Proposed Global Solution for the Disposal of Unwanted Nuclear Materials

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Abstract

In this paper, the arguments for international disposal projects are first presented in a fairly generic manner. Properly planned, constructed and operated repositories can bring benefits in safety, security, environmental protection and economics to both the host country and the customers of an international repository. Thereafter the particular attributes of the Pangea concept are pointed out. The solid technical basis underlying the choice of candidate host countries and the special arguments leading to identification of Australia as a particularly suitable host for a variety of additional, non-technical reasons are summarised, together with a review of the project scope.

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Introduction

In this opening plenary session of a major international conference it might appear, at first, surprising that presentations from three of the major nuclear nations are accompanied by a talk on a feasibility study for a budding disposal project, presently run by a small group of experts and financed by relatively few organisations. The objective of Pangea, as many here will know, is to progress the concept of radioactive waste disposal in an international framework, with a common repository in a host country serving the needs of a range of customer countries. Why have the organisers of ICEM been kind enough to offer a prominent platform for the presentation of this concept?

My feeling is that Pangea is representing here not just our own proposal, but rather the general concept of international disposal. Discussions which I have had throughout the waste management community since the Pangea concept was launched have made clear that there is a widespread appreciation of the advantages of shared disposal and that many insiders feel that the time is ripe to have an open debate on the issue. This by no means implies that the waste management community is blind to the major political obstacles to international solutions. Rather, it is a reflection of years of built —up frustration at the slowness of progress towards implementing repositories, with the many delays being determined largely by political and social dissent. An opportunity to fulfil our ethical responsibilities to future generations by preparing proper disposal facilities in a co-operative effort between a willing, well suited host nation and a number of customer countries, under arrangements recognised as being fair to all, would be certainly welcomed by the technical community. Also in the wider circle of stakeholders, including the general public and the political leadership, there is a broad appreciation of the technical benefits - and of the sociological challenges — resulting from international waste disposal solutions.

Although many individuals do consider the time to be ripe for international initiatives, I accept also that there are other schools of thought. From some national programmes, there is understandable apprehension that increasing attention on international options may lead to questioning of the need for (or, at a minimum, the timing of) national repositories. In particular, national disposal programmes near to implementation of facilities are concerned about any distractions from this path and would prefer to complete their tasks without additional complicating issues being raised. Should we wait with international proposals until some national repositories are operating? There is some truth in the opinion that international disposal may become more acceptable once this is the case. The counter-arguments are that numerous programmes may have (or have already had) problems establishing a national geologic repository, for financial, sociological or technical reasons. Perhaps a globally optimised choice could be easier to implement. In any event, for environmental, safety and security reasons, acceptable solutions to the disposal of unwanted nuclear materials must be welcomed by all, and every serious effort to achieve these solutions deserves support.

Resistance to international repository concepts is to be expected from nuclear critics who oppose any promising solution for waste disposal. Equally expected, but less understandable, is the resistance in some quarters, based on the fear that less effort — or lower funding — will then be devoted to national programmes which can keep many specialists in work for decades. However, solving problems using global optimisation must be preferable to postponing responsibilities or to squandering of resources by duplication of technical work.

In this paper, I will first present the arguments for international disposal projects in a fairly generic manner. Properly planned, constructed and operated repositories can bring benefits in safety, security, environmental protection and economics to both the host country and the customers of an international repository. This win-win situation is described at more length in a paper to be delivered next month in Antwerp [1].

Following the generic part, I will move on to point out the particular attributes of the Pangea concept. The solid technical basis underlying the choice of candidate host countries and the special arguments leading to identification of Australia as a particularly suitable host for a variety of additional, non-technical reasons will be summarised, together with a review of the project scope. All these aspects were described in the Waste Management 99 Conference in Tucson [2, 3, 4].

Finally, since Pangea is a private initiative with no direct involvement of the Australian government, it is appropriate to mention the reactions to the project to date and the current status. Our intention is to develop and explain our plans in greater depth and to present the case for Pangea for open debate by the technical community, the politicians and, most importantly, the Australian people.

