclear programs also support nuclear weapons programs in the five declared nuclear weapons states—the US, Russia, the UK, France and China—in particular, civil programs provide pools of expertise from which military programs draw. Is it not a chicken and egg situation? The weapons programs and the missiles came before the nuclear programs. The argument we had with the previous person who was here, Dr Mudd, was pretty simple. He said if you start with the weapons program initiated in the Manhattan Project in 1942 until you get the nuclear weapons used at the end of World War II, then those secrets stolen by the Russians, the Chinese being given it from the Russians—the UK was a direct beneficiary of the Manhattan Project. They were involved in it. France got access to that material pretty quickly.

The key states that were involved had weapons programs well before they developed any civil nuclear program. Is it not an inversion to argue that the core problem here is the civil program, rather than the fact that nuclear weapons were developed and used at the end of World War II? The capacity and the extension of that development of nuclear weapons is separable from their nuclear civil programs that did not come for a decade and a half or more.

Dr Green—You are ignoring a few points. You are ignoring the fact that at the moment the five declared nuclear weapon states account for 60 per cent of global nuclear output and that there is frequent transfer of personnel to and from the civil program to the military program.

Mr HATTON—But initially weren't the weapons developed in place?

Dr Green—Yes, in the five declared nuclear weapon states. In the other weapon states, the civil nuclear programs provided the fundamental basis for the development of their arsenals.

Mr HATTON—Let us just concentrate on the—

Dr Green—But why?

Mr HATTON—Because I am choosing to ask the questions, not you, that is why. I would like to understand why all of the emphasis is put on the civil when, in the key nuclear powers—have a look at them; have a look at the Security Council of the United Nations—the development of their programs was initially exclusively to develop nuclear weapons and provide nuclear weapons arsenals against each other, and to go thermonuclear, in the United States case, and then have that information given to Russia. The mutually assured destruction of the 1960s was based not on civil capacity and civil power production; it was based on the development of enormous arsenals and the continued development, in technological and innovation terms, by Russia, the United States, China, the UK and France.

Dr Green—Do you dispute that 20-plus countries have used their civil nuclear programs for some level of weapons research and/or production and that four or five countries have gone all the way, using their civil programs to develop arsenals of nuclear weapons?

CHAIR—Dr Green, I would urge you to answer the questions, not ask questions. For you to ask questions is disorderly and I could remove you from the meeting. Please answer the questions.

Dr Green—I do not think he asked a question anyway. Did you?

Mr HATTON—Yes, I did ask a question. The rebuttal was an attempted rhetorical response. The main nuclear states have developed weapons programs first. They developed civil programs after that. Once those weapons programs were in place and the arsenals built, we had the development of other weapons programs from other countries, not all of which were dependent upon their civil nuclear programs.

Dr Green—To a very large extent they were dependent on those civil programs.

Mr HATTON—The stress of your argument here is that civil comes before the military use, whereas in fact the development historically is entirely the other way. You may be against nuclear use altogether or virtually altogether. I think that is the approach that you are taking. I know it is convenient to put the stress on civil power production through nuclear means.

Dr Green—Isn't this an inquiry into the civil nuclear industry?

Mr HATTON—Yes, but if it were just that, then the evidence that you would have given us, the evidence Dr Mudd gave us, the evidence that the doctors against nuclear warfare gave us, the evidence that other groups are giving us, would not be making an absolute conjunction between civil nuclear production and weapons use and related military uses. We have had earlier evidence today that they are virtually one and the same thing and almost indistinguishable. I think your arguments are running along the same lines. It just seems a conundrum to me that historically it is the other way around.

Dr Green—In some states.

Mr HATTON—In the key states with most production.

Dr Green—Who says what is key and what is not? I would have thought that South Asia—India and Pakistan—was very much a nuclear hot spot. They developed civil programs—ostensibly civil programs—and then that led to production of arsenals of nuclear weapons.

Mr HATTON—Yes, I know that happened, but you have also said that 60 per cent of civil nuclear power is in those key leading states and you have made a conjunction to say that it is just swapping those people from one to the other, that it is indistinguishable effectively, so therefore the civilian use of nuclear power can be condemned on that basis. Is that not true?

Dr Green—Not entirely, but it is a problem, and I think a useful way to phrase this is: let us imagine the history of the last 50 to 60 years without the development of civil applications of nuclear technology. We would imagine that most or all of the five declared nuclear weapon states would have gone ahead and developed arsenals of nuclear weapons, so we are agreed on that point.

Mr HATTON—Yes.

Dr Green—It might also be the case that one or more of the five declared nuclear weapon states would abandon its arsenal of nuclear weapons if it did not have the synergies and the economies of scale that come from having a significant nuclear power sector. Another crucial point is that it is unlikely that any of the non-declared nuclear weapon states would have developed arsenals of nuclear weapons if not for being able to ride their weapons programs on an ostensibly civil program. We would almost certainly have fewer nuclear weapon states in the world today if not for civil nuclear power.

Mr HATTON—Let us go back a step in terms of development of the Nuclear Non-Proliferation Treaty and the fundamental agreement at the core of that. Whether it has worked well or ill, certainly you could argue that it has not worked as well as it should have. A core provision is that those people who are mining uranium—countries such as Australia—or those who wish to build civil programs—electricity production based on civil nuclear reactors—had to sign up to not be engaged in proliferation and they had to sign up to the peaceful uses of that material. Those who did not sign up had no such provision in relation to them. You know that India is not a signatory to the Nuclear Non-Proliferation Treaty. It has not stopped it from (1) having a civil program, or (2) developing a weapons program. And those other countries that were not signatories to the Nuclear Non-Proliferation Treaty have not been retarded in any material way, given that the technologies exist. The Nuclear Non-Proliferation Treaty is an attempt to contain, an attempt to control the situation. Whether it has been breached, whether it has been broken, whether it has been cast aside by some, it is the most significant approach the world has had historically to try to contain this technology once it was developed, is it not?

Dr Green—No. Go back to Atoms for Peace and extensions of that, leading up to the NPT and IAEA safeguards. It is not just containing. It is also proliferating—proliferating civil technologies despite their dual-use capabilities. As for safeguards, the more the better, but the system has been shown to be flawed. We usually talk about Iraq here because Iraq exploited each and every loophole in the system, so you cannot say that safeguards in the NPT and IAEA system hindered Iraq. On the contrary, it was the basis upon which they built their nuclear weapons program, exploiting each and every loophole.

Mr HATTON—I think it is demonstrable, given what has recently happened in Iraq, that there was an enormous amount of bluff and bluster and a country that wanted to demonstrate that it was a great regional power, and in fact wanted to become a larger regional power, but their capacity was fundamentally proscribed in the 1991-92 war, and that the period after that—not allowing the weapons inspectors in and all the rest of it—was one of the greatest con jobs in history.

Mr ADAMS—Dr Green, I apologise if Miss Stubbs felt I was badgering her. That was not my intention. I accept your right to be here and to give evidence, Miss Stubbs. The issue is about uranium and it is about energy in the world. There is a shortage of energy in the world. We are facing a crisis in world terms. China is driving some of this because of its growth and where it is moving to industrialise and improve its quality of life. I take it that you are totally opposed to uranium mining and nuclear energy. What other sources can we offer countries like China to continue to improve or to industrialise in the way that they have, when they would argue that the West has used nuclear energy and many other sources to improve its quality of life?

Dr Green—I think it is a really interesting question. It is an important and a valid question, but in some respects it is the wrong question, because it is the Western countries who are primarily responsible for greenhouse gas emissions and the unfolding problem of climate change. It is still the Western countries with vastly greater per capita emissions, far greater than India or China, so it is upon us that the responsibility lies to take the lead in addressing these questions.

As for what we can do for China: supporting Chinese moves to address energy demand through efficiency measures, demand reduction, and doing similar things much more energy efficiently, and helping them to develop clean energy technologies, the same sorts that should be developed everywhere, which are a mix of solar—also solar water heating—wind, wave, geothermal, biomass and all the rest of it.

Mr ADAMS—Dam building.

Dr Green—I do not really have a response to that, because I am not quite sure what you are getting at. There is a question as to large hydro, isn't there? Usually when you are talking about people interested in a clean energy future, there is a distinction made between large dams, with major environmental and social impacts, and small-scale hydro, which can be done much better.

Mr ADAMS—Small is beautiful!

Dr Green—Not necessarily, not if you are losing efficiencies along the way. I am not supposed to be asking questions, but if I can throw one into the air in relation to China: would a Chinese nuclear industry whistleblower be sent to a prison/re-education camp or would they be executed immediately?

Mr ADAMS—I do not know the answer to that.

Dr Green—Does anyone have an answer?

CHAIR—The committee will not take that question. Thank you for your evidence here today. Dr Green, you said that you were going to give some documents to the committee and table some further information. If you have that information, I would like you to hand it to the secretariat right now, thank you.

Dr Green—I do not have it now, so I will submit it separately.

[1.53 pm]

NOONAN, Mr David Joseph, Nuclear Campaigner, Australian Conservation Foundation

SWEENEY, Mr Dave, Nuclear Campaigner, Australian Conservation Foundation

CHAIR—Thank you for agreeing to give evidence before the public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of parliament and remind you that giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. I also remind you that the committee prefers all evidence to be given in public. However, at any stage you may request that your evidence be given in private and the committee will consider your request. I invite you to make an opening statement before we go to questions.

Mr Noonan—Thank you for the opportunity. We would like to make a brief statement to point out some key issues that we think are most relevant for the committee's consideration and that we would welcome questions on.

ACF, as a national environment group, has for nearly 40 years protected, celebrated and defended the Australian environment. Our positions are based on fundamental and considered public policy considerations. We believe that, in answering the fundamental challenges of climate change, we need to take the perspectives of public policy in regard to public safety, security, waste management, health and environmental protection. On these grounds, the proposal that nuclear can provide any answer to climate change is flawed and a false premise and should not be presented as a valid argument for any continuation or expansion of the nuclear industry, nor for any continuation or rationalisation of any continuation or expansion of uranium mining in Australia.

