Submission to the **Joint Standing Committee on Treaties** for the **Agreement Between Australia and the Argentine Republic Concerning Cooperation in the Peaceful Uses of Nuclear Energy.**

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Introduction

Sutherland Shire Council has, for over a decade, provided important information that has raised many key concerns about the proposal for a replacement reactor at Lucas Heights.

More recently council has questioned Australian policy on nuclear waste management.

In the context of this record, council welcomes the opportunity to present our concerns to the Joint Standing Committee on Treaties about the agreement between Australia and the Argentine Republic concerning cooperation in the peaceful uses of nuclear energy. This is a submission prepared at short notice in light of the committee's limited schedule.

Overall, the Australian Nuclear Science and Technology Organisation (ANSTO) and the federal government's attempt to seriously address nuclear waste management issues has been mediocre.

The important issues with respect to a repository for long lived intermediate waste (sensibly called "high level waste" by the McKinnon Review, 1993), the need to raise the prospect that overseas reprocessing of highly radioactive spent nuclear reactor fuel may not continue into the future, the questionable legal status of importation of spent fuel rods from Australia to Argentina, as well as certain imprecise sections of the treaty itself, remain as further examples that nuclear policy in Australia continues to be undertaken under a non-precautionary and minimal accountability basis.

The following submission outlines the implications of these issues for the agreement between Australia and the Argentine Republic.

Submission

For several decades the former Australian Atomic Energy Commission, now ANSTO has been making applications to successive Commonwealth Governments for a replacement to the multipurpose reactor HIFAR at Lucas Heights.

In 1997 the current Commonwealth Government announced that a new nuclear reactor would be established at Lucas Heights pending assessment under the Environment Protection Impact of Proposals Act, 1974. An Environmental Impact Statement process was undertaken, resulting in a favourable report from the Commonwealth Minister for Environment. Assessment included review of the proposal by three international peer review agencies. The Commonwealth Government confirmed its intention to proceed with the proposal in 1998.

In addition to large quantities of low level waste generated by the reactor and associated activities, the highly radioactive spent fuel rods stored for many years on the site represent an issue of ongoing concern to the local community and other parts of Sydney.

The Commonwealth Government proposes to reprocess these rods overseas and store the waste in a yet-to-be-identified site in Australia, on Commonwealth land. This

proposal has important implications for the Sutherland Shire community given that rods will continue to be stored at Lucas Heights for ten years, well beyond the four year operational level required by the reactor, and that it would be necessary to transport spent fuel rods and residues through communities between Sydney and South Australia.

Ministerial condition twenty-seven set by the Commonwealth Minister for Environment on environmental approval of a new reactor in 1998 requires the Minister for Industry, Science and Resources and the Minister for Health to:

> "give timely consideration to strategies for the long term management and eventual permanent disposal of Australia's long-term intermediate-level nuclear wastes, and associated issues."

This is a subject that has not been seriously approached by ANSTO or the Commonwealth Government, given the persistent delays in consideration of sites and associated issues, other than to suggest temporary waste storage. A failure to make significant progress while bringing on line a new waste-generating reactor indicates that the Commonwealth considers nuclear waste and waste residue accumulation appropriate in Australia.

Council's independent expert advise (*Attachment 1* to the present submission) is that the Commonwealth Government will continue to face difficulties, most likely insurmountable in the short to medium term with respect to development of a nuclear waste repository for Intermediate Level Waste. This is a serious matter, because it indicates that Lucas Heights will remain the defacto repository for the Commonwealth of Australia, despite assurance from the Commonwealth Government over many years that this situation would be rectified. Current Commonwealth progress on a repository and store corroborates this predication.

The pre-conditions set in the EIS process for the new reactor are minimal but for two important issues:

- *" Incorporating in the tender specifications a requirement by the vendor to demonstrate solutions for the ultimate disposal of spent fuel (EIS page 20-7)"*

- *" Transporting spent fuel from the Lucas Heights Science and Technology Centre (LHSTC) as soon as practical allowing for the constraints of fuel cooling, radiation safety and economic transport"* (EIS page 20-8).

Delaying transport of spent fuel from LHSTC to a nine-year period is a direct contradiction of Commonwealth Ministerial undertakings. The previous Commonwealth Minister for Industry Science & Resources provided an undertaking to Sutherland Shire Council that the period of on-site storage of spent fuel would be minimal and for operational requirements only. The current Minister confirmed to Sutherland Shire Council that HIFAR fuel, as opposed to the new reactor fuel, is to be removed from LHSTC by four years after the shutdown of HIFAR. This undertaking defines operational purposes as four years.

With respect to the vendor demonstrating solutions of the ultimate disposal of spent fuel, significant and costly problems exist in this area for ANSTO and INVAP. Sutherland Shire Council has been advised that the silicide fuel which ANSTO will

likely use for the replacement reactor has a major problem with respect to reprocessing (see Barnaby report – *Attachment 2* and below).

