
COMMONWEALTH OF AUSTRALIA

# Official Committee Hansard

# SENATE

## SELECT COMMITTEE FOR AN INQUIRY INTO THE CONTRACT FOR A NEW REACTOR AT LUCAS HEIGHTS

**Reference: Inquiry into the contract for a new reactor at Lucas Heights**

MONDAY, 4 DECEMBER 2000

CANBERRA

BY AUTHORITY OF THE SENATE

**INTERNET**

The Proof and Official Hansard transcripts of Senate committee hearings, some House of Representatives committee hearings and some joint committee hearings are available on the Internet. Some House of Representatives committees and some joint committees make available only Official Hansard transcripts.

The Internet address is: **http://www.aph.gov.au/hansard**

To search the parliamentary database, go to: **http://search.aph.gov.au**

**SENATE**

**SELECT COMMITTEE FOR AN INQUIRY INTO THE CONTRACT FOR A NEW REACTOR AT LUCAS HEIGHTS**

**Wednesday, 25 October 2000**

**Members:** Senator Forshaw *(Chair)*, Senator Chapman *(Deputy Chair)*, Senators Allison, George Campbell, Lightfoot, McLucas and Sandy Macdonald

**Senators in attendance:** Senators George Campbell, Chapman, Forshaw, Lightfoot and McLucas

**Terms of reference for the inquiry:**

To inquire into and report on:

(a) the need for a new research reactor, including:

(i) the validity of science and industry enhancement claims of the Australian Nuclear Science and Technology Organisation (ANSTO) and the Commonwealth Government,

(ii) the adequacy of supply, and the cost, of radioactive sources and nuclear medicines used in diagnosis and treatment,

(iii) the opportunities for alternative sources of nuclear materials for medical applications, such as additional cyclotrons at appropriate locations,

(iv) the validity of nuclear expertise and national interest claims of the Department of Foreign Affairs and Trade, the Australian Safeguards and Non-Proliferation Office, ANSTO and the Commonwealth Government for the replacement reactor, and

(v) consideration of alternative approaches and means through which Australia's national interests in nuclear disarmament and non-proliferation and nuclear safety can be supported and advanced;

(b) the process leading up to the signing of a contract in June 2000 with INVAP of Argentina for the construction of a new nuclear reactor at Lucas Heights, with particular reference to:

(i) the quality and accuracy of information relied on in assessing the tenders, including a review of how the economic, environmental and public health impacts were considered,

(ii) the probity of the tender arrangements and the accuracy of the cost assessments,

(iii) the checks made of the record of the preferred tenderer, INVAP, and its capability to undertake the project safely and economically and its record in matching international best practice in other projects, and

(iv) public access to information about the proposal and the consideration of issues raised through the public consultation process;

(c) the nature of the contractual commitments entered into and the degree to which they are binding on the Commonwealth, including in the event that not all approvals are obtained and all other preconditions met, or that a future Government decides not to proceed with the reactor, with particular reference to:

(i) the timeframe and process to be followed by the Australian Radiation Protection and Nuclear Safety Agency in considering the issue of a construction licence and an operating licence, and the consequences under the contract if such licences are not issued,

(ii) any other requirements for approvals from the Commonwealth, state or local governments and the consequences if such approvals are not obtained,

(iii) the consequences if preconditions set in the Environmental Impact Statement and other previous inquiries are not met at the time of granting of a construction licence,

(iv) the nature of any provisions in the contract related to the ability of either party to terminate the contract prior to completion and the provisions in relation to compensation for termination, and

(v) whether all or part of the contract and other documents created during its consideration and approval should now be made public;

(d) whether the preconditions set by previous inquiries and assessments into this proposal have been adequately met prior to the contract being entered into, with particular reference to:

(i) fulfilment of each of the conditions for approval set out in the draft Environmental Impact Statement and its supplement report, including requirements for waste management,

(ii) whether the recommendations of the Economics References Committee inquiry into the Lucas Heights proposal which reported in September 1999 have been adequately responded to,

(iii) the adequacy of occupational and public safety protection procedures, and

(iv) the adequacy of nuclear incident plans and emergency procedures; and

(e) the adequacy of proposed fuel and waste management provisions in the contract (or yet to be finalised), with particular reference to:

(i) the specific fuel proposed to be used and its source, the type of fuel rods and where they will be manufactured,

(ii) the proposed spent fuel management arrangements during operation,

(iii) the arrangements made to ensure that spent fuel rods can be reprocessed, stored and ultimately disposed of safely,

(iv) whether the new reactor is subject to negotiation of satisfactory contracts for international reprocessing of spent fuel rods; and, if so, which countries will be involved and will these contracts be subject to a provision which requires the return of Australian waste as is the case with some of the existing Lucas Heights fuel rods, and

(v) the timing of any requirement for the provision of an Australian long-term waste storage facility for rods from a new reactor.

U0

## WITNESSES

**Committee met at 10.12 a.m.**

TIDD, Air Vice Marshal (Rtd), Donald Arthur

**CHAIR**—I declare open this meeting of the Senate Select Committee for an Inquiry into the Contract for a New Reactor at Lucas Heights and I welcome this morning Air Vice Marshal Don Tidd to the hearing.

**Air Vice Marshal Tidd**—Thank you. I had two roles in the reactor program: first as a leader of a red team review in the middle of last year and, more importantly perhaps to you, as a process auditor during the tender evaluation this year.

**CHAIR**—Thank you, Air Vice Marshal. The rules of the committee are that we prefer all of our evidence to be given in public. If, however, at any stage you wish to give evidence in camera, you can request to do so at that time and the committee will consider such a request. We do not have a written submission from you this morning, but we do appreciate your attendance here. I understand you have an opening statement that you would like to make. If you could proceed to do that now, we will follow that with some questions from members of the committee.

**Air Vice Marshal Tidd**—Thank you for your welcome. I accept your offer to make an opening statement as this should assist the committee in being aware of my participation within the overall context of the replacement research reactor program. My involvement in the project firstly concerned leadership of a red team review in mid-1999 of the draft tender as presented at that time. My second activity was the performance of a process audit in the period from 27 January to 6 April of this year. I completed the audit with a briefing to the tender selection review committee on 12 May of this year. I will not address the red team review further unless you care to raise the issue.

As to my involvement in the project, ANSTO approached a local Canberra company called Total Logistics Management Pty Ltd with the objective of seeking professional assistance for their red team review. I occasionally do subcontract work for this company and was available to undertake the task.

In January this year, ANSTO again sought assistance for the process audit as their plan to have the Australian National Audit Office perform the function did not eventuate. I accepted the second task. With respect to my capability to undertake such tasks, the committee might note that I am a retired air force officer with considerable experience as a major capital acquisitions project director. I have been a chief Defence negotiator for several major procurement contracts.

The Defence outsourcing program has involved me both as the responsible authority for the Air Force component and as the portfolio authority when I was appointed an assistant chief of the Defence Force. This position also carried membership of the Defence Source Definition Committee which established the public record of accountability for Defence source selections for major capital projects. Since retirement, I have assisted Defence in the industry in tender preparation, evaluation, and the response to tenders. These posts, coupled with my professional engineering qualifications, have afforded me wide experience in the field of complex acquisitions with major technical implications.

With respect to the reactor project, the purpose of the process audit was to provide a systematic and independent examination to determine whether the activities and related results complied with planned arrangements, detailed and relevant project documentation, and whether the arrangements were implemented effectively. Some boundaries affected my process audit. Firstly, detailed evaluation of tenders commenced in early January with a process audit not commencing until the end of January. Secondly, the ANSTO audit committee decided that the internal auditor, Mr Clark, would perform the audit of the source selection report preparation and follow-on activities. This truncated my audit and brought forward the end date. Finally, my contractual arrangement required only two days of effort per week. I would ask the committee to note, however, that the probity, risk and process audits overlapped, and the boundaries on the process audit ought not to have impacted on the integrity of the audit outcome.

The process audit involved the following activities: analysis of project documentation covering direction and guidance for ANSTO personnel; discussions with tender evaluation working groups; selective examination of the tender and responses; review of questions and answers as part of clarification; attendance at weekly coordination meetings; attendance at tender evaluation management group meetings; attendance at clarification meetings with bidders; attendance at management meetings to refine clarification discussion outcomes; and review of selective risk assessment reports.

The tender evaluation by ANSTO involved an examination of each bid against the tender requirement to determine compliance and risk. This was achieved by a number of working groups with science specialist personnel. Following completion of the evaluation, which also included clarification discussions, the tender evaluation management group was required to perform a comparative evaluation of the results of each tender against each other, relative to evaluation criteria enunciated in the tender at section 4.3 of book 1. This led to preparation of the tender evaluation report, ranking each tender against evaluation criteria so as to allow determination of which tender resulted in the best value for money decision.

I did not audit the activities of the management group in preparing the evaluation report, as indicated in my comments on the boundaries applied to the process audit. However, I have included this statement to emphasise the process relative to some criticism implied by companies that were not the preferred source. Within my experience, the ANSTO process followed normal Commonwealth procurement guidelines.

The tender evaluation process encompassed a number of elements. My broad conclusions on the process, relative to the previously enunciated aim of the process audit, are as follows: the project documentation was very concise and clear; the personnel involved well understood their responsibilities; communication with tenderers was controlled; and control of documentation was done very well. With regard to detailed evaluation of tenders, it was diligently performed in assessing compliance of each bid with the tender requirement. It was fair and consistent. There was risk determination which utilised the Australian standard and professional advice. The clarification process was fairly done and equal to all, with no negotiation. ANSTO meetings were conducted regularly. With the supplementary pricing proposal, all bidders were provided with detailed requirements.