Some of the key matters that we would wish to put to the committee for consideration and potential discussion include that there is clearly no demonstrated expansion of nuclear power in the Western world. In contrast, nuclear power is in decline. The number of reactors across the USA and western Europe peaked some 15 years ago and is highly likely to continue to decline with the scheduled closure of some 50 nuclear power plants in western Europe across a range of countries, given government legislation, government policy and government schedules of closure based on ageing and unsuitability for extension of life for existing reactors.

In contrast, any new reactor in the Western world is an exception, with only one currently under construction, in Finland—a reactor that is not apt to meet prerequisites of demonstrated commercial viability—and with only one being planned in the Western world, that being in France. If there are new reactors in the US, it clearly would only be because of the massive public subsidies currently being offered by President Bush. We would consider that, in the case of Australia or in the case of the developing world, such massive-scale public subsidies are an unacceptable contribution towards a hazardous nuclear industry.

In terms of where there may be proposals for significant expansion of nuclear power, they are substantially limited to Asia. There is a slow roll-out of nuclear power within industrialised Asia

and there are proposals for significant potential expansion in China and in India. Those are matters fundamentally privy to the committee because they are the two proposed new markets for expansion of Australian uranium mining and exports. Even if the government's intentions in the cases of China and India come to fruition, they are still relatively minor contributions toward energy provision in those countries.

For instance, while China only provides some two per cent of their electricity for nuclear at present, if the full expected expansion were to unfold there—a fivefold or sixfold claimed potential for expansion of nuclear capacity—that is also within a doubling of their projection of total electricity use, so nuclear power in China would only go from some two to six per cent of electricity generation. That is not a significant contribution to global greenhouse gases on an international scale, nor is it necessarily a significant contribution to energy provision in China relative to other options, given that China has a 10 per cent manageable renewable energy target over the same time line. In the case of India, electricity generation might move towards 10 per cent within 20 years if all of the Indian government's projections for expansion were to come to fruition. That is, again, a relatively minor contribution towards energy provision there in a larger scale context.

We say that both of those markets are seriously problematic for Australian uranium mining and exports in terms of a range of issues, including safety and proliferation and our international responsibilities. We note the potential division in the federal cabinet over the proposal for the export of Australian uranium to India, for instance, where two senior ministers have in recent times made media statements effectively saying that Australia must export uranium to India, appearing to ignore the position of the foreign minister that Australia does not export, and will not export, uranium to Nuclear Non-Proliferation Treaty signatory countries. That is apparently a fundamental difference of opinion developing within the federal cabinet, driven by the expectation that the pursuit of the uranium dollar is perhaps a more important consideration for some people than Australia's continued obligations in terms of safety and proliferation issues.

We also note the proposal from the foreign minister to provide additional conditions of approval on uranium sales, one being, we consider, a minimum initial condition of approval—an additional condition—that a country receiving Australian uranium will have to, within some agreed time line, expedite the IEA's additional protocols in terms of safeguards. We support that condition. That move towards there being responsible conditions placed on uranium sales should also include a whole range of other matters, one of which is that Australia should no longer agree to the reprocessing of Australian obligated nuclear materials; spent nuclear fuel. We should not be isolating plutonium, which is weapons capable and a key concern in terms of proliferation, dirty bombs, and non-state parties gaining nuclear-weapons-capable materials.

There is also a range of treaty obligations that Australia could be using as prerequisites on any remaining uranium sales, including that countries demonstrate signatory ratification to the Comprehensive Nuclear Test Ban Treaty, and that nuclear weapons states further their obligations to disarm under the NPT and demonstrate verified closure of their nuclear testing facilities. They also should be supporting a credible fissile material cut-off treaty. One of the prerequisites for that would have to be the end of reprocessing and separation of plutonium, regardless of assumptions or what may be called a military or a civilian program.

We note the key comments by Elbaradei, the executive director of the IEA, fundamentally saying that the nuclear safeguards regime has been shown to fail over time, having failed to address a range of key issues, including the rise of terrorism, the increased nuclear black market over time and clandestine nuclear weapons states. Elbaradei stated in the *New Yorker* in May that there are some 30 threshold nuclear weapons states that have the potential to, through their existing civilian nuclear power programs, within a short period of time realise a nuclear weapons program and actual capabilities in that direction.

In terms of uranium mining, which is a large part of the terms of reference for this inquiry, the ACF notes that uranium exploration is a highly speculative and high-risk activity for the proponent and that uranium exploration provides no right or no assumption to proceed to a mining stage. In terms of potential sources of uranium supply in Australia, we believe that high regard should be given to democratic issues and public acceptance issues of uranium mining and uranium export. It is clear that under existing government policy there will be no uranium mining in Western Australian or in Queensland, for instance.

It is clear under the existing commitments of the South Australian government, including the clear personal commitment given by the premier Mike Rann that there will be no new uranium mines in South Australia while that government remains in office. My colleague Dave Sweeney will address more specifically Northern Territory issues in a moment.

This inquiry could have referred specifically in its terms of reference to the proposed expansion of uranium mining at Roxby Downs, given the scale of that expansion. We note that BHP Billiton lodged an application this week for a referral under the Commonwealth EPBC Act for assessment and approvals for the proposed Roxby Downs expansion. It will require a full Commonwealth EIS that will presumably take some 18 months or more.

Roxby Downs is proposed to expand to become the world's largest uranium mine. Any potential for uranium mining and export expansion in Australia will largely be driven by that proposal, and that proposal alone, and it may be that no other uranium mining proposal comes to fruition in a comparative number of years. The drivers for proposed uranium exports to China and India fundamentally come from, we would say, the proposal to expand the Roxby Downs uranium mine in South Australia.

We draw to the attention of the committee that even though the referral under the EPBC Act has now been lodged and is now public it does not answer what we would say are a set of significant and unresolved issues around the proposed expansion of Roxby Downs, including the potentially irresolvable matter of the long-term management and isolation of radioactive tailings, noting that some 80 per cent of the radioactivity in the original ore bodies is retained in the tailings even with the extraction, processing and export of uranium.

We note the potential for significant degradation of the Great Artesian Basin and the Mound Springs if the company were to source their intended additional water supplies—apparently up to some 120 million litres a day of additional water supplies, above what they already take from the GAB free of charge—from a public water resource. ACF notes that they currently take some 33 million litres a day. That has the potential, we would say, on our advice and understanding, to cause significant degradation of those natural systems and should be an unacceptable part of the proposal.

There is also a significant power demand from the new mine proposal. It may be that the next power plant built in South Australia will actually be to drive a uranium mine and not for any other reason. There are also legal privileges that operate in regard to Roxby Downs in South Australia. They have an Indenture Act that overrides essentially all of the other relevant legislation in SA. It overrides the Environment Protection Act, for instance, the Water Resources Act, the Aboriginal Heritage Act and even the Freedom of Information Act. In our view, there are unacceptable legal privileges given to uranium miners in that case and the company, BHP Billiton, should agree to give up those legal privileges before serious or credible consideration is given to the application.

We also note that the federal government has formed a uranium industry framework. We see that in some respects as an unfortunate public relations program, to facilitate the vested interests of—

CHAIR—Mr Noonan, this is going from a short opening statement to quite a long one, which will curtail the questions, so please try to wrap it up.

Mr Noonan—Thank you. We welcome discussion about the attributes of nuclear power and its economics. In a more detailed sense, they may be matters for a further inquiry, given that I understand that initially this inquiry did not intend to address, as a fundamental term of reference, nuclear power issues. I gather that was a statement by the minister at the time of the launch of the inquiry. My colleague Dave Sweeney might comment on matters more specific to the Northern Territory and other considerations.

CHAIR—Very shortly.

Mr Sweeney—Very shortly, Mr Chair, absolutely. The committee would have noticed that the ACF submission is effectively in two parts: an overview about the broader industry, the international dimensions, our obligations et cetera and a second part scoping-in in more detail, looking at the operational impacts and the regulatory framework et cetera in the Northern Territory. That reflects ACF's long involvement in the Kakadu and Top End region and the importance of that region in a conservation sense as well. We have had a long involvement in that, from Fox right through to now.

To put it at its briefest to allow you time for questions, we are concerned about the past, the present and the future. There have been former uranium mining operations, from Rum Jungle through South Alligator, across the East Alligator River, into the Nabarlek mine. Now there are continuing and unresolved rehabilitation issues at all of those sites. We have a current operation system at Ranger, where there are significant environmental and significant social impacts from that large-scale industrial activity, and I must take this opportunity to say that that activity was imposed on the traditional owners and they had no say. They had no right. They said no and Fox explicitly overruled their veto.

We have a situation where last year the Ranger uranium mine workers showered in and drank water containing 400 times the Australian safety standard of uranium. This year there are continuing health and safety challenges and prosecutions in court in Darwin. There is growing radioactive contamination in the footprint of the current mine. We are also concerned about the future prospects in the region, particularly the potential for future mining at Koongarra and

through West Arnhem. Those prospects have been exacerbated by the uncertainty and the breaking of 2½ decades of convention and tradition that has happened recently with the federal government's move to assume direct control of the authorisation and licensing of uranium in the Northern Territory.

We see a concern past, present and future. We see an inadequate regulatory regime. We see an industry where a Senate inquiry specifically looking at this issue reported that Australian uranium mining is characterised by underperformance and noncompliance and spoke of the regulations as complex, confusing and inadequate. We see that problem, an operational problem, a past unresolved problem that requires urgent rehabilitation attention and future threats, both on a political and on a very practical mine level.

I expressed an earlier hope to the secretary of this committee that perhaps a range of these more detailed issues would be better suited to the forum in Darwin in late October. I appreciate that logistical and other constraints might make complexity for the chair and for the committee's consideration of that request, but we remain available if that option is preferred by the committee.

CHAIR—Thank you. On page 10 of your submission you describe some additional conditions you would like to see satisfied before further sales of uranium are approved. Would you describe your proposed additional conditions on uranium export.

Mr Noonan—How would I describe them?

CHAIR—No, describe what they are. What do you have in mind?

Mr Noonan—We consider that, at a minimum, an obvious first matter is that there should be an end to Australian approval for reprocessing of Australian obligated nuclear material in spent nuclear fuel. That is a key safety and proliferation issue. We think it is a very straightforward matter and an obvious matter in terms of international discussions, for instance, toward a credible fissile material cut-off treaty.

Mr ADAMS—How does that affect the economics? Do you know that?