The report by F. Barnaby highlights key issues for Australia:

- Difficulties are anticipated for reprocessing the silicide fuel likely to be used in the replacement reactor;
- Reprocessing costs for any fuel type will be a very significant expenditure for Australia into the future;
- Non-reprocessing alternatives are costly and environmentally risky; and
- The need for high level nuclear waste disposal in Australia remains.

In the event of international agencies moving to a non-reprocessing approach, it is very unlikely that other countries will be prepared to store Australia's spent fuel. Such a situation would require Australia to manage its own fuel, meaning storage and possibly conditioning a highly radioactive material, potentially in an urban context.

The recent decision to move to ban reprocessing of spent nuclear fuel in Europe after the OSPAR commission voted to compel England and France to review reprocessing in favour of dry storage, creates a huge problem for the federal government and for ANSTO. The possibility that COGEMA, where all spent fuel from HIFAR is currently reprocessed, will be under pressure to close means that ANSTO may soon be left without absolutely any satisfactory, documented arrangements for spent fuel – reprocessing and disposal.

Furthermore, Greenpeace France's case early this year in the French courts claiming that French Nuclear company COGEMA was in breach of the 1991 Radioactive Waste Management Act calls into doubt the integrity of ANSTO's contract with COGEMA, and raises the following questions:

- does COGEMA have the correct licences to reprocess Australian spent fuel rods;
- does COGEMA have the technology in place to reprocess the waste;
- is COGEMA in breach of the French 1991 Radioactive Waste Management Act;
- will COGEMA be able to reprocess the initial two cores of silicide fuel proposed for use in the new reactor?

Although parts of the contract between ANSTO and COGEMA was tabled in the Australian Parliament in June we are yet to be given access to commercial sections of the contract.
These questions must be resolved before taking any further steps to secure a new research reactor for the future of Australia.

Another issue that must be resolved before further progression is the matter of Argentina's capacity to legally and technically accept spent fuel rods from Lucas Heights for reprocessing or processing.

The Constitution of Argentina, Article 41 (1994) states: *"The entry to the national territory of waste currently or potentially hazardous, and of those radioactive, is prohibited."*

The possibility that ANSTO accepted INVAP as the preferred tender based on the presumption that INVAP would accept the waste from the new reactor for processing,

but that Argentina's Constitution prohibits the import of radioactive waste, is of major concern.

ANSTO and the Department of Industry, Science and Technology will argue that spent fuel rods are not classified as waste thus legitimising the importation of the rods into Argentina.
However, spent fuel rods from Lucas Heights have, for many years, been regarded as waste. Until recently, the rods have simply been stored on site as there was no further use for them and there was no known method of disposal. Indeed the McKinnon Review stated that 'the spent fuel rods at Lucas Heights can only sensibly be treated as high level waste'.[1]

In it's submission to the Senate Select Committee for an Inquiry into the Contract for a New Reactor at Lucas Heights in May, French nuclear company Technicatome claimed that INVAP has no facility to reprocess the spent silicide fuel from the replacement reactor, and thus that its promised alternative spent fuel disposition strategy is unsustainable.

Clearly, these legal and technical issues concerning the reprocessing or processing of spent fuel rods from Lucas Heights in Argentina must be resolved.

To conclude, consideration must also be given to the actual document of the agreement between Australia and the Argentine Republic. There are a few ambiguous items that warrant attention:

1. Article 11 and 12, concerning the relationship between processing and reprocessing. The conditions for Australia requesting or consenting to nuclear spent fuel reprocessing are not clear in the agreement. Likewise, the issues with regards to safeguards in relation to spent fuel reprocessing in Argentina are not clear.

2. Article 12a:
   "if so requested, Argentina shall ensure that such fuel is processed or conditioned under appropriate arrangements in order to make it suitable for disposal in Australia".
   The nature of "appropriate arrangements" to make processed or conditioned fuel suitable for disposal in Australia are not made clear.

3. The timing and permission required to return processed fuel and radioactive wastes to Australia are not clear in the agreement.

In 1991, Sutherland Shire Council successfully challenged the importation of off-site radioactive waste to LHSTC, under the ANSTO Act. The federal government at the time subsequently amended the Act to overturn the impact of that decision for future cases. Our concern is that our local community is vulnerable to ad hoc waste man decisions by federal governments and that the nuclear agreement with Argentina may compound that local problem further.

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[1] K. R. McKinnon et al., *Future Reaction: Report of the Research Reactor Review*, August 1993, p. xxiii.

Attachments

Attachment 1: New Research Reactor Fuels – *F.Barnaby, Consultant to Oxford Research Group, September 2000*

Attachment 2: Replacement Nuclear Research Reactor at Lucas Heights Science and Technology Centre – Review of the Draft Environmental Impact Statement by *Alan Martin, Alan Martin Associates, United Kingdom, October 1998.*

NEW RESEARCH-REACTOR FUELS

Prepared by Frank Barnaby
Consultant to Oxford Research Group (UK)
September 2000

The new research reactor at Lucas Heights, to replace the existing HIFAR reactor, is likely to use low-enriched uranium (LEU) silicide fuel elements, at least at first; it may eventually switch to uranium-molybdenum fuel. The silicide fuel will be enriched to a level of less than 20% (probably 19.9%) in uranium-235 (i.e., low-enriched uranium or LEU).