Overall the process audit revealed that the activities and results complied with project direction and guidance. A detailed report, caveated commercial-in-confidence, was submitted to

ANSTO on the process audit. It has been my understanding for many years that any report paid for by the Commonwealth becomes the property of the Commonwealth. ANSTO has recently confirmed this with me. I must therefore advise the committee that I am unable to provide it with a copy of my report, in the event that you ask for it, as I no longer control it. I would also note that I signed a confidentiality agreement with ANSTO, which puts me in some jeopardy if you were to press the case. However, I would certainly be pleased to respond to your questions.

**CHAIR**—Thank you very much, Air Vice Marshal. Was it part of your role to assess the technical competency of each of the consortiums that put in a bid in the tender evaluation process? I use the term 'technical competency' as a sort of shorthand term as I cannot think of another phrase to describe whether or not they could actually deliver on what was required by ANSTO in terms of the actual design of the reactor, its neutron beam capacity and so on—or was it your role to assess just the process? Is that clear?

**Air Vice Marshal Tidd**—Yes. My role was to observe the process and to establish whether it complied with the project documentation which ANSTO had produced. On your issue about the competence of the suppliers, their pre-qualification was a task done before I entered into this arena. In any event, it was outside the purview of my task and, knowing very little about the nuclear industry and a lot more about the aircraft industry, I would not have felt competent to even attempt to do so.

**CHAIR**—That is what I was getting at—that your work did not involve, as it were, independently assessing the nuclear capability issues.

**Air Vice Marshal Tidd**—No.

**CHAIR**—ANSTO used a reference reactor for each of the four bids. Did you have any role in examining the field reports and documentation that related to the reference reactors? My memory does not serve me well here at the moment—that may have been part of pre-qualification but I do not think it was. I understand that ANSTO, for instance, sent representatives to visit each of the reference reactors in Egypt, Canada and Europe who then brought back and filed reports on that aspect of assessing the tenders. Did you, in turn, review that?

**Air Vice Marshal Tidd**—No, I did not. I was aware that ANSTO had sent teams overseas to examine the products of some of the various bidders but, once again, any evaluation and technical appreciation was outside the purview of my particular mission.

**CHAIR**—The fact that they did send people overseas and that they did include reference reactors as part of the assessment, am I correct in assuming that that would be seen to be an appropriate process, whether or not the results stood up is another issue again? Am I making the right distinction here?

**Air Vice Marshal Tidd**—I think from my position, having described what I did in the process, but from the point of view of ANSTO's strategy in preparing a tender for issue to pre-qualified suppliers, they would need to have some understanding of the technology that was available in the world, because if you are writing a tender and you do not know what you are writing about you are not going to get a very good result. I would suspect that they probably

used the knowledge they garnered on the latest technology to a system in the evaluation of the tenders, particularly when it became a comparative evaluation as opposed to the vertical process where they looked at each tender somewhat in isolation.

**CHAIR**—You also made a statement about best value for money. How critical was the price in the assessment of each of the bids? Was it fundamental?

**Air Vice Marshal Tidd**—I really cannot talk on price, because the pricing of the tenders when they were submitted in early January was immediately isolated from the rest of the tender. The detailed evaluation of the pricing was done quite separately by, I believe, one or two people and I never saw the pricing whatsoever. I am aware of the overall ANSTO project budget because it was raised at the red team review in mid-1999 when there was some discussion about the adequacy of the budget and whether it would achieve the desired result. Most bidders who do not know what sort of project budget is available are going to be pretty poor bidders. There had been a ministerial statement issued sometime in 1999 which indicated the project approval level of the project but, as to detail pricing, I saw none of that. I was aware that following the clarification discussion when there was some finetuning of the tenders the supplementary pricing proposals were sought from the bidders. Once again, this occurred after my process audit had concluded. Mr Clark would probably be the only one who could answer that question.

**Senator GEORGE CAMPBELL**—Are you aware, or can you advise us, whether the main focus in assessing the tenders was on quality or on price? Setting aside the actual price, was the focus on the evaluation of the tenders on quality of product or quality of outcome or was the price a determining factor?

**Air Vice Marshal Tidd**—I think you could probably say that occurred in three separate areas which were drawn together. The main activity of the tender evaluation working groups was to look at the details of the bids minus the pricing element. As you can imagine, there were literally hundreds of questions relative to the tender. The specialist looked at how these were answered to determine whether what each bidder was saying was, in fact, true. Many bidders will answer a question saying that they will comply, but without substantiation it places Commonwealth public funds at risk if you just accept that blandly. So to some extent the tender evaluation teams do their own appreciation of the substantiating information provided by each bidder to form their own conclusion as to whether there is compliance or not.

Value for money really is a subjective determination—and I am sure I am not telling you anything new—of a number of criteria which were enunciated very early in a tender. Price is clearly one, and the tender evaluation working groups per se, except the finance one, never even saw that. They had no understanding of the pricing at all; it was a closely guarded secret—as it should have been—and that was part of ANSTO's strategy. That pricing would have been brought together with the technical issues, the operating issues, and any other ones when the tender evaluation management group began its comparative determination of bids with a view of ranking each tender against each of those criteria. Out of that would come a preferred source, if I may use that term. I do not think that people use 1, 2, 3, 4 any more; they have a preferred source and the rest are in a list.

**Senator GEORGE CAMPBELL**—ANSTO said they relied very substantially on computer modelling to determine the parameters of each of the bids. Were you familiar with this computer modelling? Did you see the computer modelling?

**Air Vice Marshal Tidd**—If you are talking about the computer modelling of the neutron beam effects, I have to say, no, I did not. Not being a nuclear engineer I have little understanding of that sort of modelling whatsoever.

**Senator GEORGE CAMPBELL**—They said they used computer modelling to assess the performance of the reactor. I do not know whether that was narrowly just on the neutron beams or whether it was more broadly.

**Air Vice Marshal Tidd**—I would suspect they did use some computer modelling. There were some criticisms raised during the tender evaluation and, bearing in mind that when you are looking at a new technology—something which is perhaps not off the shelf—one of the tools which a tender evaluation agency can use is a form of modelling to assess whether what is being put to them is realistic. The usefulness depends on the value of the model, where it came from, and the experience of the people who understand the parameters of the model. I would have to say that I could not offer any definitive statement on ANSTO except that it struck me that the people there seem to know what they are talking about—but that is from a man who spent most of his life in the aircraft industry.

**Senator GEORGE CAMPBELL**—As one who has spent a fair bit of his life in the shipbuilding industry, it is hocus-pocus to me too. Was the question of liability of the tenderers examined in your audit? In other words, what I am talking about is whether or not INVAP, or the other tenderers for that matter, feel, in performance, that the liability of the Commonwealth was secured through appropriate assurance policies or whatever. Was that assessed in your tender?

**Air Vice Marshal Tidd**—I cannot really answer that question. I am sure that liability was an issue discussed in the working group which evaluated the draft contract conditions—in other words, what liability the Commonwealth may have had, particularly in regard to ANSTO, and what liabilities the contractor may have borne if he were the preferred source. I am sure that would be issued, because I am well aware that ANSTO borrowed heavily from Defence's contract terms and clauses in a document called DEFPER 101—unless it has had a new name since I retired—which had various liabilities in it.

**Senator GEORGE CAMPBELL**—Is that a standard process in Defence procurement?

**Air Vice Marshal Tidd**—It is standard terms and conditions which have been provided by the Australian Government Solicitor. They are subject to review. It is a relatively dynamic document. They use this as the terms and conditions. It then goes with the functional performance requirements and any other things, such as Australian industry involvement, et cetera, into a draft tender. I would suspect that liability was certainly discussed, but I never observed it. Once again, my job was to observe the process in action more so than the content.

**Senator GEORGE CAMPBELL**—Can you explain to us what a red team review is?

**Air Vice Marshal Tidd**—The purpose of a red team review is to establish the coherency of the draft tender, especially with respect to terms of tendering, draft terms of contract, functional and specific requirements and necessary standards. In particular, the criteria for value for money determination is assessed with the aim of ensuring that bidders understand the process and how a preferred supply will be established in contract. In broad terms, a red team review is a quality check by persons not involved in the preparation of the tender. Bidders also use this process to ensure that their response answers the stipulated requirements and substantiates the compliance position. I suspect the red review tag comes from the use of a red pencil to highlight issues for the drafters to take under consideration and, to confuse the issue, I would note that some companies also use a green review, which is a lesser level review.

**Senator LIGHTFOOT**—Air Vice Marshal, the committee has received a submission from one of the unsuccessful tenderers, Technicatome. The submission questions the methodology used whereby the tender proponent divided items into separate aspects or books, as they were called, which were then evaluated by independent components—by teams specialising in those particular areas on those particular items in the books. Technicatome writes that it was informed at debriefing that 'the tenders were mainly assessed on a paper basis based on ratings given by separate assessors working each on different chapters'. It expresses concern that this methodology could mean that the 'overall consistency of concept proposed for the reactor' is ignored and, to quote again, 'where the overall optimum is not the sum of each local optimum.' Would you like to comment on the aspect of the tender evaluation methodology and perhaps upon the concerns that were expressed by Technicatome?