Mr Noonan—There are a number of ways of managing spent nuclear fuel. It does not necessarily have to be reprocessed. The demonstrated economics—for instance, in the current consideration in Japan—are that reprocessing in the major plant that they are building now may be a far more expensive way of managing spent nuclear fuel in the long term than direct storage or disposal. Economics is certainly one relevant parameter but there are a range of other relevant parameters. The reprocessing plants in France and the UK, for instance, have characteristic radiological discharge signatures as the largest dischargers of radioactive materials to the marine environment and to the atmosphere. Reprocessing is, we would say, fundamentally polluting activity.

Mr HATTON—You are both nuclear campaigners, so in your working life at the Australian Conservation Foundation you have taken that approach. Are you both fundamentally against any civil use of uranium to produce power in the countries that we sell it to?

Mr Noonan—Our organisation has well-considered public policy on the issue. We believe there is no demonstrated net benefit from the nuclear industry, including from uranium mining, and we advocate for change in society from less hazardous means of answering society's needs to more sustainable means. We believe that that would not in the long term include a furtherance or a continuance of the nuclear industry.

Mr HATTON—Given the previous groups that we have had, you seem to be dealing with this more on the basis of the processes themselves, both in mining and the related activities, as well as the safeguards and the problems with that, rather than making a direct interconnection between one kind of use and a military kind of use. Is that so? You are primarily concerned with the focus of your argument on the processes and the problems that have occurred there historically.

Mr Noonan—We see the technology as fundamental dual use. The technology itself inherently brings both sets of potential adverse outcomes.

Mr Sweeney—We subscribe to a view by a former UN weapons inspector, who had worked with the International Atomic Energy Agency, who said that the distinctions between the civil and military applications are more psychological than real. Once there is a technical capacity, it is a question of regulation, it is a question of civil society and other institutional watchdogs and, above all, it is a question of political will as to how one uses that. We believe that this industry poses such significant risk, if used inappropriately or poorly in either civil or military, that the risks overcome any social benefit from it.

Mr HATTON—In terms of environmental impact, could we have said the same thing about coal when they first started to dig that out and use it, and the way in which it has fuelled modern industrialisation?

Mr Sweeney—Coal obviously has very severe and adverse impacts. One of the great things, one of the very positive things that ACF has welcomed, Mr Hatton, about this current situation we find ourselves in and the increased nuclear debate and discourse in this country at the moment, is what we believe is the movement in the debate from ignoring greenhouse to senior levels of government and policy makers accepting that it is real. We have moved into a solutions orientated start of this debate. We welcome that. What we do not welcome and do not accept is that our choices are A or B, coal or nuclear. We believe that there are a variety of sources, a variety of options, a variety of techniques and a range of policy initiatives and market initiatives that can and must and should be used to address where we are. But we welcome the fact that we are now realising that coal is a serious, fair dinkum and continuing problem and we need to move on. We believe we need to move on from both the coal and the nuclear economies.

Mr HATTON—That is where I want to go with my questioning, despite the fact of your core interest. The fundamental focus of the inquiry is on fossil fuel alternatives, with this as a subset, although it is getting a header today. In terms of the problems that we face at the moment, how do you see the existing terrain and 10 to 20 years out where do you think we are going with non-fossil fuel alternatives? Or do you think we are going to continue to be anchored primarily with what we have got now, which is coal, gas, the other fossil fuel based stuff and uranium?

Mr Noonan—The example of western Europe shows how far behind Australia is in demonstrating a different path to either the coal or the nuclear proposed futures. Much of western Europe has significant government policy commitments for 20 per cent of renewable energy by 2010, within five years, rolling out existing technologies. Our federal government has a mandatory renewable energy target of only two per cent, so one-tenth of what western Europe will demonstrate within the next five years. West Germany has a government policy of 50 per cent renewables by 2050. They believe that is realisable within the development of renewable technologies and energy efficiency and demand management means in that foreseeable future.

Two of the key reasons that we would say that nuclear is not an answer in any of these respects is the very long lead time and the very high capital investment that is required for nuclear options. The UK government recently reaffirmed their understanding that it would take some 10 years, if there were to be new nuclear power plants in the UK, between a decision to go down that path and the actual operation of any new nuclear power plant. That is a decade lead time. If you are looking at potentials for renewables and economics of renewables, what you need to compare is not today's economics of renewables but the economics of renewables that there will be in 10 or 15 years time. If you make a decision today to go down a nuclear path, you are then undertaking a significant opportunity cost in society's options and, given that government means are limited, if the government makes a decision for the very high capital costs of the nuclear power option, they then forgo the application of those public resources to other means. The relative economics may well be that renewables are demonstrating very significant reductions in cost over time and potential for very significant expansion of application over time, so if you look at the potential for renewables in 10, 15 or 20 years it will be very greatly more than what it is said to be in a comparison today. Given the long lead time and the high capital investment for nuclear, we would say that it is one of the least effective potential answers to those core issues of climate change or of energy production in any context.

Mr ADAMS—On the western Europe issue and the 20 years, whether they do that, that is their technology too. They own the technology. Some of the economics is working for them in that area. Would you say that? It is in their interest to go down that track.

Mr Noonan—Western Europe has seen it as in their interest for a number of countries to have legislative phase-out of nuclear power—for instance, in Germany and Belgium. They have seen it in their interest to have government policy to phase out nuclear in Spain, Netherlands and Sweden. The phase-out of nuclear power in the UK because of the age of the plants is just as effective as any other sort of a policy position.

Mr ADAMS—You are giving evidence that Germany has legislation to phase out nuclear energy?

Mr Noonan—Germany has a legislative commitment to phase out nuclear energy within 20 years, yes.

Mr ADAMS—I do not think that is going to happen. I do not think that is a political reality. But you are saying that that is your belief?

Mr Noonan—It is the belief of the German government. The broader debate about nuclear appears to assume that the proposed major nuclear expansions in China and India will occur.

Should some people in this debate then deny the government positions in other countries that are moving in the opposite direction?

Mr ADAMS—All the evidence that I have personally—and I do not have any before this committee—is that nuclear energy in Europe will be renewed, and they will need to do that because there are no alternatives. If there is other evidence, I will accept that—we will accept that when it comes before us—and hopefully we can gain some of that evidence as a committee. What is driving this debate is this gap of where we are going to go with energy in the world. We can have legitimate views about nuclear energy or we can stick our head in the ground. Your argument is that it is going to take 10 years to get a nuclear power station up and in 10 years you could achieve a lot in renewable energy. Is that your argument?

Mr Noonan—For instance, wind could be installed in many cases within one year and those wind farms can produce clean green renewable energy for a period of almost a decade before a new nuclear power plant would turn on a single light bulb.

Mr ADAMS—Sure, but are they going to be a base load? Can they give us a base load?

Mr Noonan—One of the issues with base load is that energy efficiency demand management is by far the most cost-effective way of addressing base load power, for instance. Also, energy efficiency demand management is the most cost-effective way of addressing greenhouse gas emissions. There are key US studies that show for every dollar invested in energy efficiency, one realises seven times more savings in energy and in greenhouse gas emissions than if the same single dollar had been invested in a nuclear proposal.

Mr HATTON—Probably, as we have got now, we will end up with a mix of energy sources coming from a range of different things. In terms of those non-fossil fuel alternatives, what is your assessment of the strengths and weaknesses of the current dominant modes that are in operation? Do you have any view of any of the ones that have been recently developed, particularly in Australia? Do you know about what is happening there with the solar tower and so on?

Mr Noonan—The ACF would welcome providing a more detailed response and information to the inquiry on those sorts of matters. Looking at your current terms of reference, we did not do that for today, for instance. We would expect though, in regard to the question, that there would be no realisable potential for nuclear power in Australia, for a range of key reasons, and that that should not be realistically considered as part of that mix.

Mr HATTON—I am not talking about in Australia. We have only been looking at power in terms of the people we flog the uranium to having a nuclear power capacity. What I am talking about is wind, solar and the rest of it in terms of usage in Australia and worldwide, and where that is going, given that part of your evidence relates to an equalisation in terms of what nuclear might or might not provide worldwide, because even if China and India take it up, you expect others to close down. I am interested in filling the gap and how we fill the gap going forward.

Mr Sweeney—If I can briefly touch on the international dimension, I think you are right. Even if the most optimistic expansion scenarios are realised and there are significant technical, financial and political problems facing them, that will not match those reactors that come off-line

during the same period, that reach the end of their natural life, irrespective of the political wins. There are technical limitations on a range of current reactors and that is captured in the International Atomic Energy Agency predictions which say now, as we sit here in 2005, that nuclear energy generates 16 per cent of the world's electricity.

It says in 25 years time, 2030, their prediction, their model, is that it will provide 12 per cent. Over 25 years that is a 25 per cent drop in market share of nuclear. Obviously the global pie has grown, the global demand has grown, but nuclear's relative market share has shrunk, so we are back to your question—and I think it is the key question that all energy policy framers and others have to grapple with—how do we power our future? If nuclear is not the silver bullet—and we say for a host of reasons that it is not, but the International Atomic Energy Agency says at best it is going to be 12 per cent—if nuclear is not the answer, what is? That is why one of the core arguments that we have as well is that, apart from the proliferation, apart from the site-specific, apart from the waste, apart from a range of unresolved and massive issues, there is an opportunity cost, a distraction factor, in this debate. We need to move on past that.

My colleague will probably have a greater understanding on those questions you are asking, like 'Hot rocks—what are their potential?', 'The solar tower near Broken Hill—what is its potential?', 'Wind in the South Australian expansion program—what is its potential?'

I cannot give the level of detail I would like to give here today, but we can certainly take that on notice and present it to the committee. We looked at the terms of reference as antinuclear campaigners from a national environment group with a long-held position against the nuclear industry and came prepared for that, but we are very prepared to engage in a more positive discussion in moving forward about how we fuel Australia and elsewhere.

Mr HATTON—Mr Sweeney, that is very useful because for me the core question is non-fossil fuel alternatives, with the others we are going to look at as part of this committee being central to answering the question of how we get from here to there.

Mr Noonan—As an organisation we would certainly welcome the opportunity to fully participate in further case studies the committee may be considering and to do that in a very detailed, substantive sense.