The HIFAR fuel is enriched to 60% uranium-235 (i.e., highly-enriched uranium or HEU), which could be used to construct nuclear weapons. The use of the new LEU fuel, therefore, removes any risk that Australian research reactor fuel could be used for the proliferation of nuclear weapons.

Silicide research-reactor fuel

Silicide LEU fuel elements are used in, for example, the High Flux Reactor at Petten in the Netherlands. Silicide fuel typically consists of uranium silicide (U_3Si_2) in an aluminium matrix. But there is a major problem with silicide fuel - it is very difficult, to say the least, to reprocess it commercially.

The 20-MW replacement research reactor will probably use about 40 new fuel elements per year.

Reprocessing problem

In a reprocessing plant, such as the one operated by Cogema, the chemical procedures result in the production of a sand-like substance that clogs the reprocessing line. Using a centrifuge in the line to remove the 'sand' could probably solve this problem. But this would cost millions and Cogema says it's not worth the cost. The reprocessing plant at Dounreay is no longer available. It seems that there has not been any commercial reprocessing of silicide fuel in Europe.

The USA could possibly reprocess silicide fuel but so far as I know has not so far reprocessed any significant amount. It is committed to take back silicide fuel under its take-back programme but the US Department of Energy's preferred option for disposal of silicide fuel is not reprocessing.

The US has stated that it will not take back spent research-reactor fuel after 2006. Therefore, research reactors that convert from HEU to silicide LEU will probably have to convert again to another new LEU fuel. Currently, the most promising is uranium-molybdenum or Moly fuel. Cogema says that Moly fuel should be in production in about 2005.

Moly fuel

Moly fuel can be reprocessed. Moly fuel also has the advantage that it can be loaded with more uranium-235 that silicide fuel. It can, in other words, be made into a

higher density fuel.

Silicide research reactor fuel typically contains about 4.5 grams/cubic centimetre (g/cc) of uranium-235. Moly fuel can contain between 5 and 8 g/cc of uranium-235. Research reactors that will use Moly fuel will have lower fuel cycle costs than those that use other fuels of similar enrichment.

Cogema has tested Moly fuel and there seems to be no problem with dissolving the fuel for reprocessing. Cogema would presumably be willing to reprocess Moly LEU fuel as it currently reprocesses non-silicide HEU research-reactor fuels.

Storage of silicide fuel

Because it cannot be reprocessed commercially, silicide LEU fuel elements will have to be stored until final disposal in a geological repository. The storage of silicide fuel elements is not easy because the aluminium cladding may corrode and release the highly-radioactive fission products in the elements.

The dry storage of silicide fuel elements is possible if the air is very dry to prevent the aluminium cladding from corroding and releasing fission products. Dry storage is likely to be effective for only 20 years or so after which the fuel elements will have to be permanently disposed of.

Silicide fuel elements could be stored under water if the water was very pure. Some have been stored this way for about 16 years but there is little information about how long such storage is possible without corrosion. It is unlikely to be much longer than twenty years.

Permanent disposal

Aluminium-clad fuel is in an unsuitable form for permanent disposal. A possible way of permanently disposing of spent aluminium-cladded silicide fuel elements is the 'melt and dilute' method. The spent fuel is melted and then natural or depleted uranium is added to the molten material.

When cool, the mass will form a solid block, which could be permanently disposed of. Presumably, the melted fuel could, as an alternative, be mixed with borosilicate glass and vitrified for permanent disposal.

Conclusions

There has been very little experience in the use of silicide research-reactor fuel.

Silicide fuel cannot be reprocessed commercially. It must, therefore, be stored and permanently disposed of as high-level radioactive waste.

Storage in dry or wet stores is only possible for a limited time because the aluminium cladding will corrode and release radioactive fission products from the elements. This may considerably complicate Australia's waste disposal problems.

There is no tried and tested method for the permanent disposal of silicide fuel in a geological repository. Presumably, some sort of 'melt and dilute' method to produce a solid block will have to be used.

It will be some time before a suitable alternative research-reactor fuel to silicide fuel becomes available.

Replacement Nuclear Research Reactor at Lucas Heights Science and Technology Centre

Review of the Draft Environmental Impact Statement by Alan Martin, Alan Martin Associates, United Kingdom

1. INTRODUCTION

In September 1997, the Government of the Commonwealth of Australia announced a proposal to build a replacement nuclear research reactor at Lucas Heights Science and Technology Centre, Sydney. Because of the potential for the replacement reactor to have a significant impact on the environment, the Minister of the Environment decided that an environmental impact statement (EIS) should be prepared.