**Air Vice Marshal Tidd**—The process employed follows pretty well my understanding of Defence procurement guidelines.

**Senator LIGHTFOOT**—When you say 'pretty well', does that means it was lacking in—

**Air Vice Marshal Tidd**—Sorry—it does follow. I was not as precise as I should have been. Essentially, the tender evaluation starts off with a view to examining each bid to find compliance with the requirements stipulated, be they functional performance requirements, quality requirements, contractual terms and conditions, Australian industry involvement—all those sorts of things. The objective is to filter out those things which are important and find out whether there would be some risk to the Commonwealth with that particular proposal. All of these things eventually have to be weighed against the criteria enunciated which form the value-for-money determination. In simplistic terms, those criteria invariably will cover the cost, the operation and technical issues, the cost of ownership, Australian industry involvement—all those sorts of things. I am talking in very general terms but the ANSTO ones, to my knowledge, were a bit more detailed than that and would cover these issues.

As part of the review by the tender evaluation working groups, they recorded their risk assessments on a database. It was called TRES. I cannot tell you what the acronym 'TRES' stands for, but it was mainly a way of recording those results and applying the Australian standard on risk management where risk was perceived, and dealt with what weighting may be applied to those. Clearly, everything is risky but some things are more risky than others. The whole objective in the end is to get a quick summation of which tender may have the most risk.

Having done that, the tender evaluation management group, which comprised the project manager, the safety and licensing team leader, the technical team leader and the team leader who was responsible for finance and the contract conditions, got together and started the lateral evaluation of all this data, with a view to saying, 'We've looked at it this way, we now have to compare them against the others and find out, from this TRES report, which tenders offer the most risk in each particular area,' such as the operational, technical, financial and whatever else.

These people are also at a fairly senior management level. They have been actively involved in watching their working groups do this review and in having clarification discussions with the bidders, so they also have an intuitive understanding of where they believe people sit relative to one another. That brings the four together. It all focused on these criteria. This is the normal way in which Commonwealth procurement guidelines require you to come up with the preferred source in the end. I did not observe the last process; as I explained in my opening remarks, that boundary was cut off and it was done by another auditor. But that is the normal way that it is done in Defence and it accords with the Commonwealth procurement guidelines.

I will comment on my experience with tenderers who are not preferred. Firstly, these bidders spend a lot of money putting in bids. A million plus is quite the norm for large, complex bids. At the end of it, they are told they are not the preferred source, so they are obviously not going to feel very happy. One of the issues is that the debrief which they receive at the end invariably will never answer all the questions that they have. I have to say this from experience. I have briefed contractors, told them why they did not win and, if you told them everything, all you would get is a great raft of submissions to ministers, parliament and senate committee meetings to discuss all of this. So there is a fine line as to how much you might tell these companies.

I would suspect that Technicatome was well aware of this process. In fact, from what I read, I thought all the companies thought the process was pretty fair to all of them, to be quite honest. From my reading of both the Technicatome and the Siemens comments, I thought they were quite mild compared to what I have seen in the past. The process looked at all these things. If Technicatome say they did not understand it, I do not think that is quite the truth. I think they were just having a gentle try at the Commonwealth, particularly ANSTO, about the way it went about this.

In the end, a value for money determination boils down to what weighting you put on such things as finance, the requirement to meet the operational technical requirements, the lifecycle costing and the industry involvement. That would appear to be a subjective outcome, where people try to do it as objectively as possible. In my experience, many countries use value for money judgements. Most of the tenderers who are not preferred generally say that they do not understand the process, which I do not think is quite true. Have I answered your question?

**Senator LIGHTFOOT**—Yes. That was very good. Technicatome also went on to express some surprise that the fuel and the design of the reactor were treated as relatively separate issues. They were not incorporated or enshrined into the one study. Was Technicatome's attitude towards that in variance with how you would have thought that should have been treated?

**Air Vice Marshal Tidd**—Once again, I did not get involved in the technical issues because they were outside my area of expertise. In fact, I have only ever had the experience of using nuclear physics on an aeroplane once. That was on a F111 as a means of non-destructive

inspection. I did sit in on a discussion where the fuel rods were developed. It seemed to me, and it had nothing to do with the audit, that there was the issue of new type fuels coming through the pipeline and how they would be treated, particularly from a disposal point of view, and all those nasty issues associated with radioactive material. That was a problem that ANSTO was trying to address. They asked, 'What options would we have if we define a particular fuel rod configuration now? Does it debar us in the future from picking up an improved type of fuel rod which may be less harmful to the environment?' That is probably all I could say about the Technicatome issue. I do not think ANSTO treated them separately; I think ANSTO was trying to establish what level of flexibility might exist for them relative to fuel rod disposal, particularly after usage.

**Senator LIGHTFOOT**—If INVAP and Technicatome were playing football and the latter lost, they may be seen as sore losers.

**Air Vice Marshal Tidd**—I have never met a source who was not preferred to be anything else—and note I did not use the words you used.

**Senator LIGHTFOOT**—The submissions from the unsuccessful tenderers seemed to suggest that, while no fault could be found with the tender process, there were questions that they said could be raised about the extent to which the process led to an appropriate or inappropriate outcome. Is it possible, in your experience, that a rigid adherence to process could lead, nevertheless, to a failure to select the most appropriate tenderer?

**Air Vice Marshal Tidd**—There are enough safeguards in the system to stop that happening. ANSTO employed a process where its working groups developed positions. They had a more senior level committee, the tender evaluation management group, to consider all these issues and write a report. It then went to the tender selection review committee, to which I gave a briefing and was subjected to some issues and questions. That is the balance: to say that, while there needs to be relatively strict adherence to the process, it is probably unlikely that you will wind up with the wrong selection source based upon what you have learned.

I mentioned in my opening remarks that I have sat on the Defence Source Definition Committee. I presume it is called something else now, but it does the same function: it essentially is the devil's advocate of the recommendations put forward by the lower level committees who are nominating a preferred source. Most of these committees and the ANSTO review committee operated in the same way that the Defence committee did. It looked at the report and it looked for the devil's advocacy approach to say, 'Are we sure that we have got this right?' That is the appropriate check and balance. ANSTO's strategy and its organisational throughput and its checks and balance were no different from Defence. While Defence may occasionally get some swipes over things like Collins class submarines, the process in Defence has probably very rarely been brought into question, because it is a key purchaser of highly priced equipment. It has to make sure that its process is correct, but at the same time it really is value adding and purchasing the correct value for money decision.

**Senator LIGHTFOOT**—So there is an audit process that would rebut that suggestion?

**Air Vice Marshal Tidd**—Yes, I believe so. I think there are enough checks and balances in the organisational arrangements to militate against someone saying, 'This is the process and if

you follow the process and something came out of the bottom and it was a wrong decision.' I think there are enough checks and balances to stop that happening.

**Senator LIGHTFOOT**—Yes, thank you, Air Vice Marshal.

**Senator McLUCAS**—I have a couple of questions. You said that, in that final stage when the financial component came in, another auditor had the role of auditing that section of the whole process. Which auditor was that one?

**Air Vice Marshal Tidd**—Mr Clark who is the internal auditor for ANSTO. While he does not audit the books, he normally works for ANSTO to do those sorts of things. I expect in his case he was probably more well known to the ANSTO audit committee than the civilian outsider.

**Senator McLUCAS**—Going back to this process of the books and the various evaluations of each of the components of the tender process, I need some clarification about what is the question that is being asked. Is the question that a review committee would be asking about the technical performance, 'Is the tenderer capable of doing this?' in which case you would end up with a very clear yes or no answer? Or is the question a different question that that committee asks of the process?

**Air Vice Marshal Tidd**—I think ANSTO, as part of its strategy in pre-qualifying for potential bidders, essentially made the decision as to whether these companies had the capability to meet their requirements. It then became more of an issue of their price and their joint venture arrangements with companies in Australia that may be able to do this. One of the building companies, I understand, was going through some organisational changes at the time. I think ANSTO had essentially been through that. When we break down the technical elements, I think we need to keep in mind that the nuclear reactor, relatively speaking, is a small part of a works program. A lot of the project budget will be spent on the works program with the nuclear reactor being a relatively small component, albeit the glamorous bit. When you start looking at these you need to look at who is an expert in the facilities area and what goes with it and who are the experts in the nuclear arena. You will not find anybody with a total overview of the whole thing. So the specialists need to break down these books to their individual parts and, at a later stage, their expert comments need to be drawn back together again to get that synergy which I think Technicotome were talking about. I think the tender management group were the people who actually brought that back together again, aided and assisted by the reporting system which had filtered out those things which were not worth worrying about, in other words, those things which are compliant—no risk, let's not worry about them. It is sort of separating the chaff from the hay. Let us concentrate on the key issues. Does that answer your question?

**Senator McLUCAS**—I think so but then the key issues in that process were not necessarily the technical issues; they were more the partnership and the financing. Is that what you are telling me now?

**Air Vice Marshal Tidd**—No, I think that the bringing together of all of those issues was somewhat outside my process audit because of my end date in this but Mr Clark would have seen the tender evaluation management group once again draw all these issues back together.

Those people would have been the first group which, as a group, would have seen, for argument's sake, the pricing data. Bearing in mind there was some change to the pricing data as a result of the supplementary pricing proposals where there was some fine tuning. They would have drawn all these issues together to make this preferred source proposal which was then submitted to the tender evaluation review committee.

**Senator McLUCAS**—Thank you.

**CHAIR**—One of the requirements indicated in the tender documentation was that it would be necessary to arrange for the reprocessing of the fuel, or at least the potential for that, in the first year or two years—it has also been referred to as the first two cores of the reactor. This is to do with this issue that the fuel that is intended for use in the reactor may not be available or certified at the time of start-up and therefore they would use what is called silicide fuel. Was that a matter that came across your desk: how that would be complied with, that whoever the successful company was would have to arrange for reprocessing or conditioning of that spent fuel?