Mr HATTON—This is encompassed by this inquiry. Uranium is only a subset, it is only a case study. The rest of the inquiry is about all the alternatives. The inquiry is not about the subset, not about just uranium; it is about non-fossil fuel alternatives. That is why it would be useful to have input.

Mr Noonan—If that was the intention of the committee in your terms of reference, that is not clear and it is not well understood in the community out there. That may well be reflected by the vast predominance of submissions focusing on nuclear and uranium misuse. It was thought that the perspective of the committee was that that was what you were addressing.

Mr HATTON—That is my perspective and it has been from the start, as I indicated to you previously.

Mr MARTIN FERGUSON—While a lot of us would not have disagreed with your view, it is not uranium or coal; it is a whole range of issues in terms of solving our energy needs.

Mr Sweeney—From our perspective there has been confusion. We looked at the terms of reference, we looked at the title of the inquiry as well, and we thought this was the first of a series. We imagined there would be a similarly dedicated inquiry looking at solar or renewable, or a similarly dedicated inquiry looking at the strategic importance of Australia's liquid natural gas reserves. I did not realise that this was, if you like, the bag that caught all the ideas. We assumed, on the terms of reference and on the title, that this looked at nuclear and uranium.

CHAIR—The terms of reference are:

The House of Representatives Standing Committee on Industry and Resources shall inquire into and report on the development of the non-fossil fuel energy industry in Australia.

The Committee shall commence its inquiry with a case study into the strategic importance of Australia's uranium resources.

And this is part of the case study.

Mr MARTIN FERGUSON—The potential problem is that even with additional reactors, putting aside whether some are going to close down in Europe or there are going to be more in Asia, the truth is that the growth in energy use internationally is going to be so big that the end result is probably that nuclear contribution is going to decline in significance, just because of the growth. Potentially the biggest contributor to the provision of that energy is coal, which raises very serious issues, hence the broader terms of reference in terms of global warming. That is why, with respect to some of the things you have said today, I do not question that we have a very serious problem internationally.

In terms of those international issues, you talked about the market and the dramatic increase in the price of uranium. In the last 12 to 18 months it has virtually trebled. What do you attribute that to?

Mr Noonan—It is largely to do with a shortfall in uranium production, rather than any demonstrated increase in demands. It is in part due to the drawdown of inventories that power utilities in the US and elsewhere had provided for themselves and it is partly due to a reduction in the provision of previously weapons-grade high-risk uranium from the USSR, coming through Russia. That is not to say that Russia does not have major stockpiles of highly enriched ex-military provided materials. They are choosing not to put them onto the market. They have had contractual agreements with the US, for instance, that limited the amount of Russian uranium that would be put onto the market from those sources. That is not to say those arrangements will stay that way in the future. Russia may also look to the price increase in uranium and wish to re-enter the market with its own previously military stockpiles. The assumption that the shortfall in the market has to be made up by increased mine production is not necessarily the total reality of that.

Mr MARTIN FERGUSON—Beyond Australia there are some potentially very big mines. Do you acknowledge that?

Mr Noonan—Certainly. Canada has always been a larger uranium producer than Australia. Canada does have a couple of major mine proposals intended to come on line in a similar time line to Roxby Downs.

Mr MARTIN FERGUSON—Including countries of the old Soviet Union.

Mr Sweeney—Central European countries, Kazakhstan and others, indeed.

Mr MARTIN FERGUSON—You raised in your submission—and touched on it partly today—some conditions for further sales of Australian uranium. The truth is there are going to be further sales from Australia and it does not matter whether or not there are additional mines. Would it better to have a country such as Australia, which is absolutely committed to those processes, including consideration of issues of additional criteria you raised today, than some country that does not have such a commitment as a condition of sale?

Mr Noonan—Firstly, Australia does not have a credible track record on uranium sales in the nuclear trade. There is a range of obvious conditions that we would put to you that should be added to those conditions of export.

Mr MARTIN FERGUSON—Yes, it is in your submission.

Mr Noonan—They are demonstrations that Australia has not exercised those responsibilities to date. Even if those conditions were to be added, it does not necessarily make our uranium trade a socially and environmentally responsible outcome.

Mr MARTIN FERGUSON—You would prefer Australia to withdraw and leave it to a country that has no regard for those types of conditions of sale?

Mr Noonan—We would prefer Australia to expedite the most stringent conditions on any uranium trade and to use our influence internationally to require that. We would also then expect Australia to use its influence not to further expansion of the nuclear industry in uranium mining but to constrain that and wind it back. It is the view of certain governments in Europe that it should be fully phased out. Australia could then much more expeditiously use our resources and our capacities to further leapfrog technologies that the developing world could take up within a reasonable time. We do not wish the developing world, in its right to realise proper lifestyles and quality of life, to repeat the mistakes of the Western World, either through the nuclear or coal industry's adverse potential environmental and other outcomes.

Mr MARTIN FERGUSON—We should be doing the research in the other alternatives anyhow. Just out of interest, in terms of rehabilitation, I acknowledge the problems of Rum Jungle and some of the other areas through there. It was a disaster. At Nabarlek, some of the buildings were left there at the request of the Indigenous community and are now a real problem. What other rehabilitation problems do you raise with respect to Nabarlek as things that should be considered in the future?

Mr Sweeney—There four issues in relation to Nabarlek. One, as you have said, is physical plant on the site, the former water and diesel storage areas and the construction camp.

Mr MARTIN FERGUSON—You know they were left at the request of the community?

Mr Sweeney—I do understand that, but I also understand that they have now fallen into disrepair.

Mr MARTIN FERGUSON—Correct.

Mr Sweeney—There is a range of problems, including asbestos materials in the construction camp and the like. Another is the revegetation. There has been a profound lack of revegetation; the revegetation program has not worked well at Nabarlek. That is an issue and a problem. A third, and probably the most significant, is an area which they used to call the badlands on the site and now they call the ‘radiation anonymous’ area. That is an area which has a considerably high level of radiation readings and there is a seepage plume, as I understand it, moving from that area slowly down towards one of the catchment creeks. That is a significant issue. I understand there is considerable talk about how best to manage that, whether it should be by lifting up the first three or five or six centimetres of soil and placing it somewhere else, or how best to address that issue.

The fourth and overarching point at Nabarlek is that there has been, in recent years, a profound failure of communication between agencies and a profound failure of the regulatory culture. What happened was that a former senior person in DBIRD, the Northern Territory Department of Business, Industry and Resource Development, without the advice or consent of the Northern Land Council—the traditional owners—or the supervising scientist, returned \$9.6 million of a \$10 million rehabilitation bond. By the time that was done there was no closure agreement and there were no closure criteria. There was a meeting between those agencies, the day after the bond was returned, to discuss closure criteria.

That is a snapshot, one of many, of a breakdown in communication and a breakdown in regulatory compliance, understanding and enforcement. There are a few clear lessons from Nabarlek for transfer across the river to Ranger. We are looking at Ranger now. It is a major mine and the current life-of-mine plan is that mining will finish in 2008 and milling in 2011. There is a major challenge in trying to rehabilitate the Ranger project area. Is a legal requirement that it be rehabilitated into a quality of land comparable to the surrounding Kakadu National Park.

The other requirement under Australian law—under the agreement with the Australian government and the mining company—is that they isolate the radioactive tailings, as my colleague has said, which contain 80 per cent of the radioactivity of the original ore body, for a period of not less than 10,000 years. That is a considerable challenge anywhere. It is a great challenge in a monsoonal area.

Look at the Nabarlek experience. That shows that you need to get your planning right, you need to have adequate financial provision, you need to have the technical capacity, you need a transparent and rigorous regulatory framework and you need to include the traditional owners so that the aspirations are clearly understood et cetera. They are some things that we can learn to apply now in the Ranger context, because Ranger is a huge challenge. Irrespective of what one thinks of the future of nuclear power, the minimum responsible position is not to leave a legacy

of leaking tailings dams and trashed communities and land dotted around the country, and we have that challenge right in front of us now at Ranger.

Mr MARTIN FERGUSON—Including what you do at Jabiru.

Mr Sweeney—Yes, all of these things. Mining has profound social impacts and social outcomes and consequences as well. All of these things need to be addressed in Rio Tinto's exit package for the region.

CHAIR—We are out of time, gentlemen. Thank you for your submissions. If there are any further questions, I will have the secretariat contact you. You are going to send the secretariat that extra information as well?

Mr Sweeney—Alternatives, yes.

CHAIR—Thank you very much.

Mr Sweeney—Thank you for the opportunity.

[2.36 pm]

HORE-LACY, Mr Ian, General Manager, Uranium Information Centre

CHAIR—Thank you for agreeing to appear and to give evidence before the public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearing is a formal proceeding of parliament. I remind you that giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. I also remind you that the committee prefers that all evidence be given in public. However, at any stage you may request that your evidence be given in private and the committee will consider your request. I would ask you to make a short statement before we move to questions.

Mr Hore-Lacy—Thank you, Mr Chairman and committee members. I appear on behalf of the Uranium Information Centre, hereinafter the UIC, of which I am general manager. The centre was established in 1978 to increase public understanding in Australia of uranium mining and nuclear energy. It is funded by companies involved in exploration for and mining of uranium in Australia and export of that product. Through my board those companies have asked me to present industry views to this committee. I am happy to take on notice any company-specific questions you may have and I will refer them to the company concerned.

This inquiry is very timely. Attitudes to nuclear power are becoming much more positive internationally, both at public and government levels. In Australia there is renewed interest in uranium exploration and a desire to expand those mining operations we already have. For the industry these developments represent a reward for patience and perseverance. While the end of uranium mining and nuclear electricity has been predicted from time to time, the reality is that Australia's involvement in the nuclear cycle has been a long one. It began in the 1940s when the world first realised the energy potential of the peacefully applied uranium atom.

It was quickly recognised then that Australia was one of the few countries in the world with significant uranium resources. That remains the case today. We have about one-third of the world's known economic resources of uranium. Australia's first commercial uranium mining began at Radium Hill in South Australia and at Rum Jungle in the Northern Territory, both in 1954. Australia's interest from the outset has not only been an economic one. We have worked within international forums to ensure that the use of uranium was for the benefit of nations wanting it for electricity generation and that it was supplied and used in a safe and environmentally responsible way.