Under the terms of the Environment Protection (Impact of Proposals) Act, 1974, the proponent for the proposal is the Australian Nuclear Science and Technology Organisation (ANSTO). The EIS was prepared on behalf of ANSTO by PPK Environment & Infrastructure Pty Ltd, assisted by a number of sub-consultants.

This review of the Draft EIS has been prepared for Sutherland Shire Council by Alan Martin Associates, United Kingdom, specialists in the provision of technical services and consultancy to the nuclear industry and to regulatory authorities. The Review is concerned primarily with the nuclear- and radiologically-related aspects of the proposal, including need, siting, radioactive waste management, spent fuel management, radiological safety and decommissioning.

2. REVIEW OF INTRODUCTORY CHAPTERS

General comments

The Draft EIS is a well presented document and gives a wide coverage of the issues arising from the proposal for the replacement reactor in a form suitable for a wide readership. However, in some of the technical areas with which this review is concerned, notably, spent fuel management and radioactive waste management, the Draft EIS is considered to be superficial. In particular, there is inadequate consideration of contingency arrangements in the event that the declared policies are unable to be implemented for any reason.

Chapter 1 - Overview of the proposals

This chapter provides a brief overview of the proposal to construct a replacement nuclear research reactor at LHSTC. The proposal was announced by the Minister of Science and Technology in September 1997 and followed a Research Reactor Review in 1993. The objectives of the proposal are defined and these are a combination of commercial, educational and political aims.

At the same time, the Minister also announced a number of important and related policy decisions and these included:

- the merging of the existing Australian Radiation Laboratory and the Nuclear Safety Bureau into a new Australian Radiation Protection and Nuclear Safety Agency;
- the decision that reprocessing of spent fuel would not be undertaken at Lucas Heights or anywhere else in Australia;
- the setting aside of $88M to cover the costs of managing spent fuel from HIFAR, including the cost of reprocessing overseas; and
- support for ANSTO's initiatives on the development of Synroc technology.

In this review, issues arising from the chapter are discussed under the headings of the later detailed chapters.

Chapter 2 - The decision making process

Chapter 2 outlines the decision making process and sets out the role of the EIS in the overall process.

As will be discussed later in this review, various aspects of the strategy for spent fuel management depend both on the fuel design for the replacement reactor and on the extent to which the vendor is able to offer, or to assist in securing, spent fuel management services. It is our view that Stage 2 of the decision process (see Figure 2.3 of the EIS) should include a specific step of review and confirmation of the strategy in the light of the preferred bid and before placement of the reactor supply contract.

Chapter 3 - Background to the proposal

This chapter summarises the histories of nuclear activities in Australia, of Lucas Heights Science and Technology Centre and of HIFAR. The background to the proposal is summarised and an important input to this is the Research Reactor Review undertaken in 1993. The review considered a range of options and recommended that if, after about five years, certain conditions were fulfilled then it would be appropriate to make a positive decision on a new reactor. The Commonwealth Government took the view that the review provided useful background on its deliberations but that it did not regard the recommendations and conditions of the review as pre-requisites for the Government's decisions.

Chapter 4 - Need for the proposal

The specific objectives of the proposal are set out and include maintaining the capability for isotope production and other irradiation services for medical, agricultural and industrial applications, the provision of research and training facilities in nuclear science, and the maintenance of nuclear expertise in support of the strategic national interest.

Overall, it is considered that a good case is made for a replacement reactor. The important point is that although ANSTO is the proponent in the terms of the EIS, the

proposal is from the Commonwealth Government and is based to a significant degree on the political considerations of the strategic interests of Australia.

Chapter 5 - Description of the proposal

Basically, the proposal is to replace HIFAR with a research reactor tailored to meet Australia's current and expected future needs. The specification is therefore rather general at this stage and it would be up to each potential reactor vendor to put forward a design meeting the general functional specification. The reactor is specified to be of the pool type and the reactor pool would be connected to a service pool which would be used for the handling of irradiated materials, for the storage of spent reactor fuel and for the loading of transport containers.

Pool type reactors are in wide use and are generally recognised as offering the flexibility needed for research purposes whilst providing a high degree of inherent safety.

Our main comment on the outline specification is that, given the uncertainties associated with the management of spent fuel, the absence of any discussion of the fuel and cladding is a major deficiency. Although the majority of research reactors use aluminium-clad fuel, TAIGA reactor fuel is clad in stainless steel. The choice of fuel matrix and cladding are important in the context of the availability and cost of reprocessing, and of the feasibility of long-term storage, see later discussion. Evidence needs to be provided that these aspects have been subject to detailed technical assessment. However, it should be recognised that from a commercial point of view, the specification of a particular type of fuel could reduce the number of potential vendors.

With regard to siting of the replacement reactor, it is clear that on non-radiological grounds LHSTC is the ideal site, since it already has the infrastructure and expertise for the operation of the reactor and the control of products and research, and is in an accessible location. From the radiological perspective, the site seems adequate, subject to suitable restriction of levels of radioactivity in liquid and gaseous effluents.