The goal: geologic disposal, rather than long-term storage

Storage of spent fuel or high level wastes for long periods of up to hundreds of years is a topical issue. Storage of this sort is attractive to many because it retains easy retrievability and avoids contentious decision making in the short term. Storage is a proven technology and can be carried out safely almost anywhere, at or below the ground surface. There have been various proposals for international storage of spent fuel, often aimed at circumventing the sociological problems associated with national siting which arise despite the demonstrable safety record. The Pangea concept presented here, however, goes beyond storage which merely postpones the task of developing a real solution for removing radioactive wastes from the human environment Storage also leaves an open-ended risk due to the possibility of direct inadvertent or deliberate intrusion by humans. Pangea aims at ultimate disposal, i.e. at permanent isolation of the wastes. The concept is based on a deep geologic repository. Today, repositories of this sort for unwanted nuclear materials are recognised as having two roles. These are:

- to dispose of long-lived radioactive wastes in a manner which will ensure the safety of all future generations, without placing on them any burden of active maintenance measures

- to enhance world security by minimising the threat posed by the potential misuse of plutonium and enriched uranium derived from dismantling of surplus weapons in an age of nuclear disarmament.

What advantages do international repositories offer relative to national disposal projects in these two key areas?

In the area of safety, in particular long-term safety, the difference between a multinational repository and a national project is not the level of safety to be aimed at. There is no need to tighten the rigorous safety requirements set for national disposal facilities and it is definitely not ethical to seek regions or countries where less stringent safety measures could be acceptable. In both cases, the repository should provide demonstrable safety by means of a robust barrier system, based on both engineered containment and also geological retention of radionuclides.

There are, nevertheless, certain technical issues which affect the choice of disposal concepts at any location. Most obvious is the question of the availability of suitable geologic formations. Repository designs are flexible and requirements on the geology can often be relaxed by increasing the sophistication of the engineered barriers. Thus, most countries should be able to find suitable sites. The key advantage of a global choice of geologic environments concerns not the

absolute level of safety, but rather the confidence with which we can predict the future safety. The problem of reliable prediction of future repository behaviour can be eased by adopting the approach that the long term containment of waste materials will be easier to achieve and to demonstrate in a simple, stable geological environment chosen from global rather than national considerations without the restrictions imposed by political boundaries.

The previous point emphasises the issue of long-term safety, but concerns about operational safety are also of obvious relevance — in particular to the host State for an international repository. The specific operational safety issue most often raised by nuclear opponents concerns the incremental risks arising from the increased transport requirements when all wastes in a region are moved to a centralised repository. However, practical experience to date indicates that radiological risks arising from radioactive waste shipments are extremely low and are not determining factors in any disposal strategy. Similarly, the costs of transporting the restricted volumes of spent fuel or high-level wastes arising in the fuel cycle are not limiting factors (provided, of course, that extreme measures are not necessitated by orchestrated opposition, as has happened, for example, in Germany). For voluminous low-level wastes, on the other hand, repositories near the waste sources are economically attractive.

In summary, well chosen international repositories have no safety drawbacks and can have advantages, in particular concerning the ease of demonstrating the safety case.

A key challenge which is most certainly of global interest in connection with disposal of nuclear materials and which can be more effectively met by an international repository is that of safeguarding these materials against misuse by terrorists or by rogue governments. Current estimates are that Russian and American plans for reducing weapons arsenals will lead to a surplus of around 2000 tonnes of highly enriched uranium (HEU) and over 200 tonnes of bomb quality plutonium. There are simple options for dealing with these weapons grade materials. The plutonium can be fabricated into mixed oxide fuel (MOX) which is then burned in reactors, producing highly radioactive spent fuel which is much more proliferation-resistant. Alternatively it can be conditioned into a suitable form for disposal, e.g. by incorporation into a SYNROC type of matrix. The HEU can be blended down to produce normal low enriched fuel for the current generation of reactors. Again the result is spent fuel which is more proliferation resistant but still requires safeguards measures. Thus, a deep geologic repository provides a proper end point for each option. An international repository in a country acceptable to all nuclear weapon States could facilitate the process of obtaining the necessary political agreements.

Furthermore, the safeguarding of nuclear materials at an international repository would be easier, more transparent and highly amenable to international oversight by the IAEA and by any other States. This improved safeguards regime is equally important for spent fuel from commercial nuclear power production. The advantages of disposal in a politically stable nation with all appropriate mechanisms for enforcing safeguards already in place are immense. Numerous small repositories spread around the world are clearly more difficult to monitor effectively. In fact, given a global choice of repository location, it would also be feasible to choose a site with particularly favourable characteristics from a safeguards and monitoring angle.