Australia was one of 18 member nations of the preparatory commission which established the International Atomic Energy Agency in 1957. Our voice on nuclear issues has been internationally respected ever since as a responsible one. Australia has played a leading role in the development and maintenance of international arrangements to ensure the use of uranium for peaceful purposes only. We have made a major contribution to international research on issues associated with the disposal of wastes generated by the nuclear fuel cycle, and we have been able to do this because of our desire and determination to be strategic and principled in our supply of uranium to the world.

We acknowledge the major role played by the Australian Atomic Energy Commission, now somewhat remodelled as the Australian Nuclear Science and Technology Organisation, in all of this. In noting that the purpose of this inquiry is to consider the strategic importance of Australia's uranium resources, we can acknowledge that already, in an international sense, we have been strategic in our policies and practices for a long time.

Sound foundations have been laid for Australia to maintain its reputation as a reliable and preferred supplier of uranium to the world. The policies of a succession of governments over the past 50 years—and particularly on a bipartisan basis since 1977—have positioned Australia to take advantage of growth in demand for uranium and a continuing increase in prices, which can be predicted with strong confidence. Not only do we have about one-third of the world's economically recoverable known resources of uranium, but seven of the top 20 known uranium deposits in the world are in Australia.

The industry has demonstrated that it can mine its uranium in a safe and environmentally responsible way, safe for the workers directly involved in the industry and safe and with minimal environmental impact for the wider community. What is more, as the world continues to address the need to reduce greenhouse gas emissions, it can look to nuclear power plants as the most significant and cost-effective means of doing this, while enabling access to a continuous, reliable supply of electricity on a large scale.

Nuclear power is used because it is economically attractive, as well as providing energy security. As well as uranium, Australia has significant resources of coal, natural gas and some hydro options. Many other countries are not so fortunate in their energy providence. They have decided that they need nuclear electricity. In a strategic sense, were Australia to withhold its supply of uranium, it is becoming increasingly undeniable and inevitable that those countries needing it will seek it from elsewhere, since it is a low-cost fuel for capital intensive plants. It is likely that they will seek supplies from places that cannot boast Australia's record of influence to ensure the safety of the nuclear fuel cycle and the control of weapons proliferation.

It is the submission of the interests represented by the Uranium Information Centre that public policy in Australia should reflect this reality. Our hope is that, as a result of this inquiry, policy at all levels of government will enable uranium mining in Australia to further develop under legislative and regulatory requirements that ensure the highest possible standards of occupational health, public safety, environmental protection and countering weapons proliferation.

We believe that the use of nuclear electricity around the world will continue to grow. Australia's uranium producers do not say that nuclear is the only answer to the world's energy needs but they do say that it needs to be regarded as an important part of the mix, which should also include renewable sources where they are available, economic and efficient. We also support the coal industry's endeavours to dramatically reduce carbon dioxide emission from the use of their product and to achieve this economically.

Consistent with the role of the Uranium Information Centre, our written submission to this committee seeks to provide objective and up-to-date information relevant to the committee's terms of reference. Those interests I represent trust that this will help the committee to provide sound advice to parliament, the government and the community on the continuing strategic importance of Australia's uranium resources. As never before, these resources provide an

opportunity, reflecting a happy coincidence of national self-interest and environmental altruism. However, I should emphasise that the normal role of the UIC is not so much advocacy as to provide comprehensive, reliable and up-to-date information on nuclear power. We stand or fall by our reputation in that regard. I look forward to your questions.

ACTING CHAIR (Mr Hatton)—Thank you, Mr Hore-Lacy.

Mr MARTIN FERGUSON—In terms of renewables, what is your organisation's attitude to the role of government in creating incentives, potentially subsidising the growth of some of those renewable energies, given the major problem that exists with global warming now?

Mr Hore-Lacy—We do not have a specific position on it but, if I might venture some comments, I think we need to ask why those subsidies are there. If it is to achieve low carbon emissions, then they should be applied to anything which achieves low carbon emissions and not, for example, as in the UK, discriminating against nuclear power. In other words, if subsidies are available for wind in Australia, on the basis of carbon reduction, they should be equally available to nuclear.

Mr MARTIN FERGUSON—I notice that you have sat here from the start of proceedings today. There have been issues raised in terms of the potential sale of Australian uranium for nuclear power stations that might come into operation in Asia. There is going to be a potential closure of facilities in Europe. As uranium is normally sold on the basis of long-term contracts rather than spot price, where do you see the potential market for Australian uranium? What is your comment with respect to what is happening in Europe?

Mr Hore-Lacy—The potential market is pretty much where it is now. I do not see any reduction in nuclear capacity or interest in Europe. I note the policies of the German government, I note the policies of the Swedish government and I note that those policies are timed, as it were, to possibly take effect way into the future, several changes of government away. In other words, for Germany it will be about 2010 before their current policies matter, if they last that long. In fact, they might not last till Christmas.

Mr MARTIN FERGUSON—There is a long-held policy position in Australia across governments of all political persuasions that we should only sell uranium to countries who are parties to the Nuclear Non-Proliferation Treaty and who also enter into a bilateral with Australia with respect to tracing its peaceful use. With respect to potential demand in India, does your organisation believe that we should walk away from the requirement for importing countries of Australian uranium to be parties to the Nuclear Non-Proliferation Treaty?

Mr Hore-Lacy—The organisation does not believe that, because we have not discussed it, and I doubt if the members believe that. As I understand it, all of our main members would want to go along with Australian government policy in this regard and would see that as rather important, with the two requirements you mentioned and also the third about the additional safeguard; additional protocol.

Mr MARTIN FERGUSON—Thank you.

Mr ADAMS—Mr Hore-Lacy, I do not know if you picked up that last question. On what grounds would you support Australia exporting uranium to India?

Mr Hore-Lacy—We would go with the government policy, as I understand our main members. Let me just comment on that, if I may. This is an issue that, for instance, the World Nuclear Association has some sentiment on, that India is rather hard done by. The reason that China is a recognised weapons state is that it did its nuclear explosion, I think, in 1967. The NPT came in in 1970 and India did its first explosion in 1974, so it was left out in the cold. Essentially, India and China are in much the same position. Both of them have had a weapons program preceding a civil program. In India the two are mixed up together to a greater extent than I believe is the case in China, but India has been very scrupulous in its nonproliferation intentions and practices, unlike one neighbour, so there is a measure of injustice there. It seems unreasonable to ask India to abandon its weapons program while not asking China to do the same, because it is pretty much the same situation.

We note with interest the new American initiatives in this regard, which may give rise to some reclassification of India and enable the world to treat India alongside China, but all that is some distance away and I am not wanting to express a view that is in any way different from the government's position.

Mr ADAMS—You raised the issue in your submission about regulations duplication—that is, it is not about not being regulated, it is about having state and federal regulations, or both, having acts which have to be met when there is duplication. Is that what you mean? Would you like to comment on that?

Mr Hore-Lacy—I think there is something in our submission on that and, yes, I think we are in favour of consistent regulations to achieve a high standard of performance, without duplication. We would also like the regulations to be consistent across different industries. At the moment it would seem that the uranium industry is under much greater scrutiny than other industries, arguably with at least the same, if not greater, occupational health implications of broken pipes and so forth. That does not seem to me to be terribly reasonable.

Mr ADAMS—I just want to make sure we get that clear. You talk of one set of regulations and not two, which is basically the same, I take it?

Mr Hore-Lacy—They need to be consistent, and we recognise that state authorities and federal authorities have an interest in the matter. How that is precisely arranged, I do not presume to comment.

CHAIR—Mr Hore-Lacy, consideration is now being given to the export of Australian uranium to China. Does your organisation support export to China?

Mr Hore-Lacy—Once the bilateral safeguards agreement has been worked out, yes.

Mr HATTON—Mr Hore-Lacy, I think you were here when evidence was given by the Medical Association for Prevention of War (Australia), Victorian branch. In their evidence, they alluded to the Greenpeace report into laser enrichment, principally of uranium, called *Secrets*,

Lies and Uranium Enrichment: The classified Silex project at Lucas Heights. Are you aware of that project or the details of that?

Mr Hore-Lacy—I do not know about details but I am aware of the project, to a degree, and I am following it with great interest.

Mr HATTON—What is your understanding of that project?

Mr Hore-Lacy—It is applying laser excitation to separating isotopes of various minerals. It is applied to silicon enrichment, it is applied to zirconium enrichment—the sorting out of isotopes—and it is applied to uranium. The uranium project is the one that is of specific interest here. It promises to be a low-energy and low-cost way of enrichment—that is to say, sorting out isotopes. It is obviously a molecular process, rather than an atomic process. There has been a lot of money spent in both France and the US on unsuccessful atomic laser processes applied to atoms of uranium. This is applied to uranium hexafluoride, which is the same substance as used for enrichment in other processes.

Mr HATTON—It is also, according to the argument, used for other substances like carbon and silicon.

Mr Hore-Lacy—Yes.

Mr HATTON—Do you know if it is chiefly used for uranium or is it across a range of different elements?

Mr Hore-Lacy—It is still experimental. There are several strands to it, as I understand from the public releases on the web site. There is the uranium project, which was formerly being financed by USEC until they pulled back from it to pursue another avenue, and there are silicon, carbon and other things that they are operating on, about which I do not know very much.

Mr HATTON—Further, they argue that in 1996 Silex signed an agreement with the United States Enrichment Corporation, resulting in the US Department of Energy classifying the Silex process as restricted data and the arguments, at first instance, where a private group has had that kind of restriction. Do you know anything about its status in that regard? Is what they have developed so significant that they have that determination from the US Department of Energy?

Mr Hore-Lacy—I do not know anything very specific about that. I would assume that it relates to the same sort of sensitivity, for instance, that would result if we were developing a new kind of centrifuge enrichment in Australia. The centrifuge enrichment technology is one that I know causes some concern around the place because of its potential for enriching right up to weapons grade. Presumably, the same concerns would apply to Silex, but I do not know any detail on that.