Chapter 6 - Alternatives to the proposal

This chapter reviews various alternatives to the replacement of HIFAR, for example by the use of alternative technologies or by use of overseas facilities for research and isotope production. The review confirms the findings of the research reactor review that the objectives will best be met by a replacement reactor. Alternative reactor designs are briefly considered and it is shown that the pool concept, as proposed, offers advantages over other concepts.

The alternative of refurbishing HIFAR is discussed and concluded to have a number of disadvantages in comparison to a replacement system, in terms of reduced capability and reliability. An indicative timetable and cost to refurbish HIFAR has been prepared by ANSTO and suggests that it would take six years to plan a refurbishment, with a fifteen month shutdown for installation and commissioning. This is assessed as costing at least $150M (1997), though no justification of such an estimate is presented, in terms of an outline scope of the work required. The period

claimed to be necessary for planning the refurbishment is comparable to the time required to design a full scale nuclear power station and is clearly excessive. This in turn raises doubts over the validity of the cost estimate. In the latter context, it may be noted that, deducting the site-related construction costs shown in Table 6.7 of the EIS, the cost of the replacement reactor is apparently only $152M.

The Draft EIS also considers alternative sites away from Lucas Heights as well as within Lucas Heights. As discussed above, the use of Lucas Heights has the advantage of an existing infrastructure. Identification of alternative sites would lead to delays and ANSTO estimates that the cost of establishing the supporting infrastructure would increase the total project cost from an estimated $286M to $600-650M though, again, little justification is presented to support these estimates.

Within Lucas Heights, six alternative sites were identified and assessed against 10 criteria. This ranking process supports the proposed location.

Finally, Chapter 6 considers alternative strategies for the management of spent fuel and radioactive waste. These aspects are covered below.

CHAPTER 10 - Management of reactor products, spent fuel and wastes

The radioactive products and wastes that will arise from the operation of a replacement reactor will be similar to those currently arising from HIFAR. Similarly, the quantities of spent fuel that will arise will be comparable with those from HIFAR, though the fuel design will be different. The main issues of concern to Sutherland Shire Council are

- the management of spent fuel;
- the storage of radioactive waste on the site; and
- the restriction of the levels of radioactivity in gaseous and liquid effluents discharged from the site.

These issues are discussed in the following sections, making use of relevant information from Chapter 10 and other chapters.

3. SPENT FUEL MANAGEMENT

Policy

The key points of policy are that the Commonwealth Government has declared that:

- the stored inventory of radioactive materials on the Lucas Heights site should be reduced;
- a reprocessing facility for spent fuel will not be established at Lucas Heights or anywhere else in Australia; and
- spent fuel will be reprocessed overseas and, where it is a condition of the reprocessing country, the wastes will be accepted back for storage at the proposed repository and waste storage site in South Australia.

In addition, ANSTO has given a commitment to store spent fuel only for the

minimum time consistent with operational requirements and technical constraints. In particular, no fuel would be stored at Lucas Heights for more than nine years before it is transported abroad for reprocessing or conditioning. Arrangements for the transport would begin when the inventory reached five years arisings. There are various aspects of this commitment that need to be justified and clarified:

a) It should be explained why the minimum time before fuel can be transported is 3 years. Is this a regulatory limit or is it a based on the decay heat of the fuel? If it is the decay heat, is the limit expressed for the flask or for individual elements?

b) Why does a transport batch have to be five years arisings? Until the fuel type is known, the quantity of elements that can be loaded into a single flask cannot be known, but it appears that about 3 years of discharged fuel would fill a flask.

c) Why cannot the five year timescale be the target and the nine year time limit the back-stop? Arrangements would then begin to be made well before a 5-year batch had arisen.

b) What are the contingency arrangements for removal of spent fuel from the site in the event that an overseas reprocessing route is not available at acceptable cost or under acceptable conditions.?

Current stocks of spent fuel

Currently, there are about 1400 spent HIFAR fuel elements in storage facilities at Lucas Heights, about 900 of which are in the Spent Fuel Dry Storage Building and the remainder either in storage flasks or in other storage facilities. It may be assumed that a further 300 or so elements will arise up to the proposed shut down date of HIFAR in 2006. About half of the existing stock is of US origin and the US Government has announced that it will take back all high enriched research reactor fuel discharged from reactors by 13 May 2006. There will be no return of waste from the reprocessing of this fuel.

The balance of the fuel is of UK origin and, until recently, this was to be reprocessed at Dounreay with the eventual return to Australia of cemented intermediate level waste. As a result of various difficulties at Dounreay, it is now unlikely that the fuel can be accepted by the UK. This situation has arisen very recently and is not covered by the EIS.

The position is, therefore, that provided some of the US fuel is removed before 2003, there should be sufficient storage capacity for the HIFAR fuel up the planned time of shutdown in 2006.