**Air Vice Marshal Tidd**—I think the short answer is no, I would not have been involved in that. It is not beyond the ambit of many contracts to place an obligation on the contractor to take responsibility for particular activities in the initial work up and operation of a thing, and that may well have applied to the nuclear fuel, bearing in mind what I occasionally read in the newspapers about the debate on what to do with spare fuels.

**CHAIR**—INVAP, like Technicatome and, from memory, Seimens, are part of a team. In this case I think it includes the John Holland construction company, and Technicatome had Baulderstone Hornibrook, both well-known builders of civil and building construction in Australia. It has also been indicated to us that, with regard to the nuclear technical side of this project, INVAP will be engaging companies from other countries to undertake design work on the reactor itself. I think, for instance, the Russians will be involved and some other countries as well. Again, was it made known to you that it is not just INVAP that is doing all the design and construction work of the reactor but that in fact a range of other countries or companies are involved?

**Air Vice Marshal Tidd**—I was aware that essentially INVAP is the front name of a consortia of companies that will all be involved in various aspects, such as the works people, St Petersburg Nuclear Physics Institute from Russia, to provide some expertise on neutron beams. I was aware of all that. From the point of the audit which I did, it did not have a great deal of technical significance that there were several. In fact, it seems it would be pretty rare to find one company that could do all of this.

**CHAIR**—I cannot answer that personally but, given that we have not built a reactor since the 1950s and it is the only one that we will be building, the questions that have been raised go to whether we can be certain that we are getting the world's best practice. But they are not issues that you had to focus on?

**Air Vice Marshal Tidd**—No.

**CHAIR**—What about safety considerations? Were they the focus at all of your audit?

**Air Vice Marshal Tidd**—No, again my job was really to observe the process at work. However, safety was an issue that raised itself constantly. I think because of the philosophy that ANSTO employed which, from what I understand, is consistent with the rest of the world, they have such a thing as 'defence in depth'. They have ARPANSA, which is their regulatory arrangement and that is an issue which both INVAP and ANSTO would have to come to grips with. Regulatory authorities are not always time responsive. I think they were very conscious of safety, probably more so because there was also the local feeling from the people around Menai and Lucas Heights about the nuclear reactor. Obviously, from a public relations point of view, safety would have to be an issue which we need to spell out to the broader community.

**CHAIR**—Finally, it has been said, and I think it goes over part of the questions and answers that were raised earlier, that tender companies were asked to respond not so much to a detailed technical set of specifications—as I think you would probably be looking at, say, if you were a major civil project such as a dam or a bridge—as to a set of requirements. I am paraphrasing here quite a deal because I am not a technical expert either. What we want is a reactor which will have X amount of neutron beam and flux, and it should be able to do this and this and this, and have a hot source or a cold source. Is that a fair statement that that was the nature of the initial tender specification?

**Air Vice Marshal Tidd**—Yes. From my reading of the tender this year and from the review which we conducted last year in the red team, much of the specification was to do with functional performance. But if you take the works component there are a lot of Australian standards which have to be applied in terms of how you do this and that to buildings. But essentially it was a functional requirement. If you were tempted to be too explicit, bearing in mind that specifications written by engineers can range from the broadly functional to the very detailed, if you are pursuing the latest technology that is available on the market, you really need to give the bidders the maximum latitude in terms of what they can propose to meet your functional requirements. If I may use the aeroplane analogy, one might say: how far, how high and how fast? And that was the exact functional requirement used on the government's VIP fleet of Falcons in 1988 when I issued a tender. So a functional performance specification works pretty well and you can take advantage of what can be available in the market.

**CHAIR**—Yes, but I suggest, and it has certainly been argued, that when you go out to buy military hardware—particularly if Australia does, say, aircraft—you know what is out there. All the major companies or nations in the world are endeavouring to produce something higher and faster and better which does this and this and this. So you have a range of options that you can look at and then you can say, 'We want them adapted in this way to suit Australian flying conditions.' This was the sort of debate that went on with the F111 and the TSR2 and there were the Phantoms and then the frigates, and so on. But when it comes to building a new reactor when you do not have any track record in that at all in this country we are not really talking about an industry where there is so much happening. It is not the same as your aircraft analogy. Essentially, the technology is already there; it exists in reactors around the world. It is not a matter of being able to find a company able to produce you something new, exciting and unique that is different from any of the others. Do you have a comment about that?

**Air Vice Marshal Tidd**—I was suggesting that in pursuing the latest technology you find quite often that what the salesmen tell you is not quite true in practice.

**CHAIR**—Yes, but nuclear reactors are not the technology that you go around carrying in a briefcase and selling every day of the week, whereas you might with military aircraft.

**Air Vice Marshal Tidd**—I do not profess to be a nuclear engineer, but I would suggest that what ANSTO was looking at was a particular set of functional requirements. And while there is not great industry growth in nuclear reactors around the world, in terms of someone trying to demonstrate to you that you will get value for money in terms of design, qualification and predicted life, those are issues because 20-megawatt nuclear reactors are perhaps not readily available off the shelf, if I may put it that way. So to some extent there is some risk in doing it, even though the basic aspects of nuclear physics is probably pretty well known.

**CHAIR**—This is where the reference reactors come in. What I am getting at here is the argument that comes from some of the companies that missed out and from other people. They say that if you set up a set of tender specifications or requirements which are fairly general and essentially say, 'Give us the best that you can possibly give us,' anybody can succeed under that criteria, but it might be a different thing when you actually go and look at performance and what they have already done compared to what it is that you are really after. But you did not look at that area. These are the arguments about the Egyptian reactor, for instance, and INVAP's performance in that regard.

**Air Vice Marshal Tidd**—I cannot help you on that issue.

**CHAIR**—I am sure that Technicatome will be looking at that. Thank you for your attendance this morning, Air Vice Marshal. We appreciate you coming along, and if there are any other matters that we need to check with you, we will be in touch.

[11.03 a.m.]

**DONAGHY, Mr Todd Anthony, Marketing Development Manager—Asia Pacific, Mallinckrodt Inc.**

**PEARCE, Mr Glen, Nuclear Medicine Product Specialist—Australia and New Zealand, Tyco Health Care, Mallinckrodt Inc.**

**CHAIR**—Welcome to this morning's hearing. The committee prefers all evidence to be given in public, but if at any stage you wish to give part of your evidence in private you may ask to do so and the committee will consider your request. We understand that your comments this morning go to the issue of the production of medical isotopes. I now ask you to make some opening comments and then we can proceed to questions.

**Mr Pearce**—Todd and I both have Bachelor of Applied Science degrees specialising in nuclear medicine. We both have 12 years experience in the nuclear medicine industry, working as senior scientists through hospitals in the country and the city and as chief scientists in private practice. I am going to speak more about the local area and Todd will speak more about the experiences that we have in supply of isotopes internationally. The question as I see it is: can we import enough molybdenum? Obviously, you have made other decisions, and this is nothing to do with the tender issue which has just been discussed . Can we import enough molybdenum to cover the Australian market? I believe the answer is yes, we can do that. The other question is: can we import generators to supply the Australian market? I believe that we can produce some, but we cannot sustain the entire market. Todd will go into that in more detail later. Do we need a new reactor? As somebody who has been in this industry—and I am possibly not the best one to ask; you guys are going to make that decision—I believe that yes, we probably do need a new reactor. Do we need a research reactor? Definitely.

With supply of anything to country areas in Australia, there are logistical problems. In my experience, the most difficult aspect of supplying radioisotopes to Australia is not getting it in from internationally, it is actually the domestic transfer. As a scientist in Tamworth, I have often encountered delays with our dangerous goods, either because of couriers who might have been new on the run, technical difficulties with the product from ANSTO or whoever the supplier was, fog that delayed planes arriving in some cases, air delays—you name it, there were several problems. As I said, the supplier was not always bringing this stuff in from international destinations. Most of the time it was being brought in from Lucas Heights anyway. Earlier this year, I believe, ARI had some technical difficulties and were able to supply generators of only half the normal size to practices all over Australia, through technical difficulties they were experiencing at that time, affecting thousands of patients and nearly all of the departments in Australia. However, from my experience, they are mostly reliable and the supply from all of the companies over the country is very reliable.

For us, as importers, once we get our sources cleared through customs, that is when the fun begins and that is where we experience most of our difficulties. Mallinckrodt has over 30 years experience in importing pharmaceuticals into the Australian market. While we have had a few delays, we are very confident in our supply channels and in our ability to supply the Australian market. Several of our customers can vouch for our high level of customer service and our

reliability over that 30-year period. We have three regular deliveries per week. We bring in thallium, gallium, indium and ytrium on those three deliveries, basically every week of the year.

**Senator LIGHTFOOT**—Are they all radiopharmaceuticals?

**Mr Pearce**—They are all radiopharmaceuticals. We also used to import molybdenum generators into Australia, but due to regulations from airlines, transport index limitations at that particular time, shielding costs and lower competitive end pricing, especially from ARI, a management decision was made at that particular time to pull out of the market—or we were forced out of the market in Australia. We are currently interested in reregistering our technetium generator to supply a section of the nuclear community. There are quite a few who are not happy with the current level of service or the actual generators that are being supplied—there are some problems with the current one. We are confident that we can be competitive in that current market, and we are looking at those situations at the moment.

**CHAIR**—I think members of the committee are familiar with this, particularly those who had the opportunity to visit Lucas Heights, but would you very quickly explain, for the purposes of the record, what the generator is and what it does.

**Mr Pearce**—With the technetium generator, we have a molybdenum source that is produced from the reactor. Every week a nuclear medicine practice receives this generator and every day they milk the generator. They extract a daughter product of the molybdenum, which is technetium 99M, and that is used to mix with cold kits to make radiopharmaceuticals. That is the main generator.