An international repository of this type can engender trust not only in the disarming nuclear weapon States and in the host and customer countries of a commercial disposal operation, but also in all of the world's nuclear nations. A respected nation - with suitable geologic conditions and with impeccable environmental and non-proliferation credentials - willing to accept such materials, could thus give an added impetus to the disarmament programmes of the major nuclear weapon States and could improve safeguards on conventional spent fuel. The result is again a win-win situation - in fact, this could even be labelled a win-win-win situation since the international repository is then of direct benefit not only to the host and the customer but also to the present and future citizens of all nations interested in encouraging peace in the world.

Further advantages of international repositories

An international repository can bring advantages beyond the direct safety and security areas mentioned, advantages which benefit both host and customer countries. These include bringing economic benefits, minimising global environmental impacts and enhancing public

acceptance of disposal. These points are briefly explained below.

Economic benefits: Shared repositories are certainly attractive from an economic point of view. Deep geologic repositories have life-cycle costs in the billions of US dollars. This is true even for small countries with low projected waste volumes; for example, the Swiss estimate of life-cycle costs for disposing of HLW or spent fuel from a 120 GW(e) nuclear programme is around 3 billion US dollars. Moreover, a large part of the costs of any deep repository are fixed independently of the inventory since they are needed for exploration, for gaining access to the underground by shaft sinking, for installation of infrastructure, and for the complex permitting and licensing procedures. The marginal costs of excavating more disposal volume underground are relatively small. Accordingly, large savings are possible if small countries combine their efforts or if a large disposal programme were to accept wastes from foreign sources.

For a country accepting foreign wastes for disposal, there could clearly be enormous direct economic benefits. For countries paying for wastes to be disposed abroad there could also be financial advantages because economies of scale allow lower unit costs (and excellent geological conditions can obviate the need for very expensive engineered barriers). For society in general, it is certainly better to channel resources to other causes rather than expending them on duplication in numerous countries of expensive technical and geological work.

Public acceptability and ethical arguments Why should a country agree to host an international repository? Only if the safety and security aspects are clearly seen to be taken extremely seriously by all parties and if the economic and infrastructure benefits are very clear, is it even conceivable that public acceptance in a host country can be achieved. A serious host country will not allow itself to be "bought"; there must be also a clear perception that the host is undertaking a service which helps less advantaged countries fulfil their moral responsibilities for their waste in an ethical manner. A serious customer nation will insist on being assured that the highest standards of safety and environmental protection are applied to any facility accepting its waste. If these two conditions are fulfilled, it becomes plausible that overall public acceptance of geologic disposal could be higher than in the present controversial situation.

The ethical issues associated with waste disposal have been discussed at length in recent times. The principles espoused by the waste management community concerning intragenerational and intergenerational equity have been formulated. These involve protection of all persons and of the environment now and in the future, irrespective of national boundaries. Clearly an international repository must and could be implemented in accord with such principles. In particular, the level of safety required for populations around any repository cannot be a function of the facility location. The aspect of disposal of unwanted materials from disarmament raises a new and powerful ethical argument. A responsible, secure host nation which accepted the responsibility of the guardianship of materials which might otherwise cause mass destruction anywhere in the world would definitely be on high moral ground. An improvement in global security benefits all peoples now and in the future.

Minimising global environmental impacts
Environmental protection can become easier for all parties with a world-wide choice for a disposal site. On a global scale, the extensive use of nuclear power in, for example, East Asia, contributes to limiting carbon dioxide emissions; this can continue, however, only if feasible and cost-effective disposal solutions are found even for countries with complex geology. An international repository can contribute here. At a national scale, small, crowded countries or geologically complex countries with limited siting choices also have a difficult problem in implementing any new and large industrial project while minimising impacts on the human environment. In a host country with remote areas far from the public, siting can be less contentious. Indeed, there is a definite potential for using a well-funded repository implementation project as a vehicle for improving facilities and conditions in inhospitable areas.

Nevertheless, a major international repository, with its necessary transport and site infrastructure, will obviously have a significant environmental impact, comparable perhaps to a mining project. To compensate for this asymmetric burdening of host and client, appropriate benefits may justifiably be expected by the host. These may go beyond the obvious financial arrangements to

include wider agreements in the areas of trade, politics or diplomacy. Again, the objective is to ensure a win-win situation, with potential advantages for both host and customer country.