Spent fuel from the replacement reactor

For the spent fuel from the replacement reactor, in accordance with Government policy, the intention is that this will be reprocessed overseas. COGEMA has indicated that it is prepared to accept low-enriched aluminium fuel and is reported to have signed contracts with operators of some research reactors. In the COGEMA

process, the dissolution mixture will be diluted into the dissolution liquor from LWR reprocessing. In 1997, ANSTO indicated that for a number of reasons, including the expectation that the returned waste would be high-level (heat generating) waste in vitrified form, the COGEMA route is not attractive (Ref 1).

For other types of research reactor fuel, the availability of reprocessing is less certain. COGEMA has indicated that it wishes to offer a long-term and reliable back-end solution but makes it clear that this depends on the development of a suitable fuel matrix (Ref 2). Silicide fuel, although meeting the needs of the reactor designers and operators is not suitable for reprocessing.

The other major commercial reprocessor, BNFL, has not offered reprocessing services for research reactor fuel, probably because it was considered that the Dounreay facilities of the UKAEA were more suitable for the purpose. Even though the Dounreay position has changed, it is unlikely that BNFL would wish to take any steps in the near future that could jeopardise, commercially or politically, its mainstream reprocessing activities.

The overall position is that there is major uncertainty over the management route for the balance of the HEU HIFAR fuel and that the availability of a route for reprocessing of spent fuel from the replacement reactor will depend on a suitable type of fuel being selected. It is not clear that any reprocessing route is fully secure, as the UK experience illustrates.

For all types of fuel there is significant uncertainty over the costs, particularly if the situation is that there is only one service provider. In 1992, AEA Technology gave an indicative estimate of £31.5M stg for the reprocessing of 2000 HIFAR elements at Dounreay, excluding transport. In 1998 terms, this would be about £40M, in addition to which the currency conversion rate is now less favourable to Australia. For non-aluminium fuel types, there is no information available on costs but the choice of fuel type could be a major factor.

The need for contingency plans or arrangements

If there is to be any confidence that the policy can be maintained that Lucas Heights should not be used for the long-term storage of spent fuel, it is essential that suitable contingency arrangements or plans are in place for the management of spent fuel. These need to be such as to be fully within the control of the Australian Government, *i.e.* not to depend on technical or political factors in other countries. The only plausible approach that would be fully consistent with the policy not to undertake reprocessing in Australia would be to make provision for extended storage of spent fuel at an suitable site. Storage could be in storage/transport casks so that no handling of fuel at the storage site would be involved. The most obvious possibility would be to broaden the scope of the proposed national repository and waste storage site to accommodate spent fuel storage, should this be necessary. The direct disposal of the spent fuel cannot be regarded as a plausible approach in the short to medium term. Any such disposal will require the development of some form of processing, conditioning or encapsulation to produce a suitable waste form of adequate performance. Processes of this type are comparable with fuel reprocessing and therefore inappropriate to a site such as Lucas Heights. It is recommended that Sutherland Shire Council should seek assurance that any form of

processing of fuel beyond simple physical encapsulation will not be undertaken at the site.

Return of waste

Apart from the HEU fuel accepted by the USA, overseas reprocessing is conditional upon the return of waste to Australia. The declared policy is that it will be placed in the proposed national long-lived intermediate level waste storage facility. There is already cemented waste in store at Dounreay from the past reprocessing of HIFAR fuel and an export facility for the waste is expected to be available at Dounreay by around 2005 and the UK will be looking to return the waste soon after that time.

Section 10.4.4 of the EIS notes that for HIFAR fuel reprocessing at Dounreay, about 9 to 12 m^3 per year of cemented long-lived intermediate level waste were produced. This waste is of low concentration and has a very low heat loading. ANSTO's intention is to make use of other waste conditioning technology, such as Synroc or borosilicate glass to reduce the volume of waste by a factor of 100 or more. In this connection, it may be noted that the volume of waste is primarily a function of the fuel matrix and the reprocessing flowsheet rather than of the waste conditioning technology. The uranium/aluminium fuel matrix and aluminium cladding result in high salt raffinate streams and this is the main factor controlling waste volume.

In any case, given the small amount of RRR fuel to be reprocessed, ANSTO would have little control over either the process or the waste form since these would be decided by the reprocessor. The requirement would be for Australia to take back an equivalent quantity of radioactivity, based on an internationally agreed formula for waste substitution, rather than the specific radioactive wastes arising from the reprocessing of the ANSTO fuel.

While some reduction in waste volume is desirable to reduce costs of transport and storage, it is not necessarily the case that the disposal problem would be simplified by having a small volume of concentrated waste rather than a large volume of dilute waste. In the extreme case, the equivalent activity from 40 years of operation of the RRR could eventually be returned to Australia in a single canister of vitrified waste. However, as has been observed by ANSTO, the management and disposal of such waste would pose difficult problems and it is unlikely that such an approach would be viable.

4. RADIOACTIVE WASTE MANAGEMENT AT LUCAS HEIGHTS

Legislation, regulation and policy

Chapter 10 of the EIS sets out the legislative and regulatory background to radioactive waste management, ANSTO policy and the management of current and future waste arisings. The regulatory arrangements are well developed and will be strengthened by the setting up of ARPANSA.