**CHAIR**—The generator extends the life, does it?

**Mr Pearce**—Yes. It usually has a shelf life of a week or two weeks. It comes into the practice only once a week and they milk it daily for the amount of activity that they require to service the patients for that particular day. The half-life of technetium is only six hours, so they may have to milk it twice a day on some occasions.

**Mr Pearce**—Do we need a research reactor? Yes, I think it is very important for the growth of nuclear medicine and the development of our health system. That is my personal belief. Do we need more cyclotrons? Yes. At the moment we are currently lagging very much behind the rest of the world as far as our PET—positron emission tomography—technology goes. I realise that this is not the same thing, but you are delving into it or touching on the sides of that as there are cyclotron produced agents that we are actually bringing in as well. Are private companies interested in running these cyclotrons? Yes, very much. We are doing that over the rest of the world at the moment with my particular company. If the licences come our way, we have a genuine interest in being part of that sort of process as well. Are private companies interested in the commercial running of a reactor? Yes, I believe so. It is happening in other parts of the world at the moment—for example, in our home base in Petten. This is where I would like to hand over to Todd, who can tell us a bit more about those sorts of things.

**Mr Donaghy**—Having read through some of the submissions by some of the medical professionals and the proceedings of the committee, there are a couple of issues that I wish to speak to, the first being the supply of molybdenum to Australia. The argument there is about

importation of molybdenum versus local or domestic production and therefore supply for the local market. It comes down to a number of issues, the first being cost. In the short term there is no advantage in producing it locally. You are in a better cost position to import the molybdenum. There is a worldwide market for molybdenum, and there is a basic market price that a number of companies compete on to maintain a price around a respectable level. There are at least six or seven companies that can supply molybdenum.

In the long term certainly you are in a better cost position to produce and then supply your own molybdenum for the production of your own generators to a domestic market. You also then have the opportunity to export that to other countries that may not have the capacity or the ability to produce their own molybdenum. So the cost situation is really a short-term versus a long-term situation. Currently ARI, or ANSTO, do not have the capacity to produce their own molybdenum, and therefore they are importing it. I believe that a lot of the physicians here who are working in nuclear medicine believe that the cost to them in their practice of the molybdenum-technetium generators will reduce by Australia having its own production facility of molybdenum. I would refute that, suggesting that in the long term it can give the company a reduced production cost, but they are likely to take more margin from that than to pass that cost onto the nuclear medicine community.

**CHAIR**—I just wish to clarify something: you said that ANSTO currently does not produce molybdenum.

**Mr Donaghy**—It does not; it imports it. I am not sure of the source. I know it is not from Mallinckrodt.

**CHAIR**—So they import it and then produce technetium?

**Mr Donaghy**—They produce the generators from there.

**CHAIR**—Presumably there is no-one else producing molybdenum in Australia?

**Mr Donaghy**—No, there is no-one at all. The main sources of molybdenum worldwide are Mallinckrodt—out of their institute in Petten, the Netherlands—and Nordion in Canada. They probably supply the majority of the world's molybdenum.

**Mr Donaghy**—Another issue that the previous witnesses have stated is reliability and the concern that the importation of molybdenum into Australia is potentially unreliable because of the world market. They believe that Australia is just a small fish in relation to that size but again I refute that. Mallinckrodt has a significant history of exporting molybdenum and a number of other radioisotopes out of its facilities in Petten and in Maryland Heights in the United States. Currently, it is estimated that they would ship between 7,000 and 10,000 packages per week to worldwide markets, Australia being one of them. We have a long and consistent history of shipping product and getting it there on time regardless of where it is in the world. The Netherlands being where it is has access to many different airlines and airports so that they can ship their product to all around the world. If I can use Australia as an example, we currently ship from many airports. We normally ship through Singapore, Bangkok and Tokyo to get the product to Australia, with a turnaround of possibly about 20 hours flying time, which is quite reasonable when you are talking about the products that we are getting. The half-lives of these

products tend to be short. We are talking about a number of hours and days, but the quantity that is required can be easily adjusted to serve the local markets in Australia.

**Senator GEORGE CAMPBELL**—If I understand what you said earlier, that in fact is what is happening now.

**Mr Donaghy**—That is right.

**Senator GEORGE CAMPBELL**—If ANSTO is importing the molybdenum, we are dependent upon overseas suppliers.

**Mr Donaghy**—That is exactly right. There were some concerns that during times of worldwide shortages the smaller markets would suffer. I would suggest that that is unlikely to be the case. What has happened in the last few years with the molybdenum market worldwide is that companies have got together to ensure each other's supply to their markets around the world. They have a primary supplier. They also have a backup and maybe a second or third backup from there.

**Senator GEORGE CAMPBELL**—Are you aware of any experiences where the supply has been interrupted to Australia?

**Mr Pearce**—As a customer earlier this year they got half the amount they normally would get. Half the patients had to be cancelled. That was for one week earlier this year that I know of.

**Senator GEORGE CAMPBELL**—ANSTO only got half the amount?

**Mr Pearce**—For whatever technical problems they were only able to supply the Australian market with half of what they normally—

**Senator GEORGE CAMPBELL**—But you do not know whether or not they were only able to get half of the molybdenum. They were only able to supply half the market?

**Mr Pearce**—They had technical difficulties in the amount that they received that particular week.

**Mr Donaghy**—Speaking from a Mallinckrodt company point of view, I am aware that in the last two years that even during times of low yields of product we have had no problems in supplying any of our customers worldwide with the amount of activity they require. Our reactor is in the Netherlands and we work closely with a company called IRE in Belgium that also produces molybdenum. They are currently our backup supply. There are a number of small companies around the world that are geographically placed so that they can supply molybdenum to any market, Australia certainly being one of them.

Another of the main concerns brought up relates to the transportation, the shipping via airlines into Australia. There is an index which controls the amount of radioactivity that can be placed on any airline, which is a TI or transport index. Most of the airlines set this index at a certain level so that only a certain amount of radioactive product can be placed on that airline.

There is no problem in shipping any type or amount of molybdenum worldwide because of the shielding and packaging material that is used. If the product exceeds this TI the normal practice is to add more shielding to it thereby protecting anybody else or any other product that may be on that plane. There is, however, the situation where sometimes paperwork is not done correctly or airlines may off-load product as it moves about the world. Mallinckrodt have been shipping products around the world for many years now. They rely on their good relationships with airlines and their experience in making sure the paperwork is done correctly. I can speak from our company's point of view to say that it would be a very small percentage of our product that would not arrive at its destination on time and intact due to the experience we have in shipping and with the paperwork. We have a wonderful relationship with the airlines in getting the product from point A to point B.

**Senator LIGHTFOOT**—Thank you, gentlemen. What were some of those radioactive elements that you import as radiopharmaceuticals—ytrium, molybdenum—

**Mr Pearce**—We are regularly bringing in gallium, thallium and indium. We are bringing in ytrium at the moment for a company called Novatis on a clinical trial. They are the four for Australia.

**Mr Donaghy**—We also have the ability to import a number of other products that are currently not registered in Australia but that we do sell to other strategic markets around the world, Asia being one of them.

**Senator LIGHTFOOT**—Are they radioactive elements as well?

**Mr Donaghy**—They are radioactive.

**Senator LIGHTFOOT**—Are they elements though?

**Mr Donaghy**—Yes. They would include phosphocol which is a phosphorous 32 product.

**Senator LIGHTFOOT**—Phosphocol is not an element, is it?

**Mr Donaghy**—I must admit, I cannot answer that.

**Senator LIGHTFOOT**—Perhaps you could take that on notice and get back to us.

**Mr Donaghy**—Yes, I will. And there is iodine 131 which is a product produced at Lucas Heights at the moment.

**Senator LIGHTFOOT**—Could some of these elements that you introduce as radiopharmaceuticals be sourced in Australia?

**Mr Pearce**—Thallium and gallium are already being produced by the cyclotron.

**Senator LIGHTFOOT**—In Australia?

**Mr Pearce**—In Australia. ARI would have a majority of the market. There are two other companies sourcing already. We are bringing in, obviously, that thallium and gallium as well, and more cyclotrons are able to produce those products.

**Senator LIGHTFOOT**—Cyclotrons cannot produce all the radiopharmaceuticals that are required in Australia—is that correct?

**Mr Pearce**—Yes, because the molybdenum is the problem.

**Mr Donaghy**—And a number of the other therapeutic items are reactor produced as well.

**Senator LIGHTFOOT**—Mr Pearce, you said that the problem is not bringing the radioactive elements into Australia; it is, in fact, distributing them in Australia.

**Mr Pearce**—Yes.

**Senator LIGHTFOOT**—Could you explain that, please?

**Mr Pearce**—As I said, most of the time the international channels are so well organised—the distribution line to the airports, to the airlines, as Todd has said. We get the product into Australia and we get it cleared through Customs. But there are the internal regulations—the IATA forms that people have to lodge for dangerous goods. The people that suffer most are the people in the country, the people that are isolated anyway. So in Western Australia, if we miss a plane or a deadline, the people miss their end product, and the patients are out of the door at 8.30. With nuclear medicine, unlike radiography or some of the other things, patients' timing is crucial. People have fasted, they turn up at 8.30 a.m. ready for their scan, some of them—especially in country areas—have travelled for hours to get there, so the isotope being on time is the most important thing. While we are bringing it across 24 hours we are planning still to have our product on that door at 8.30. It is usually no good for them to get it at 12.30, the patient has gone home by then.