Mr HATTON—In terms of the broader question of the advances in technology, the fact is that this innovation would seem to make it possible for people to have easier, quicker and cheaper access to enrichment compared to the massive infrastructure that is needed with gas centrifuges and so on and it would be more difficult to track countries that were seeking to enrich in this way. There are some associated arguments that in some of those countries that have been causing

problems—in Iran, for instance—they have used laser enrichment processes in order to produce weapons material. Do you know if that is the case?

Mr Hore-Lacy—No, I do not think that is the case. I do not think anybody has used a laser process to produce anything much so far. It is still very experimental. Silex are now shaping up to raise the funds for the first pilot plant, I think, so it is only in an experimental stage. I do not know of Silex being very much different from centrifuge technology in the respects you mention. I do not know of it being specifically cheaper or harder to track or anything else. There is a big difference, of course, between centrifuge and diffusion enrichment, which does require huge equipment.

Mr HATTON—Is gas centrifuge very hard to track?

Mr Hore-Lacy—I do not know specifically. I suggest you address that question to the Australian Safeguards and Non-Proliferation Office. But I understand that there are concerns that it is more difficult to track and more difficult to keep tabs on than they would like. This is, of course, driving the consideration worldwide towards limiting things like enrichment plants to established reputable countries and making the services available on a guaranteed basis to other countries, which is really going back to a concept that was around in the 1970s, but then we drifted away from it.

Mr HATTON—A number of groups that have given evidence to us and made submissions have twinned the military and civilian uses of nuclear energy. What is your reaction to the arguments that have been put forward? Do you see them as being so twinned or are they separable? They have argued that the greater danger in developing new nuclear capacity is the fact that almost inevitably you will get an interchange between that and military uses. In questioning, I suggested that maybe the arsenals came before civil use and so on.

Mr Hore-Lacy—That is demonstrably so, and we could work through the different countries and look at that, particularly those that have done the wrong thing under the NPT. Certainly, in the early days in the UK—and, I would assume, also in Russia—there was dual use. The early British nuclear reactors for the first two or three years in the 1950s, I think, were run both for electricity and for weapons plutonium production. I do not know what the exact picture in Russia is on that account, but we do not sell uranium to Russia so it is a bit academic. Certainly, with the UK and any country we sell to there has been nothing ambiguous since about 1960.

There are some important points to make, I think, about this whole question. There is no evidence of any leakage from civil to military. In that sense, the Nuclear Non-Proliferation Treaty primarily covers fissile material rather than equipment and expertise. It has been an extraordinary success. With the wisdom of hindsight, of course, we might wish that it had been a bit more ambitious—and we did not have the need for that additional protocol that was developed in the 1990s—and that it addressed some of the issues that are now raising concerns, but it has been an enormous success in what it set out to do.

One of the previous people giving evidence, I think, said that if there were no civil power there might be fewer weapons states now. I am using the term ‘weapons states’ in a broad sense rather than the five special ones under the NPT. I disagree. I think there would probably be two or three times as many weapons states now if there were no civil nuclear power, because the

Nuclear Non-Proliferation Treaty has had this trade-off of technical assistance for the development of civil power on the basis that people stood back from the possibility, and eschewed the possibility, of developing weapons. In the 1960s there were a number of reputable estimates that by the turn of the century there would be at least 30, probably 35, nuclear weapons states. Now we have five official ones, we have three unofficial ones and we have some shenanigans here and there. I think that is an extraordinarily good result.

My name was mentioned earlier in respect of statements about plutonium. There is a difference of opinion worldwide about whether plutonium recovered from normal spent fuel reprocessing is weapons usable.

Conservatively, it is treated as such and I have no quarrel with that, but whether it is such there are profound differences of opinion on. The facts are, first, that normal reactor-grade plutonium has about one-third non-fissile isotopes in it. The second fact is that nothing like that has ever been made to explode. The 1962 test that has been referred to was certainly of plutonium recovered from British spent fuel, from the Magnox reactors and the best intelligence I have is that that was about 15 per cent non-fissile. The third fact—and I think these facts are not disputed—is that for anybody trying to make a weapon using any plutonium, it is a very high-tech operation. It is not a terrorist backyard job. Finally, if that attempt to make a plutonium weapon were attempted with reactor-grade plutonium with a high amount of plutonium-240 in it, it would be a very hazardous and fraught undertaking. I do not think anyone disputes that. It would be almost suicidal, if not definitely suicidal, because plutonium has a high rate of spontaneous neutron emission.

Mr HATTON—In terms of the prospects of terrorists' use of dirty bombs, not full nuclear weapons, what is the likelihood of that happening? What are the problems? Has it become more likely that terrorists could get access to material and construct a pretty simple dirty bomb that could do great damage? How do we control against that?

Mr Hore-Lacy—That is a distinct possibility, but I think the possibility of them doing it with spent fuel from the civil nuclear cycle or even a research reactor is infinitesimally small because that fuel is self-protecting by virtue of its high radioactivity. A terrorist wanting to do that would probably get something like a cobalt source from some medical or radiation thing which can be shielded in lead while it is being manipulated and planted, presumably, and then blown apart. I do not know. I would think that that is a much more likely source. Spent fuel would be incredibly difficult to handle without getting zapped in the process. Even if you were suicidal, I do not think you would do very much with it. I have not seen any suggested scenario from anybody knowledgeable that that is likely.

For instance, in the US, in relation to separated plutonium, they have what is called a spent fuel standard. That is to say, the plutonium must never be any more accessible than if it were in spent fuel, the implication being that it is very inaccessible at that point.

Mr HATTON—What is your reaction to the spent fuel plutonium from the Japanese reactors and the large amounts of that and so on that we have heard about in previous evidence? Does that create a situation where Japan could be a break-out state?

Mr Hore-Lacy—I do not think so.

Mr HATTON—I would think, rather, it may then well be a threshold country.

Mr Hore-Lacy—I have no detailed knowledge of the composition of that plutonium but, as I understand it, it is all separated from normal light water reactor fuel. I therefore assume it has got at least one-third non-fissile elements in it, which makes it, as I understand it, totally unusable for anybody's weapons—Japan's or anybody who might want to nab the stuff. It is sitting there awaiting the opening of Japan's MOX plant—that is, fuel fabrication plant using mixed oxide fuel—when it will be used. Japan's national policy remains very firmly in favour of using plutonium in mixed oxide fuel to extend by about one-third the amount of energy they get out of the uranium they buy.

Mr HATTON—We also heard that a lot of the weapons material came out of research reactors. They certainly did that in the originating states. Would you make a distinction between those and the research reactors that we have now? Are they capable of producing enriched plutonium for weapons-grade material or not?

Mr Hore-Lacy—I am no expert on how you produce weapons-grade material but, as I understand it, it is normally produced in production reactors which operate with some natural uranium—that is, not enriched uranium—and heavy water; particularly heavy water and maybe a graphite moderator. That is then a particular subset of the world's 250 or 260 research reactors, and one perhaps needs to put inverted commas around the 'research', because the ones in Korea are rather large and one of the Indian ones is rather larger than is needed for research and I think was quite clearly designed as a production reactor. Those reactors all run on natural uranium fuel and I think they are heavy water moderated. Of course, one of the concerns about Iran is that they want to build a reactor just like that. It is that particular subset of research reactors that is problematical. I suggest you talk to the Australian Safeguards and Non-Proliferation Office about that. They are the experts on that; I am not.

CHAIR—Thank you for appearing before the committee today. If the committee has any further questions I will have the committee secretariat contact you.

[3.09 pm]

BRUNT, Mr David Andrew, Vice-President, Exploration and Development, Heathgate Resources

CHALMERS, Mr Mark, Senior Vice-President and General Manager, Heathgate Resources

CHAIR—I welcome the representatives of Heathgate Resources. Thank you for agreeing to appear before the committee and give evidence at this public hearing today. Although the committee does not require you to give evidence under oath, I should advise you that the hearings are formal proceedings of the parliament and I remind you that giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. I also remind you that the committee prefers that evidence be given in public. However, at any stage you may request that your evidence be given in private and the committee will consider that request. I ask you now to make a short opening statement before we proceed to questions.

Mr Chalmers—Chair and the committee, Heathgate appreciates the opportunity to be present at this hearing. Heathgate is the owner and operator of the Beverley uranium mine. Beverley is Australia's newest and smallest uranium mine. Beverley started commercial production in 2001 and is the first ISL, in situ leach, uranium mine in Australia. Our company is proud of its reputation as a new producer in South Australia. Heathgate supports this mission of the Uranium Information Centre. UIC's views, as well as Heathgate's, are included in our written submissions. However, we would like to reiterate a few key points.

Australia has a very important role to play in meeting the world's demand for uranium fuel. Companies that invest in Australia need political stability and Australia needs to take the leadership role on this issue. We support the current high standards of regulatory controls in this country. From our perspective, in South Australia the roles of the state and federal regulatory agencies are productive and appropriate. As the industry continues to develop in the country, there will need to be an additional focus remaining on these regulations to ensure they are consistent and to avoid duplication across Australia. Lastly, Australia has a unique opportunity to further benefit and emerge as the largest uranium producer in the world while at the same time responsibly helping the world with its energy and environmental needs.

Now back to our project, our company. Although small, we employ about 100 people. When you add the direct employees and indirect employees, that is a total of almost 300, largely in regional South Australia. We are also the largest private employer of Aboriginal people from the Flinders Ranges, with approximately 25 per cent of our site work force being from this area. We are very proud of that. We pay over \$1 million per year in native title royalties to the Indigenous community. In addition, we pay over \$2 million in royalties, taxes and fees to the State of South Australia. On a \$100 million investment we generate \$70 million per annum and that is growing as the price of uranium increases.

Our mine, whilst small in comparison to Olympic Dam and Ranger, is important in terms of setting a standard for the small and medium sized producers of the future. Our mine is the most

technologically advanced ISL uranium mine in the world. It is equipped with the latest instrumentation and controls. Our method of extraction minimises environmental impact and health and safety impacts to our employees and to the public. Also, as a company we are one of the largest primary explorers of uranium in Australia, approximately equal to Cameco and one of the largest explorers in the world for uranium. We are proud of that also, being a very small company.

The mine has undergone and withstood the rigours of multiple environmental inquiries and inspections over the past number of years, the last being the South Australian state EPA inquiry that endorsed our mining method as being appropriate. We look forward to the visit of the committee to our operation. We are proud of what has been accomplished over the past several years of our project. In closing, again we would like to express our appreciation for being here and are open for questions.