The Minister of Primary Energy and Resources announced in February 1998 that a national waste repository for low level and short-lived intermediate level solid wastes would be constructed in the central north region of South Australia. Eighteen possible sites have been identified in the region and a technical programme is in

hand with the aim of finding a preferred site or sites in early 1999. Subject to the necessary approval processes being achieved, construction is expected to start in 2000 and, on this basis, the repository would be operational well before the new reactor is commissioned. It is also intended that once a site is identified the possibility will be considered of co-locating a storage facility for long-lived intermediate level waste on the same site. It is not clear what will be the position if it is decided not to provide the waste storage facility. Unless some other site is found for this facility, long-lived intermediate level waste will continue to be stored at Lucas Heights indefinitely.

ANSTO has in progress a Waste management Action Plan to deal with "legacy" issues from past activities at Lucas Heights and to refurbish or replace existing facilities. Before the new reactor is commissioned ANSTO is scheduled to have completed improvements to effluent control systems, solidified existing intermediate level wastes, conditioned most of the solid waste inventory for disposal or storage, and transferred the low level waste to the national repository. For these aims to achieved, the waste repository project would need to proceed on programme or with only minor delays. Experience elsewhere is that such projects are often subject to considerable delay. It may also be noted that at the time of the research reactor review it was envisaged that a preferred site would have been identified by 1994 whilst the current programme is to identify a preferred site or sites by 1999. The current programme, which indicates start of construction of a repository in the year 2000, is likely to prove similarly optimistic.

Radiological impact of effluent discharges from Lucas heights

ANSTO has adopted a dose constraint of 0.3 mSv per year to any member of the public from all its operations. For gaseous discharges from HIFAR, the authorisation is based on an annual dose of 0.1 mSv. Assessments presented in the EIS indicate that the dose to a pessimistic most exposed group from all gaseous discharges from the site is 0.003 mSv per year. For liquid effluents, the control appears to be based mainly on the basis that the concentration of water reaching the Cronulla sewage treatment works should not exceed the concentrations in the World Health Organisation drinking water guidelines, which are based on giving a dose of 0.1 mSv per year from continuous consumption. Although the dose arising from this route is likely to be extremely low, it would have been helpful if estimates of the dose had been made to confirm this. The use of drinking water guidelines is not entirely appropriate for the purpose of setting discharge criteria because there are potential routes by which higher doses can occur. One example of this is the use of sewer sludge for agricultural purposes. Other factors are possible future uses of treated water and also the overflow that occurs from most sewage collection systems under storm conditions. It is recommended that, as a precautionary measure, SCC should ask for a more rigorous radiological assessment of the liquid discharges to be presented in the final EIS.

Also in relation to liquid effluents, it would be helpful to have a description of the engineered and administrative systems which are used to control batch discharges and to ensure that effluent cannot be released before it has been assessed and sanctioned for discharge.

The assessments presented in the EIS indicate that the levels of future discharge

when the replacement reactor is in operation will be similar to or less than current discharges and that the radiological impact will not be increased.

Overall, we consider that the current and proposed levels of discharge of radioactivity from operations on the site are such as to be of low radiological significance. However, it is recommended that:

- the site constraint of 0.3 mSv/y applied by ANSTO should be reduced to 0.1, or even 0.03, mSv/y in order to more closely reflect operational needs and demonstrate a commitment to the ALARA principle;
- a simple quantitative assessment should be undertaken of dose pathways from liquid effluent discharge, including consideration of the possible uses of treated effluent and sewer sludge; and
- the final EIS should present sufficient information on the engineering and administrative control measures for liquid effluent discharge to show that inadvertent discharge is not a concern.

Solid wastes

The characteristics and quantities of current stocks and arisings of low and intermediate level solid wastes and of intermediate level liquid wastes are summarised in the EIS. Low level waste arises at a rate of about 150 drums (200 litre capacity) per year. A new storage facility for waste drums has recently been constructed and has a capacity of 6700 drums, sufficient to receive arisings to about 2010.

Accumulations of intermediate level solid waste amount to about 200 m^3 plus 816 drums of thorium residue. It is not clear what proportion of this will qualify as 'short-lived' and therefore be potentially suitable for disposal in the proposed repository. The thorium residues are long-lived and will need to continue to be stored either at Lucas Heights or at the repository site.

Intermediate level liquid wastes arise from the production of molybdenum-99 at a rate of 0.3 m^3 per year and this is expected to increase fourfold when the replacement reactor is in operation. As of 1996, the accumulated volume was 6.5 m^3. Solidification of these wastes is a priority item under the Waste Management Action Plan and a process has been developed which will reduce the volume by a factor of 15 to 20. The product waste will be in crystallised form in stainless steel vessels suitable for storage for at least 50 years. In the longer term the intention is to solidify the waste into Synroc. ANSTO's intention is that wastes of this type arising during the operation of the replacement reactor will be solidified and stored in-situ (*i.e.* at Lucas Heights) until the long-lived intermediate level waste storage facility is available.