**Senator LIGHTFOOT**—And, of course, the isotope itself is fast losing some of its effectiveness.

**Mr Pearce**—It is decaying. When we place our orders we are obviously planning ahead; we are aiming for a certain amount of radioactivity at a certain time. So even if we are leaving 36 hours to get it there we are aiming for this particular time. A lot of the time the courier finds a radioactive parcel and if the procedure with dangerous goods has not been explained to him it will get stuck at the back of the pile. He will do all his other deliveries first, maybe, before his radioactive one. That sometimes is the case with a new run until it is explained.

**Senator LIGHTFOOT**—Mr Pearce, do you bring those into Australia through one port, two ports or more?

**Mr Pearce**—At the moment we bring it just into Sydney. We bring the ytrium into other ports.

**Senator LIGHTFOOT**—For instance?

**Mr Pearce**—To Brisbane and Melbourne. We are looking at direct distribution to Perth as well at this present time. Todd has had a look at the shipping lines or the flight paths that we would have so that we could bring it directly into Perth as well.

**CHAIR**—Do you bring it in on ships as well?

**Mr Donaghy**—No, it is all airlines. It is possible for us to fly into any port in Australia.

**Senator LIGHTFOOT**—When you say 'directly' into Australia you mean from Singapore?

**Mr Donaghy**—Singapore, Bangkok or Tokyo would be our three points.

**Senator LIGHTFOOT**—You have flown them directly into Sydney from Tokyo?

**Mr Donaghy**—Yes, three times a week.

**Mr Pearce**—We had to use Tokyo for a period of time as we did not have an approval to fly over India due to some political and other movements in that area.

**Senator LIGHTFOOT**—Did you fly over India from the UK or Europe?

**Mr Donaghy**—From the Netherlands, yes. We do now have that approval so more airlines, more shipping routes if you like, have been opened up to us. Before you continue, I would like to just add to what Glen was saying. I would estimate that about 70 per cent of nuclear medicine procedures are done on that eastern seaboard and we would not have any issue in supplying those practices with isotope. Currently we fly into Sydney and, if the product needs to go to Melbourne or Brisbane, we have no problem with just hopping on a flight from there. It tends to be a problem in the country areas where the flights are not as regular. If you miss one flight, it may be many hours before the next one goes along. Flying great distances, as Glen mentioned, to Perth and to Adelaide is where we—

**CHAIR**—Senator Lightfoot is from Perth.

**Senator LIGHTFOOT**—I empathise with you, because Western Australia is the only mainland capital that does not have a direct flight from Canberra. Although we are only 9.7 per cent of the population, we do produce 30 per cent of the national export income—thought I would get that in. How long have you been employed with Mallinckrodt and how long has Mallinckrodt been in Australia?

**Mr Donaghy**—Mallinckrodt has been in Australia for over 25 years now. I would suggest that for at least 20 of those years they have been involved in nuclear medicine, although the exact date I am not familiar with. I personally have had three years experience with Mallinckrodt.

**Senator LIGHTFOOT**—Mr Pearce?

**Mr Pearce**—I have been with Mallinckrodt for only the past 12 months. Before that I was with another Australian company called RADPHARM Scientific.

**Senator LIGHTFOOT**—When the radiopharmaceuticals are sourced from Holland, what carrier brings them to Australia and where is the port?

**Mr Donaghy**—Currently their main carrier is Singapore Airlines and it goes into Singapore and then into Sydney—one stop.

**Senator LIGHTFOOT**—So there is no problem with sourcing Dutch radiopharmaceuticals via Singapore to Perth—for which there is a flight each day?

**Mr Donaghy**—There is not. Currently we are looking into supplying Perth and the surrounding market directly from Singapore. It is something we have details of. We have not pursued it any further than that. To basically respond to concerns by the Perth nuclear medicine community that they were concerned that we could not get the product to them on time, we certainly are competitive in that market on price and they wanted us to investigate how better we could fulfil that process.

**Senator LIGHTFOOT**—Coming direct to Perth?

**Mr Donaghy**—Coming direct to Perth.

**Senator LIGHTFOOT**—I think that is an excellent idea, Mr Donaghy. With respect to the cyclotrons that you spoke about, not all radiopharmaceuticals can be sourced from a cyclotron, can they?

**Mr Donaghy**—That is right.

**Senator LIGHTFOOT**—Can you name some that are essential in—

**Mr Pearce**—In the Australian—?

**Senator LIGHTFOOT**—Yes—used in Australia that cannot be sourced from cyclotrons?

**Mr Donaghy**—Samarium I believe is one that cannot be, which is used for palliative care.

**Senator LIGHTFOOT**—You might like to take that on notice because there is some evidence given that all radiopharmaceuticals that could be used in the industry could be sourced from a cyclotron, although some qualification was made that it may not be—

**Mr Pearce**—Available at the moment. I think a lot of them are under clinical trials or are long-term propositions.

**Mr Donaghy**—Theoretically that could be true, and there have been a number of articles published that have stated that. But I think the people from ANSTO/ARI would tell you that there are enough technical difficulties in supplying high quality regular product out of

cyclotrons. To add other targets or other sources in regard to that would probably have the same difficulties. There have been articles written that suggest that molybdenum could be produced from cyclotrons, but producing molybdenum is very technically demanding and a very difficult process. If you cannot get the quality of it right, it follows on into your generators and then into the clinical environment, so I would suggest—

**Senator LIGHTFOOT**—Can I clear up producing molybdenum. Molybdenum is an element. You do not actually produce molybdenum in a cyclotron, do you?

**Mr Donaghy**—No—in a reactor you do.

**Senator LIGHTFOOT**—In a reactor. But you do not produce molybdenum in a reactor; it is made radioactive in a reactor, isn't it?

**Mr Donaghy**—I believe it is a fission product—

**Mr Pearce**—of uranium, and it breaks down to molybdenum. That is my understanding of it.

**Senator LIGHTFOOT**—It is an element. I am just wondering how you produce an element in a reactor.

**Mr Donaghy**—I must admit off the top of my head I am not—

**CHAIR**—We were presented with some evidence regarding work done by a number of so-called scientists overseas that have written a paper that suggested that there was potential to produce molybdenum in a cyclotron. But I think even they acknowledge that at this point of time it is non-commercial and it is obviously—

**Mr Pearce**—Long term.

**CHAIR**—a long-term proposition.

**Senator LIGHTFOOT**—Does your company use Lucas Heights at the present time to source some of its radioactive material, its radiopharmaceuticals?

**Mr Donaghy**—We have done once or twice in the past when one of our cyclotrons in Petten was down for servicing. We supplied our customers with Australian radioisotope thallium and gallium for a period of, I think, two weeks. It was over a Christmas period that we could not supply.

**Senator LIGHTFOOT**—Does your company propose to use the new INVAP reactor at Lucas Heights in the future?

**Mr Donaghy**—At this stage I would say no.

**Senator LIGHTFOOT**—Why is that?

**Mr Donaghy**—The current situation is that we have two cyclotrons in Petten as well as the reactor that we have access to there.

**Senator LIGHTFOOT**—That is in Holland?

**Mr Donaghy**—That is in Holland. Plus we have three cyclotrons in Maryland Heights, which is just outside of St Louis.

**Senator LIGHTFOOT**—But you have said that not all radiopharmaceuticals can be sourced appropriately, or economically at least, from a cyclotron. Where do you propose to get your non-cyclotron radiopharmaceuticals from?

**Mr Donaghy**—From the reactor in the Netherlands. There is a reactor on the same site as our production facility in Holland.

**Senator LIGHTFOOT**—Given the short half-life of some of those pharmaceuticals, wouldn't it be better to source them more directly from its original source?

**Mr Pearce**—If ARI is going to give us cost-effective pricing. But, as they are a competitor, I do not see that they are going to give us any price breaks on the products that they are selling to the same community as we do.

**Mr Donaghy**—You are correct in what you say: there are some isotopes that we cannot import to Australia because of their short half-lives. Currently, these probably do not have a substantial market that we would get into and it would not be cost effective for us to enter that market.

**Senator LIGHTFOOT**—So your products are not supplied comprehensively to hospitals and other areas in Australia?

**Mr Pearce**—We have not got registration for those. You are possibly aware of the costs of registration, and the time of TGA as well. At the moment, it usually takes us three years to go through a complete registration process and many hundreds of thousands of dollars.

**Senator LIGHTFOOT**—Does your company propose to initiate that process?

**Mr Donaghy**—Of further TGA registration?

**Senator LIGHTFOOT**—Yes, within Australia.

**Mr Donaghy**—Yes, it certainly is. When new products come around that we think have a potential market, then most definitely. The issue with generators when we pulled out from the market over 10 years ago was one of those situations where we had a product licence from DRL, which is a company in Japan, and we were not actually importing our own generators.

**Senator LIGHTFOOT**—But you have not, at this stage, initiated any moves to become licensed?

**Mr Donaghy**—We currently have no documentation with the TGA.

**Senator LIGHTFOOT**—What proportion of your company's business is undertaken in Australia?

**Mr Donaghy**—Mallinckrodt's imaging business or nuclear medicine business?

**Senator LIGHTFOOT**—Their nuclear medicine business.

**Mr Donaghy**—It would be a very small percentage—around two per cent.

**Mr Pearce**—Of the whole company's business?

**Senator LIGHTFOOT**—Yes.

**Mr Pearce**—Now we are part of a bigger company, Tyco Health Care, and their turnover is $40 billion.

**Senator LIGHTFOOT**—I am just talking about their nuclear business.

**Mr Donaghy**—It would be around two per cent. We are market leader in the United States and probably second to Nycomed Amersham in Europe.