CHAIR—Thank you. I note General Atomics also designs nuclear reactors. You may not be in a position to answer this question, but what are the prospects for reactor safety and improvement management of spent fuel in the reactor designs on which GA is currently working?

Mr Chalmers—I am not completely briefed on all of General Atomic's activities. Certainly they are an integrated company dealing with the nuclear fuel cycle. They do design third and fourth generation reactors. With regard to dealing with spent fuel, I believe they have done a number of projects on some of the canisters and whatnot for transporting the spent fuel; but other than that, I am not knowledgeable of their activities.

Mr Brunt—We have no real involvement with that aspect of the business from Australia.

CHAIR—Could you find out and exhibit it to the committee?

Mr Chalmers—Certainly.

Mr HATTON—Could you explain the in situ leaching process in terms that even I could understand? Given the previous evidence that we have in relation to Olympic Dam and the fact of the nature of the rock base in the Gawler Craton—there was a problem with the leaching process to get the uranium out of its ore base—do you have similar problems to those that exist at Olympic Dam?

Mr Chalmers—They are very different types of deposits. Beverley is unique in terms of the way that we can use the ISL technique. The uranium leaches very easily out of very permeable sands. The pore spaces allow mining fluids to contact the largely coffinite mineralisation and it leaches quite easily. ISL is a means of mining which is only applicable to probably 15 to 20 per cent of deposits of uranium worldwide. The conditions have to be unique. One is the accessibility of the fluids and the permeabilities for the fluids to contact the mineralisation. The other thing is that geologically and hydrologically is also has to be appropriate. The fluid has to be contained with clay zones so that it is not going to migrate out of the mining zone itself.

In situ leaching takes the mining fluid, which in our case is groundwater that is fortified with sulfuric acid to a pH of between 1.6 and 1.8—to give you an example, wine in some cases will

have a pH of about two—and this goes through the ore zones with an oxidant, liberates the uranium from the sand grains and is then taken to the plant. This process is recycled approximately 70 to 80 or 100 times before the uranium is effectively removed from the mining zone.

Mr Brunt—The leachability of minerals, uranium or others, from any mineral deposit in Australia is a fundamental aspect of the investigation of that deposit. I am sure that the people at Olympic Dam would know a lot of information about the leachability of their mineralogy. I am sure that they would be able to answer questions about that.

Mr HATTON—Given the particular nature of the deposit at Beverley and the fact that there are only 20 per cent or so worldwide, how much of Australia has those kinds of deposits, and where are the major deposits in the world? Are they in Canada or elsewhere; Kazakhstan?

Mr Chalmers—In Australia the only known areas for in situ leachable deposits would be the Beverley project, the Southern Cross Honeymoon project, the Gould's Dam, and Oomagooma and Manyingi, which are in the north-west portions of Western Australia. There could be additional deposits discovered but it largely has to be in sedimentary permeable zones.

Mr HATTON—And the comparison worldwide? Where are the main deposits?

Mr Chalmers—Worldwide the other areas would be Kazakhstan and a number of areas in the United States, primarily in Wyoming, Nebraska and New Mexico.

CHAIR—The Kintyre and Yeelirrie deposits in Western Australia; what are they?

Mr Chalmers—Those are not ISL amenable.

Mr MARTIN FERGUSON—There has been some criticism today by Dr Mudd of your in situ leaching process. He questions the CSIRO report and you also referred to the report of the South Australian government today. What do you say about that criticism and has your company made any financial contribution to the workings of CSIRO?

Mr Chalmers—With regard to is our process appropriate, it is appropriate. The main fundamental with the Beverley project that most people do not understand is that we are mining in a very limited aquifer that was already saline and mildly radioactive to start with. It has been rendered unusable for human or animal consumption. When we go into that mining zone and extract the uranium, as a benefit for the state and also to generate electricity, the zone is also unusable when we leave it. It was unusable to start with and unusable at the end of mining.

We are looking at ways to kick-start the attenuation process and we will continue to look at ways to do that. The CSIRO study I think was a very scientific based objective study into what we do and how we do that and it was an excellent process. Some of the issues with regard to attenuation and whatnot were addressed in the CSIRO study and all the initiatives that were put forward with the EPA are currently being reviewed with the state government and are being implemented by our company.

Mr MARTIN FERGUSON—One of the accusations was that the CSIRO work was questionable because there had been financial contributions from the uranium industry to CSIRO. Has your company made any financial contribution to CSIRO?

Mr Chalmers—I do not believe so.

Mr Brunt—No. We have had some discussion about arm's length contractor/client/consultant type relationships but no financial contributions.

Mr MARTIN FERGUSON—Have you considered, from a scientific point of view, Dr Mudd's work?

Mr Brunt—He has compiled a lot of work to do with the in situ leach uranium industry around the world and he has compiled a history of uranium events to do with these types of mines in other places. Most of that work, on my understanding, was funded by antiuranium groups. He has presented papers at some international conferences but he has not specifically approached us, that I know of, talking about these particular issues, although he was involved in the South Australian inquiry that we referred to earlier.

Mr MARTIN FERGUSON—In terms of the approval process, what was the nature of the process you went through in respect to your consultation with the Indigenous community?

Mr Brunt—The Beverley mine was the first mine to start in South Australia after the introduction of the native title federal legislation, and some complementary South Australian legislation was also introduced. At the time we were publishing our environmental impact statement and preparing for the construction of the mine, we had four overlapping native title claims over the area of the mine. We were struck with the problem of how to negotiate and achieve agreements with these groups, because without them the mine would not have gone ahead.

The four native title claims were all made, effectively, by the same people. They were all interrelated, but different individuals were involved with those claims. The consultation process we undertook, after a great deal of thought and discussion with legal advisers and others—our legal advisers, the Aboriginal Legal Rights Movement and others advising the Indigenous people in South Australia—was a process whereby we worked out what we thought would be an advantageous program of benefits for the Aboriginal people, which was generally modelled on what had happened in the Northern Territory on Aboriginal land as distinct from native title claimed land.

We called and held, I think, the largest meeting of the Adnyamathanha and Kuyani people ever held in the Flinders Ranges area. There were about 400 people present, and we presented the program to them. The meeting was held under the adjudication of the local member of parliament. We presented an offer and then we proceeded over subsequent months to negotiate with the parties involved.

Mr MARTIN FERGUSON—Over what time span was that?

Mr Brunt—The meeting was held in February 1998 and all the agreements were finalised by about September 1998. It probably took the best part of nine months to negotiate the process, because it took a while to get to the February situation.

Mr MARTIN FERGUSON—What do the essential components of the agreement include?

Mr Brunt—They include payments of what we call royalties to the Aboriginal people, the Adnyamathanha people and to each of the claim groups. Each of the four agreements are about the same. They have some initial payments to do with setting up the agreements and starting the process. There are administration payments whereby the parties receive a six-monthly payment from us that enables them to pay their people for communication issues, for legal advice and for representation in meetings with us. There are also community payments to the nearest communities to the Beverley mine.

There are undertakings in respect of employment. Our target is 20 per cent of the site work force and, as Mark indicated earlier, we are currently at 25 per cent. There are some other undertakings in respect of contracts for the supply of goods and services for the mine. It was, in many respects, a groundbreaking exercise in South Australia under the native title regime as distinct from Aboriginal land in the Northern Territory with mines such as Ranger and Nabarlek et cetera.

Mr MARTIN FERGUSON—We have had mixed success as a nation in terms of facilitating employment of Indigenous people and training across industry generally. You have achieved 25 per cent. Are there any lessons you can convey to us—because it is exceptionally important and not just for this industry—about how you achieved that success whereas other companies are still struggling?

Mr Chalmers—No. 1 is that we made a commitment to it. We have learned a lot. It was not easy. We have taken a few bumps here and there trying to retain the Aboriginal people that we have hired. We initiated a program whereby two Aboriginal liaison officers report directly to me on Aboriginal issues, because we found that if they were reporting up through the structure of the company, and there were two or three layers of management, some of those Aboriginal issues were not addressed as quickly as they should have been, which may have resulted in the loss of a good employee, so we put those measures in.

We have quarterly meetings with the claimants to communicate issues of concern between the people and the company and to update them on our activities. We have put a fair amount of money into training. Our Aboriginals are treated as 100 per cent equals—100 per cent equals in every job opportunity in our company—and we are proud of that.

Mr MARTIN FERGUSON—Thank you.

Mr ADAMS—Do you have training on site or off site?

Mr Chalmers—It is a combination of both. Logistically, we try to do as much training on site as possible. It is logistically easier for us to do it at the mine site.

Mr ADAMS—I want to go now to the issue of differences in materials, specifically the difference between class 7 material and other classes in a transport sense. There have been some difficulties in the shipping.

Mr Brunt—Uranium fits into the category, in the international codes, of class 7. It is a radioactive material, so it is shipped as class 7 goods around the world. It is generally mildly radioactive.

Mr ADAMS—What are the other classes? Do you go down to 1?

Mr Brunt—I do not know what they all are, but there are numbers of them.

Mr MARTIN FERGUSON—Does that mean you cannot move it on a ship with any food or related products?

Mr Brunt—Uranium is shipped with wine and things like that from South Australia, but it has to be separately located within the ship.

CHAIR—Is there a problem with the availability of shipping in the industry?

Mr Brunt—Yes. We flagged in our submission that there is an issue with the shipment of class 7 goods from Australia. Over recent years the decline in the number of shipping companies around the world and the decline in the number of companies that want to ship class 7 goods has made it harder to have flexibility in shipping our product from the three existing mines to the converters around the world, which are located in France, Canada and the United States. It has become more difficult than it was even just a matter of a few years ago.

There always will be an answer to that, in the sense that you could charter a specific vessel, but it is much better for the orderly development of trade to be able to ship on a shipping line that routinely visits, in our case, Adelaide. To help us diversify our shipping routes, we and the Olympic Dam producers in South Australia have opened up—as I think we have mentioned in our submission—the use of the Darwin to Adelaide railway line to ship product via Darwin. This was done as a trial earlier this year and was very successful.

CHAIR—In relation to your statement about the appointment of Aboriginal liaison officers, did you do that to start with or did you instigate that to solve a problem?