The information presented in the EIS shows that a wide variety of low and intermediate level wastes have accumulated and will continue to arise on the Lucas Heights site. The Government is proposing to construct a repository for low and short-lived intermediate level wastes and to Sutherland Shire Council this will be a welcome development. However, in our view, the declared programme may well prove to be very optimistic and so these categories of wastes could continue to be accumulated at Lucas Heights well after the replacement reactor comes into operation. For the long-lived intermediate level wastes, the position is even more

uncertain, since no decision has yet been made as to whether a storage facility would be located on the repository site. Without a commitment to provide a storage facility for intermediate level waste, the Government policy of reducing the inventory of stored waste at Lucas Heights will not be achieved to any significant extent.

5. DISCUSSION

The Draft EIS gives wide coverage of issues related to the proposal to construct a replacement research reactor at Lucas Heights. However, in a number of areas that are of particular concern to Sutherland Shire Council, the coverage is superficial and does not give confidence that the issues will be adequately resolved.

The areas of concern include the adequacy of the consideration of alternatives to the proposal, the management of spent fuel and radioactive waste, and some aspects of the discharge of radioactive liquid effluents. The shortcomings are considered to be:

Consideration of alternatives

In relation both to the case for a constructing a new reactor, rather than refurbishing HIFAR, and the case for locating a new reactor at Lucas Heights, insufficient information is presented to support the basis of the cost estimates and hence of the conclusions.

Spent fuel management

The limited discussion of spent fuel management does not reflect the complexity and long-term importance of this issue. In relation to selection of replacement reactor, the long-term management of the fuel should be a fundamental factor constraining the choice of fuel design.

The loss of the Dounreay reprocessing route has occurred since the material of the Draft EIS was prepared and this is of fundamental importance to the strategy.

In our view, there is a need for a detailed paper to be prepared as part of the Final EIS setting out a robust strategy for the long-term management of spent fuel. This should cover the status of developments in research reactor fuel designs and back-end processes, alternative strategies for the management of spent HIFAR and RRR fuel, fuel cycle costs, and the implications of the alternatives for the waste disposal strategy currently proposed. The paper should set out the contingency arrangements that are proposed to cover the event that reprocessing is not available on the necessary timescale or at an acceptable cost. It should be shown how the Government commitment that Lucas Heights will not become a long term fuel storage site will be satisfied if overseas reprocessing is not available. ANSTO should give an assurance that no form of processing or conditioning of spent fuel will be undertaken at Lucas Heights.

Further discussion is also needed on the proposals for management of the returned wastes and it needs to be made clear what will be the form of returned waste from reprocessing.

Radioactive waste management

Insufficient information is presented in the Draft EIS on the radiological impact of discharges of radioactivity in liquid effluents. The use of WHO Guidelines for drinking water is not, in itself, an adequate basis for control.

With regard to solid waste management, the proposals are largely statements of intent and there is no consideration in the Draft EIS of contingency arrangements. In particular, difficulties and delays in identifying and gaining the necessary consents for a disposal site would mean that Lucas Heights would continue to accumulate an increasing inventory of waste. For long-lived intermediate level waste, there is not yet a commitment to providing a storage facility long-lived wastes at the repository site. This means that storage of long-lived wastes could continue at Lucas Heights indefinitely. Similarly, as discussed above, Australia may need to accept consignments of waste from the past reprocessing of HIFAR fuel around 2005 and in the absence of the storage facility on the repository site there would be little alternative but to return it to Lucas Heights.

6. CONCLUSIONS

The Draft EIS seeks to demonstrate that the construction of a replacement reactor will not pose significant or insuperable problems in relation to the management of spent fuel and of radioactive waste. The difficulty is that the proposals contained in the Draft EIS depend on factors that are, in most cases, outside the control of ANSTO and this means that there are major uncertainties as to whether the proposals can be implemented. Some of the uncertainties might be resolved or reduced in the relatively short term, for example the identification and acceptance of a waste disposal site. Others, particularly those related to spent fuel management, may take a decade or more to resolve.

In our view, the Shire Council should seek an assurance that, if the Government gives approval for the project to proceed to the next stage, the final step of awarding a supply contract should be subject to demonstration of satisfactory progress in implementing declared policies regarding the reduction of the radioactive inventory on the site at Lucas Heights.

This would involve:

- demonstration that the Waste Management Action Plan is on course for completion on programme;
- confirmation of a disposal site for low and short-lived intermediate level radioactive waste;
- confirmation that a storage facility for long-lived intermediate level waste will be constructed at the disposal site;
- demonstration that there is in place a robust strategy for the management of spent fuel and that this does not involve long term storage at Lucas Heights. This should take full account of the uncertainties associated with overseas reprocessing.

7. REFERENCES

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Lucas Heights Research Establishment to the United States and the United Kingdom", October 1997.

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