International solutions are not without problems

Not withstanding indisputably positive arguments, public acceptance for accepting foreign wastes will be difficult to achieve in any potential host country. The public view is conditioned everywhere by fear of radioactivity. It is of little importance whether this fear is rational or not, the results are the same. Persistent, open dialogue based on high-quality work throughout the waste management community can help build the necessary level of public trust. But NIMBY (not-in-my-backyard), which functions so universally on a national scale, will certainly be a problem also internationally. There is a general aversion to waste disposal facilities (although this does not prevent routine trans-boundary shipments of chemotoxic wastes for disposal), and the situation is especially difficult for radioactive wastes. There are further important factors mitigating against members of the public accepting international or even centralised national repositories in their neighbourhood. The localised environmental impact of any large project which serves the good of a wider public will almost always create localised opposition. There are various ways to counteract this, the most powerful being close consultation and contact with the host community and allocation of appropriate economic benefits. Both issues are obviously of relevance also for international repositories.

The issues of perceived repository safety, economic benefits and ethical behaviour are closely interrelated. If a sufficiently broad consensus existed that hosting a repository was comparable to hosting any other major, long-term industrial project – with the usual trade-off of economic, social and environmental considerations – then there would be no ethical dilemma in exporting or importing wastes for disposal. Compensation would be based upon judgements of the value of a localised community performing a service for the common good and on the fair allocation of resources need to develop the social infrastructure associated with the arrival of a major project. There might even be competition, as has been the case for various joint international research facilities, to host a repository.

The origins of the Pangea Project

At the outset it must be explicitly stated that no government has yet endorsed the Pangea project; indeed at this time we do not seek such endorsement or approval. Rather, we seek the opportunity to engage both state and federal governments in Australia in a reasoned, objective and calm dialogue to examine a path forward of mutual benefit. We also seek to stimulate and engage in an open discussion with the public and those groups who take a direct interest in our proposal. At the same time we are seeking an international basis to brief other governments on our vision of the benefit of an international repository for final disposal of long lived radionuclides.

The Pangea concept can be traced to the SYNROC Study Group, which began its activities in late December 1988. The SYNROC Study Group was a vehicle set up by the Australian government to study the commercial potential for SYNROC in a global context. This work progressed towards a conceptual plan for a reprocessing facility located in Australia with a deep geological disposal facility to take the resultant immobilised materials and to provide the option of direct spent fuel disposal. The Pangea concept - with a different set of supporting organisations - has built on some components of the SYNROC Study Group conclusions and combined these with new concepts.

Pangea is supported by BNFL; NAGRA and Golder Associates. These organisations together bring to the Project the technical skills and the experience needed for all activities such as nuclear transport, site selection and characterisation, repository design and project management. The current group of supporters and the management team are, however, acutely aware that a project of this type can succeed only with full participation of Australian partners. Widening the organisation to include Australian investors and to interact more intensely with Australian industry is a declared objective of Pangea.

In the period after the SYNROC Study Group, it became ever more obvious that a new waste disposal initiative was justified. Despite the diligent efforts of scientists, engineers and government policy makers, many national programs were suffering delays, cost overruns, and, in some unfortunate cases, significant loss of

investment due to failed attempts to site a geological repository. The unexpected complexity of making a safety case in highly heterogeneous geologic media was a key factor contributing to these problems. We believed that both scientific and public confidence would be more easily obtained in assertions of safety if they were based, as far as possible, on simple and robust geologic systems.

A further aspect of large and growing importance was the recognition that, with the end of the cold war, an enormous effort would be required to attain the crucial goal of total nuclear disarmament. To reach that goal there will be a requirement to dispose safely of large quantities of appropriately conditioned radioactive materials which become surplus as the world progresses towards nuclear disarmament. Since the vast majority of weapons grade materials are likely to be converted to fuel for light water reactors, an international repository for the resulting spent fuel would certainly expand the range of options and economic incentives for disarming weapons states.

Pangea was developed, accordingly, with a strong focus on the long-term safety of repositories and on the security of weapons source material. The former aspect led to the definition of the "high-isolation" concept for repositories which is defined in the following section. It has as its centrepiece a geologic repository located in suitable, very simple and stable geology, with flat topography with a stable arid climate that could be predicted with relative ease. To address the latter, equally important issue, we sought to find a host country which had an international history of strong support for non-proliferation, which had a stable democratic society, and which is trusted by the other nations of the world.