**Senator LIGHTFOOT**—So you are the market leader of the United States from Holland?

**Mr Donaghy**—We import our molybdenum from Holland, from our reactor, to source all of our United States customers, but with the cyclotrons that we have there we can provide a cyclotron produced product to the United States and Canada.

**Senator LIGHTFOOT**—So you do not have access to a reactor in the United States, you just use the cyclotrons?

**Mr Donaghy**—Correct.

**CHAIR**—Senator, we do have to move to other questions.

**Senator LIGHTFOOT**—Very quickly then, what products are sold in Australia? Could you put a name to them? If there is a whole list of them, perhaps you might be kind enough to take that on notice. Is the focus of your company business in Australia on nuclear medicine or is it on other imaging modalities such as MRI?

**Mr Donaghy**—Nuclear medicine contributes about 15 per cent to our imaging business in Australia. We have contrast media for MRI, CT scanning, ultrasound. We have power injectors for delivering contrast media. We will eventually have urology systems for imaging and delivering, for example, prostate cancer treatment through radioactive seeds.

**Senator LIGHTFOOT**—Do you distribute MRIs?

**Mr Donaghy**—No, we do not. We provide a contrast media.

**Senator LIGHTFOOT**—But not the imaging machine itself?

**Mr Donaghy**—No, just the contrast media.

**Senator LIGHTFOOT**—Thank you for those answers. You will remember those questions on notice?

**CHAIR**—The committee will inform you, if we need to. Senator McLucas.

**Senator McLUCAS**—Thank you, Chair. I want to go to the issue of your involvement with molybdenum and technetium 99. It has been suggested to us that the ANSTO product is a highly subsidised product. I recognise that they are your competitors, but do you have a comment about that in the context of efficient but also cost-effective production of medicine for Australia?

**Mr Donaghy**—I would suggest, from my experience in the market, that their prices or their product would be subsidised, just knowing the competitive forces and the competitive prices, and also from my experience in Asia with a number of other companies, Australian Radioisotopes being one. Production of the core products, which would be thallium, gallium and the generators, is very much the same worldwide. There are some differences but I would say the cost of production, once the situation is up and running, the onward cost, would be very similar. So the prices and margins of most countries would be within, say, five per cent. It comes down to the competitive element of the production costs, and if companies are being subsidised, then foreign companies in this situation would probably be at a greater risk of losing market share because of that pricing.

**Senator GEORGE CAMPBELL**—Can you provide us with a list of the names of companies worldwide that provide nuclear pharmaceuticals and where they are located?

**Mr Donaghy**—Yes, certainly.

**Senator GEORGE CAMPBELL**—My second question you may have to take on notice. Is there any nuclear pharmaceutical that cannot be imported into Australia that we use in nuclear medicine.

**Mr Donaghy**—I would suggest, no. The only reason it would not be imported at the moment is because it is not registered with the TGA. However, you could have access to it. You could get approval under schemes such as the Special Access Scheme which currently some isotopes or pharmaceuticals are imported under to use in special cases with patients. I would suggest there would be no product, given the correct approvals, that could not be brought in.

**Senator GEORGE CAMPBELL**—Are you aware of the range of nuclear pharmaceuticals that are produced at Lucas Heights?

**Mr Donaghy**—Yes.

**Senator GEORGE CAMPBELL**—And they all are capable of being imported?

**Mr Donaghy**—Yes, but there are going to be situations or different characteristics where there may be a concern. For example, isotopes that have short half-lifes may have to leave their overseas production facility in large quantities if the physician here is to get the required amount into this country, and there would be a cost factor with that. But, essentially, there is no product that cannot be physically imported into the country.

**Senator GEORGE CAMPBELL**—So you are saying that molybdenum, if it was imported here and then broken down in the cyclotron or whatever happens to it, as opposed to it being processed at Lucas Heights, could finish up with an added cost to the end user?

**Mr Donaghy**—Importing it would not, in the short term, produce any added cost. In the long term, if you are producing your own molybdenum you can look at economies of scale and get your unit cost down. Essentially, you could pass that on to the consumer, but it is unlikely to happen.

**CHAIR**—But we are not producing our own. Didn't you say that earlier?

**Mr Donaghy**—You are not currently producing your own. If you were to produce your own you could pass that cost on to the consumer because your unit cost would be less.

**Senator GEORGE CAMPBELL**—Why are we not producing our own now?

**Mr Donaghy**—You do not have the capabilities at the moment in the current reactor to produce it. That is my understanding.

**Mr Pearce**—The amount that is needed, or any—

**Mr Donaghy**—I do not think you have the capability from the current reactor. I am not an expert on that reactor, but that is my layman's understanding.

**CHAIR**—We have been told and it has been said in other areas as well that one of the reasons why we need this reactor is because there are some medical isotopes that you cannot practically import because of their short half-life. Technetium is the one that is always referred to. That is also most widely used. It is said that people's lives could be lost if this does not occur. Am I correct in understanding that you are saying that, for us to produce technetium here, we have to import the molybdenum, anyway?

**Mr Pearce**—At present?

**CHAIR**—At present, yes.

**Mr Donaghy**—But with the technology which the new reactor could potentially offer you, no, you would not have to do that.

**CHAIR**—I am not talking about the new reactor, just what has been the case, because there has been a slight misunderstanding here.

**Mr Donaghy**—It is regularly imported into countries around the world. For example, our largest market is the United States. We do not produce molybdenum in the United States. We have a weekly shipment, from Petten in the Netherlands to Maryland Heights, of molybdenum and we produce all of our generators from that source. It happens on a weekly basis.

**Senator GEORGE CAMPBELL**—What share of the United States market do you have?

**Mr Donaghy**—I would suggest that we would probably have about a 60 to 65 per cent share.

**Senator GEORGE CAMPBELL**—Are the people who are supplying the other 35 to 40 per cent also doing the same?

**Mr Donaghy**—As far as molybdenum goes, no. We would probably be the only generator-selling company that produces our own molybdenum.

**Senator GEORGE CAMPBELL**—How would the United States be getting the technetium?

**Mr Donaghy**—They have companies such as Du Pont that produce generators. Nycomed Amersham would produce generators as well. I am not 100 per cent sure where they would get it from. I would suggest they would get it from a company called Nordion in Canada, which is the largest supplier of molybdenum.

**Senator GEORGE CAMPBELL**—The technetium used in the United States is all being produced in generators?

**Mr Pearce**—The technetium that anyone gets is produced by a generator. The generator starts off as molybdenum. You have molybdenum, which comes from the reactor. It goes into a little box, which is called a generator, and that generator is milked to produce the technetium.

**Senator GEORGE CAMPBELL**—From the arguments that I have heard in respect of Lucas Heights we need that reactor to produce the technetium.

**Mr Pearce**—You need the reactor to produce molybdenum. While that is the case, we can also supply the molybdenum to you to make those molybdenum generators, which then make the technetium. The technetium is crucial in the nuclear medicine world. It is used for probably 70 per cent of all the patients at the moment. It can be used to diagnose cancer. Sports injuries in elite athletes are being picked up using technetium based products. Pilots have a test now before they can fly after they have reached a certain age. There are crucial tests that are done daily that need technetium.

**Senator GEORGE CAMPBELL**—You are saying that there has never been a problem with supply. How much would Australia represent as part of the world market?

**Mr Donaghy**—As far as molybdenum goes, a very small percentage. In this day and age of contracts and supplying, you would enter into a contract with a company. If it were Mallinckrodt, it would agree to supply you with X amount of molybdenum per week over a period of, say, 12 months. Part of that contract would be that if they were not the primary source due to whatever situation that may arise, a secondary source would more than likely be named in that contract. I would suggest that that would be the situation.

**CHAIR**—What would be your company's share of the Australian market for isotopes and who are your major competitors?

**Mr Donaghy**—As far as isotopes go, we have a small percentage—around 10 to 12 per cent. With respect to major competitors, Australian Radioactive Isotopes would be the main one, Du Pont in a very small capacity, and Nycomed Amersham.

**CHAIR**—I asked you about isotopes. The terminology gets a bit confusing. Were you talking about radiopharmaceuticals?

**Mr Donaghy**—Mallinckrodt supplies the radioactive product, and we will call it 'isotope'. We also supply a lot of non-radioactive products, which are the pharmaceuticals that then have a radioactive product added to them to make them active and then useful for patients. In that section of the market, we would probably have close to 50 per cent of the market. On the pharmaceutical side of it, we have a number of high end products that are considered to be possibly the best quality products on the market, and therefore we do quite well.

**CHAIR**—Is ARI involved in that area?

**Mr Pearce**—I think they now use the factory down in Canberra. RADPHARM Scientific makes a lot of their kits in-house, but they are involved with some agents.

**CHAIR**—Which is the biggest part of the market? When we are talking about what your company does and what ARI does, what proportion of the overall market would be focused on the isotopes?

**Mr Pearce**—Dollar wise, the radioactive component is by far the most—

**CHAIR**—Lucrative. And volume too?

**Mr Pearce**—Volume is everything.

**Mr Donaghy**—But for us it is not.

**CHAIR**—That has probably covered everything. There being no further questions, I thank you very much for your evidence this morning.

[11.47 a.m.]

**WHITE, Professor John William, Secretary for Science Policy, Australian Academy of Science**

**CHAIR**—Professor White, thank you very much for your attendance this morning. I welcome you to the hearing. We prefer that all evidence be given in public but if at any stage you wish to give part of your evidence in private you may ask to do so and the committee will consider your request. We have a submission from the Australian Academy of Science, and we thank you for that. Before we go to an opening statement and questions, are there any corrections or alterations you wish to make to that written submission?