Mr Chalmers—We did not do it to start with, but there were a couple of instances where I felt that we lost primarily young Aboriginal employees and, if there had been a way they could have got to me sooner, we could have addressed any issues and not lost them as employees. It was an idea that we thought had merit and, 'Let's give it a go and see how it works out.' To date it has been a success for us.

CHAIR—How long have you been doing it?

Mr Chalmers—About a year now, I believe. We were really struggling to get to the 20 per cent about a year ago. Our employment at that time was probably 14 per cent or 15 per cent. It was a combination of the liaison position and the efforts of a lot of people,

including a very dedicated HR person on our staff, who took a personal commitment to increase those numbers. There are a lot of different reasons, but I think the liaison officer, a senior person in the Adnyamathanha group, is a mentor for the younger people and says to them, 'If you're having a bad day, don't just quit. Hang in there and you will have opportunities with the company.'

CHAIR—The reason why I am raising it again with you is that in other inquiries that previous committees have been involved in, particularly with mining industries, their problem has been that they lose staff, and this is the first time that I have heard of someone appointing liaison officers, which would appear to be an extremely good idea. If other mining companies used the same method, it might be beneficial to them and, more particularly, beneficial to the wider Aboriginal community that in the main, for whatever reason, does not sometimes get the best out of the opportunities that mining—whether it be uranium or otherwise—can provide to them.

Mr Chalmers—We take that as a compliment. It is all about constant improvement. Whether it is Aboriginal employment or whatever, we are a company that is dedicated to constant improvement in every area. Obviously, I am not Australian but I have worked in the uranium business around the world. I have dealt with indigenous people around the world, and I find it is a challenge no matter where you go, but you learn from it and try to again move forward in the best way possible.

For the Aboriginal people, one of the key issues is employment, not royalties. When we have meetings with the Aboriginal community, they want to know what the employment numbers are. We get more credibility from the Aboriginal people when we can say that we are not 20 per cent, we are 25 per cent. If we are at 25 per cent, we are going to try to go to 30 per cent and to 35 per cent. We are not going to stop at 25 per cent.

Mr HATTON—Do you feel any guilt or shame that you mine uranium?

Mr Chalmers—Absolutely not. I am proud of what we do. We are absolutely proud of what we do, because we are committed and we believe that we are helping the environment, not destroying it.

Mr Brunt—And I would say every single one of our employees would think exactly the same as that.

Mr HATTON—Or that you are part of the nuclear industry?

Mr Chalmers—Absolutely.

Mr HATTON—Given the other evidence that we have had here today and the manner in which those who are part of the nuclear industry, either mining or using uranium oxide materials to produce nuclear power, have been seen by some groups—worldwide groups—that have given evidence today, how justified do you think any of that approach is, given your experience as uranium miners, and how do you view the criticisms of the use of what you produce to produce civil power? Do you think there is any interconnection with the military uses?

Mr Chalmers—I think it has all got to be looked at in balance. Ian Hore-Lacy made the comment, ‘I don’t think the uranium industry is advocating that nuclear is a 100 per cent solution.’ It is a mixture of a lot of other sources of power and the size of the population. All that has to fit into it.

You also have to look holistically at the context of one type of energy. What are all the associated impacts with it? You have to look at air pollution relative to waste streams, relative to occupational workers’ safety and extracting, whether it is coal or uranium. It all has to be looked at holistically, but I believe that the whole concept of people having their own beliefs is good and the debate is necessary, and you have to go through that process, but again I think we have to be objective and scientific here.

Mr Brunt—The risks associated with the nuclear fuel cycle and uranium mining, under any rational assessment, are probably lower than the risks associated with the alternatives. One of the primary determinations of the Fox inquiry back in the seventies was that the risks associated with the nuclear fuel cycle and with uranium mining were not such that they should prohibit Australia from being involved in it. That is probably still true today.

Myself and all of those working in the uranium industry—I personally have been involved in it for 30 years—are proud of what we do, as Mark said earlier. We often feel misunderstood but we would like a rational assessment of all the issues relating to it because we believe that, on balance, the nuclear industry would come out ahead.

Mr HATTON—You are at one end of the chain and at the other end we have the use of the materials that you mine that produce radioactive wastes. In the United States it is largely glass vitrification, in terms of storing and trying to isolate that waste that is used. The Australian synroc has been developed but not much used worldwide. Now that there is either an interest in buying it or having bought it from overseas, it may get more use. Do you think a definitive answer as to how those materials might be stored long term would have a material difference on those people who have an adverse view of the uranium mining industry and the power industry?

Mr Chalmers—Absolutely. I think that the whole waste concept is poorly understood generally by people in the public. The topic of nuclear waste, in my opinion, is solved. There is vitrification and the fact that a lot of the waste is stored on the surface for a number of years, where it dissipates a lot of the radioactivity and the associated heat when it first comes out of the reactors, and then it is put into a more stable form and stored underground, which is where this material should go. It came from the ground to start with. Again, it has to be looked at in the context of other waste with other energy sources also. When you look at the small quantities that are generated from nuclear power plants relative to the quantities of waste that come out of these other sources, like coal and some of the other energy sources, it stacks up very well.

Mr HATTON—Mr Brunt, would you like to add to that?

Mr Brunt—Yes. I have over the years been involved in incidents to do with protests and had many discussions dating back to 1982—the first one I can recall—with people who protest about uranium mining and nuclear power, and they come up with arguments like we have heard today. The bottom line decision I have come to is that their understanding, their perception of risk, is different to mine. They seem to want a world where there is no risk and unfortunately that is not

life. I think a rational assessment of it all indicates that you have to accept that there are risks involved in every human activity and it is a matter of determining what is an acceptable level of those risks.

Mr HATTON—Given part of your answer, Mr Chalmers, I want to explore that a bit further. We had evidence earlier which put the emphasis on the half-life of uranium. Given that we have different rates of enrichment and given that plutonium is different to normal uranium or partially enriched uranium—there was a half-life given of 240,000 years or 440,000 years, something of that nature—that is the dominant image that people have of what the problem is with using uranium as a source, yet what you have just told us now in terms of civil reactors is that there is a very quick degradation. Can you explain the difference between enriched uranium and its half-life and the experience of the product of waste with those reactors, because that is a core question.

Mr Chalmers—I am not a complete expert on explaining that. When I say it is technically solved, I agree 100 per cent with what David is saying. It is all a matter of the risk and balancing the risk relative to other sources and whatnot, but the actual degradation of the fuel sources in time—I know what I read and I am stating what I read, and I am not an expert in those areas to explain it in technical, informed terms personally.

Mr HATTON—But in simple terms that I might understand?

Mr Chalmers—I think that some 90-plus per cent of the heat and radioactivity in spent fuel after 40 or 50 years has dissipated. That is a substantial amount of the problem. Certainly, there are some elements that have long half-lives, but if you have a large majority of that dissipating, then you have material that is then relatively safe to go into the final disposal process so that it can be put somewhere where it has thousands of years to finally become a lesser issue. That is what I know about the topic. I am not an expert on exactly how it all dissipates.

Mr Brunt—I think the world has lots of hazardous wastes. Nuclear wastes are just one part of that. As I recall, three per cent of European hazardous wastes are nuclear related. We use words like ‘half-life’ and ‘decay’ and people that are not knowledgeable about the industry think these are bad things to talk about. In fact, many common elements that are poisonous—arsenic, selenium, mercury, lead—do not have any half-life at all. They exist forever.

If you want to use emotive terms, then you can talk about half-life and use that sort of terminology to paint a negative picture about the nuclear industry, but to keep it in perspective we need to look at the levels of radioactive waste by comparison with other wastes. There are a lot of wastes in the world that need to be looked at. Nuclear is just one part of it. Fortunately, the quantities are very small and have been able to be handled to date at reactor sites without any difficulty. Different countries use different methods, proposed and implemented, to handle these wastes in the longer run.

Mr Chalmers—I do not want to minimise the issue of nuclear waste and how it is stored and how it is handled. I am not trying to do that at all. It is very important that everyone, including myself, is as well educated as we can be on this topic. It is a very emotional topic. There is emotion everywhere you go, including the United States. It has been debated for many years. It is important that the world is as educated as it can be, going back to this holistic approach of the

nuclear fuel cycle and also, as David said, the issues surrounding waste in general; what we deal with every day in terms of other waste and how you put that into context with nuclear waste.

Mr HATTON—As producers going into the current market and as the newest mine in Australia, how do you see the current state of the world market? What do you think it will be like in the short to medium term? Is there a major change in terms of demand? What do you think will happen with the civil nuclear power industry over that period time? Is uranium a solution to the problem we have in terms of energy use or do you think it could either stagnate or relatively decrease, as has been argued previously?

Mr Chalmers—With the time it takes to build nuclear power plants, you are going to go from, say, 450 reactors to 500 or 550. It is not going to increase twofold or threefold in the next five years. It cannot. It takes time to build these plants. You have the issue of the inventories and how they balance out. The question really is how does new production fill the void between what we need right now versus what the new demand is? That is not twice as many uranium mines and twice as much production in two, three, four or five years. It is an increase of 10 or 20 per cent and probably firming growth as time progresses over the next 10 to 20 years.

Up until the last six months or so, Australia was largely considered not to be in a position to go forward as quickly as it appears to be going forward now. There seems to be substantial support in Australia for moving the uranium industry forward. I think that Australia will play a very big role in where the newly mined uranium is over other countries, but I do not believe that in the short term—the next five or 10 years—there is going to be a doubling or tripling of the industry. The demand is not there for doing that in the next five years. Maybe I am wrong, but that is my personal opinion.

Mr HATTON—Are you the answer in terms of the greenhouse gas problem or just another part of the problem?

Mr Chalmers—One part of the answer.

CHAIR—Thank you for appearing before the committee today. If there is any additional information the committee requires, the secretariat will contact you. In closing this public hearing, I would like to mention that the next meeting is at 5.45 am on Friday, 2 September in Adelaide for the committee's inspection of Olympic Dam and Beverley.

Resolved (on motion by **Mr Hatton**):

That this committee authorises publication of the transcript of evidence given before it at public hearing this today.

Committee adjourned at 3.48 pm