The high-isolation concept

The basic feasibility of geologic disposal is accepted within the waste management community and the achievability of safe disposal has been asserted by innumerable panels of international experts. In all states with nuclear activities, active programs for repository development are underway and no insuperable technical problems are foreseen by those directly responsible, or indeed by the majority of the scientific / technical community. In wider public and political circles, however, perceptions are often different. Waste disposal programs are not widely regarded as being on a straightforward — if slow — route towards successful implementation. Rather the process is often seen as fragile, faltering or even failed. In recent years there has, therefore, been growing support for other approaches such as long-term surface storage or advanced transmutation schemes — although neither of these can be regarded as a real alternative to deep disposal.

The single most important reason for this is the lack of public confidence in the ability of scientists to predict repository performance with sufficient reliability over the long time scales of relevance. Methodologies have been developed by the experts to at least scope the bounding behavior of disposal systems. However, safety assessments for deep repositories have become enormously complex and are dependent on assembling huge site databases which are expensive, difficult to quality-assure and still open to criticism for their potential omissions or errors. Within the technical area, the issue which has undoubtedly led to the most debate is the characterization of the deep geologic environment at a potential repository site. Because the geologic media being studied are mostly complex and heterogeneous on the scales of relevance, this has turned out to be a much more challenging task than was appreciated in early years.

Pangea, using the knowledge and experience gathered over decades of study in numerous programmes on repository safety, asked a different question. If one were unrestricted by national boundaries, how would one go about choosing a repository site which would be not only extremely safe but also so simple that the safety case could be demonstrated with most transparency - for the public as well as for the experts? A set of signatures for such a site was developed, based on consideration of the features, processes and events taken into account in state of the art safety analyses of repositories. These characteristics which can be identified as essential or as favourable can be summarised thus:

- Stable geology (needed because of the long isolation times aimed at)
- Flat topography (reduces driving forces for advective groundwater flow)
- Near-horizontal sedimentary strata (simpler to explore and extrapolate)
- Stable, arid climate with little erosion (eases problem of extrapolation into the future)

- Low permeability (reduces groundwater movements in host rocks)
- Old and saline groundwater (indicates slow natural circulation; non-potable)
- Stratified salinity (counteracts thermal buoyancy effects)
- Reducing geochemical conditions (reduces solubilities of radionuclides)
- Absence of complex karst systems (simplifies hydrogeologic modeling)
- Low population density (reduces intrusion risks)
- No significant resource conflicts (reduces intrusion risks)

In principle, the safety assessment for a high-isolation site satisfying the above constraints will not differ from safety assessments as produced in other repository programs. In practice, the high isolation concept is aimed at easing the burden of demonstrating safety by choosing a system with as many positive safety characteristics as is feasible. The objective is to choose a site and design that are of intrinsic high quality with respect to safety and are also amenable to a reliable assessment of safety. In detail, the safety case for a high-isolation site may be different from that for more conventional sites because of the low energy natural system, which has extremely low driving forces for any processes which could lead to nuclide release and transport. This should make it easier to deal with groundwater flow scenarios of the types that are central to most conventional safety assessments. Direct evidence of extremely long residence times (e.g. by age dating, salinity profiling) will be an important goal. Because of the expected near stagnant groundwaters, however, the safety case may have to focus more upon potential disturbances of the natural system due to artifacts introduced by the repository itself.

A study of the world map aimed at identifying large, flat, historically-arid areas with stable and simple geologic formations quickly leads to a group of areas which were part of the original Pangea continental mass which started to break apart some 200 million years ago. Around 80 million years ago, Australia then separated from Antarctica. Remaining in the continents of the Southern Hemisphere are areas which have been subjected neither to large tectonic forces nor to the influences of repeated glaciation. The largest contiguous stretch is in the desert basins of Western and South Australia.

In addition to the geological requirements for high-isolation sites, further selection criteria were applied, based on the technological capabilities, the non-proliferation credentials, the societal stability, the political and legal system, and the economic status of potential host countries. As a result, attention is currently focused on Western Australia where extensive regions satisfy the appropriate geological, climatic and environmental conditions.

The Pangea system and its economic impact

The total waste management and disposal system foreseen by Pangea includes packaging and national transport of spent fuel or wastes (if required by the customer country), international transport in a fleet of dedicated ships, rail transport to the repository site, buffer storage and final disposal. The reference concept is for disposing of an inventory corresponding to around 75,000 tonnes of spent fuel over 40 years of operation, although there are no fundamental reasons for either limit. At the current feasibility analysis stage, designs are at the conceptual level and costs are partly by analogy with existing and planned facilities elsewhere. Broad estimates, however, give the following picture. The construction costs of the sea terminal, rail link and repository will be in the order of US$ 6 billion. Half of this cost is attributable to the sub-surface facilities at the repository, which will be progressively developed over the 40 years operational life of the repository. The annual costs associated with the operation of the repository, together with the transport and handling of the cargo from the waste generators to the repository will be in the order of US$ 0.5 billion.

It is estimated that several thousands of jobs will be created in Australia during the construction of the sea terminal, rail link and repository. Further employment opportunities exist in the manufacture of transport packages and ships. The operation of the facilities is likely to provide long-term employment for more than 1500 people. Many of the positions created will be in areas of high technology, engineering and science. In addition, there will be employment in necessary service industry branches. Finally, the economic boost of the project to the host nation will provide further opportunities for employment. The economic impulse to the Australian economy has been estimated to be of the order of 1% of the

Gross National Product of Australia over the 40 year reference operational lifetime.

Seeking the way forward

It is appropriate, perhaps, to finish with some remarks on national and international politics, which in most people's minds are the areas where the most difficult challenges are to be faced.

Our strong belief is that the host country for a successful international repository must have political credibility and therefore must be an economically viable, stable democracy. These requirements arise because there must be continuing international trust in the political system of the host country and because democracies are more likely to withstand the test of international public opinion than other forms of government. No nation should pass its waste to others unless it is convinced that this is a responsible action, based on mutual agreement between partners. A responsible action will weigh all aspects of safety, security, sustainability, economics and geopolitical considerations. Transfer of waste should bring advantages to both customer and host nations and, ideally, also for the global environment. There are many nations in the world (small countries with limited nuclear power programs or large countries in economic disarray) where establishing the economic base to build a safe and permanent disposal facility would be challenging. Also in some countries the geology, or the surface environmental conditions, or the density of population, can present major obstacles to the construction of a deep geologic repository.

With these considerations in mind, we have concluded that an international repository, available to all nations of the world, would represent a huge global asset, even though we fully recognise that some nations will wish to proceed with national solutions. We realise there are those who today will wish to oppose any international solution because it is feared this will remove an important obstacle to further commercial nuclear power generation. The goals of Pangea, however, are sufficiently justified alone by the need to deal with waste from existing commercial reactors and from the dismantling of nuclear weapons programs. We believe that these are compelling arguments for providing the option of an international repository. The key issues concern safety, environmental impact, security and ethics.

Pangea believes that the most important mission of achieving political and public acceptance will require us to demonstrate the moral and ethical values of the enterprise. Economic benefits will play an important, but secondary role, in convincing the public and the governing officials of any potential host country to accept an international repository. Equally, there must be an acceptance on the part of the international community of the ethical, political and technical correctness of the Pangea solution for those nations which choose to make use of it.

And what does Australia think of this concept? This is the obvious key question. I remind you of my earlier remark that it is not current government policy to import nuclear waste into Australia. This has been reiterated several times by government ministers and spokespersons. In order for Pangea to be successful, we would require not only formal government permits but also the acceptance of the majority of the Australian public. This can not happen without a full and open presentation of Pangea plans and a wide public debate. We believe that the new dimensions of safety, security and economics that Pangea has brought to the debate on nuclear waste disposal are compelling and we would welcome discussions which would allow a fuller assessment of the feasibility and the strategic direction of our proposal. There are numerous scientific, business and community leaders in Australia who already see the merits of Pangea's proposal. There are even more who are willing to keep an open mind until they have listened to all of the arguments. We were, therefore disappointed that the initial reaction from the Federal Government was unfavourable. We are trying to understand this and to develop a way forward which will enable us to engage in an open and objective dialogue with the government and the people of Australia. A possible beginning here is the welcome sign that the academic and business community in the State of Western Australia appears willing to encourage open debate and to help organise this dialogue.

Acknowledgement

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