**Prof. White**—No.

**CHAIR**—I should just indicate that, because the Senate will commence sitting at 12.30 and I have to be there right on 12.30, we will have to finish around about 25 past 12. If there are other issues that we wish to take up with you, we can contact you following the hearing. I now invite you to make an opening statement.

**Prof. White**—Senator, I am at your disposal.

**CHAIR**—Thank you.

**Prof. White**—I am glad to appear and thank you for inviting the Academy of Science to appear. The Academy of Science has, since the early nineties, been working with a committee of the academy to look at the need for a replacement reactor in Australia. The Senate will be aware of the many submissions that we have made not only to the McKinnon inquiry and subsequent Senate inquiries that have addressed this question but also to the environmental impact inquiry and to others related to it. I would suppose that the Senate should wish to take those statements as part of what I would wish you to understand at this time.

In those statements and in that whole process—and indeed may I say in parenthesis that the committee is still in session; we still have a committee which is active in this area and will continue to consider matters that arise—we have identified that the replacement research reactor should be a reactor of high quality. It should be one which is able not only to fulfil the pharmacological and other needs that I have heard you speaking about earlier in this session but also, from the scientific side—and we put this as our third category of importance on the scientific side, although we do believe it is very important—to be an instrument of such quality that it will benefit the Australian scientific community for many years to come and be a magnet to draw in scientists and technologists from neighbouring countries so that Australia could, as it were, re-establish in this area a profile which it has always had in the past. That would be my opening statement. We are therefore supportive of the replacement research reactor.

I would just make one final comment. That is that I, as a person not as a representative of the academy, was a member of an advisory committee to the Australian Nuclear Science and Technology Organisation in consideration of the types of instruments which were to be placed around the replacement research reactor. I would like to make it clear that that was the only capacity in which I have been involved with ANSTO. That was a process which involved

detailed consideration of technical matters concerned with optimising the performance for science and technology and not for pharmaceuticals.

**CHAIR**—Thank you. Taking up that last point you made, when did you undertake that work? Presumably that has been in recent times.

**Prof. White**—Yes. I was an ad hoc member of that committee and I think it sat from late 1998 through 1999 and finished its work in early 2000.

**CHAIR**—We understand that the position of the academy is support for a reactor. You mentioned in your opening statement and in your written submission that what you would be looking for would be high quality, presumably world's best practice—that type of terminology that is used today. There have been concerns raised from various quarters—a couple of the unsuccessful companies have raised this but I also note, for instance, that we had evidence from Mr Tony Wood, an engineer, who had worked with ANSTO—and there have been reports from time to time raising serious questions about the capacity of the company awarded the contract, INVAP, to deliver the best quality reactor. In particular, there have been concerns raised that the reference reactor which they used, which is one they built in Egypt, was not appropriate and has had significant problems. All in all, there is a cloud hanging over the project from that perspective. Do you have any comments you wish to make about some of those concerns? I could detail some of the specific criticisms of the company's performance with the Egyptian reactor and how they should be taken into account, but I will leave it at that for the moment.

**Prof. White**—You may wish to do that and I would respond as well as I could. But I have to say that I am not informed about the quality of the Egyptian reactor. I would say, however, that when the decision was made to choose INVAP as the preferred tenderer for the replacement reactor it occasioned some surprise. It occasioned some surprise in the Academy of Science and I believe it occasioned some surprise amongst other people who know about these sorts of matters in the world. That may be largely due to unfamiliarity with the ability of INVAP to perform.

The Academy of Science certainly asked to be briefed in detail about the company and so on. Some briefing has been given to us, but the academy still has some concerns about the ability of INVAP to produce what we would call an integrated project—that is to say, they have to take information and, indeed, material from various sources to produce the performance which they have suggested. It is not a criticism that I am making. It is an expression of ignorance, so it is on the basis of caution that one does raise the question about the integration of the project. We raised this matter with ANSTO and I suppose they are very conscious that we are being vigilant. The Academy of Science wants to make a success of this thing, whatever happens to it, and has held itself available to people to help in whatever way it can. So I would like to say that that is our attitude to the situation at the moment, but it would be incorrect if I were to say that there was a fulsome support.

**CHAIR**—Could I raise a couple of issues that have been put to me in regard to the reference reactor. Are you familiar with that reactor or with the type of reactor?

**Prof. White**—For the benefit of the Senate, I should tell senators that I have, in the past, been the director of a major nuclear reactor establishment in France. I was the director of the Institute

of Laue-Langevin in Grenoble, France, for a period of about five years. So I have a very close network with people who are in the nuclear science and reactor area, although my inquiries about the Egyptian reactor—which I have, of course, made because it was the reference reactor—have led to only two results. Firstly, there is some ambiguity about how many days the reactor has run since it was commissioned. I have not been able to clear up how many days it has run since that time. Secondly, a rather more positive comment came to me about the control engineering and operation apparatus of that reactor, which was said to be some of the best that this particular person had seen. So, if you like, there was a plus and a minus in some sense about it. That is the best impartial information that I have been able to obtain from individuals who are in no way connected with that project.

**CHAIR**—Let me read a couple of things and then you might care to comment. I have been told, for instance, that the Egyptian reactor was built in 1997 and that it utilises technology dating back to the early 1960s that has, in other parts of the world, long since been superseded. With respect to fuel, I have been told that the Egyptian reactor and also the RA-3 reactor in Argentina both use $U^3 0^8$ fuel, an earlier generation fuel not generally used in modern reactors. INVAP have proposed UMo with an alternative interim fuel of silicide. The Egyptian reactor does not utilise either of those fuels and, therefore, it is not appropriate to use it as a reference reactor if it is not comparable in that sense. The Egyptian reactor claims a high level of thermal neutron flux but it is only available in a very small volume and would fall well short of ANSTO's requirements. It has also been stated that the Egyptian reactor has a cycle length of 19 days at full power, and that ANSTO's mandatory requirement is for a cycle length of not less than 28 days. The supply of a cold neutron source is mandatory for the new reactor. It is understood that INVAP will obtain the cold neutron source from Russia. Apparently, that is not something that is available in the Egyptian reactor. Are you aware of any of those criticisms? If you are not, would they be issues that would be of some concern in terms of our being able to be confident that we are going to get the best?

**Prof. White**—I think it would depend upon the extent to which the Egyptian reactor is the reference reactor.

**CHAIR**—For INVAP it is. Each company was asked to nominate a reference reactor and the only reactor that was nominated for INVAP was Egypt. The ANSTO team travelled to Egypt. They did not even go to Argentina, so they did not visit any of the other ones. I think they did go to Grenoble.

**Prof. White**—They would have seen a very good one there, but rather costly. Frankly, the word 'reference' needs to be looked at further. I would say that if they have specified and, indeed, intend to deliver a reactor with a longer cycle time and with a cold source, and adapted for neutron beams, then the word 'reference' needs to be nuanced in some way or other. In a sense, it might well have been offered as something which exists and is the most modern of its kind—I am trying very hard to think of a meaning for the word in that sense—but I suppose, therefore, that the actual reactor which will be supplied will be one which relies rather heavily upon modelling and calculations and things of that kind. This is a known art, by the way. It is one of the reasons why choosing a reactor is a much better option, technologically speaking, than choosing a pulsed source or something of that kind, which are alternative sources of neutrons, because they are much harder technology. So, reactor technology is a better understood art, I think, than the design of spallation neutron sources at this time.

**CHAIR**—That observation has been made to us too, again in the context of criticism, that there was a heavy reliance upon computer modelling as compared to what I as a layman would call 'field performance,' or, 'on-the-job experience.' These are all concepts that for us are difficult to grapple with because we are not nuclear experts by any means, but it would seem to me that people could have genuine concerns. Given that we do not have any history of building, designing and constructing our own reactors, compared to other countries, and given that this is the first reactor to be built in this country for 40-odd years, that it is really to replace HIFAR, and that it is the only one we are likely to have, people could be concerned. A conservative approach might want to suggest you look to performance and experience with designing, constructing and operating other reactors around the world, rather than necessarily looking to be completely innovative. I think that is the sort of dialectic that is working here, if you like. It is therefore said, 'If you had chosen Siemens or Technicatome or one of the other companies, this concern would be alleviated.' Is that reasonable?

**Prof. White**—I think it is a fair general comment. However, I should say that ANSTO does have good technical capacity in computer modelling of cores and of the reactor, and they will undoubtedly have relied heavily upon that to check what they have been getting. If they haven't, then I would be very surprised indeed. I am not involved in that, nor was I involved in it, in this consultative committee. That would be the check and balance of that, to try and be fair.

The point remains, the one that I made earlier, namely, this question of integration. Building a successful reactor, from the point of view of doing the science and technology, as well as the irradiations, is rather like constructing a chain. You must have the fuel right, and you must have the configuration of the core right to make the best use of the fuel to get the highest intensities. You must then conduct the neutrons in such a way to a cold source to produce the special wavelengths that are needed for the science, and we could in principle be one of the best reactors in the world if that is done properly. Then you must have these things called neutron guides, which conduct the neutrons out of the reactor area into a room which can be used by ordinary scientists.

Finally, and may I underline it very heavily, you must have access conditions for users which are much easier than the present ones at HIFAR. In major reactor centres, users can come and use the laboratories without enormous protective safeguards, such as presently have to exist at Lucas Heights. Big centres like Grenoble, the national facility in Washington DC, and the Argonne National Laboratory, which are very big centres, have very easy access to users, and that is very important. So I put all of those as the links in the chain to make sure that this is a successful thing for Australian science and a national benefit.

**CHAIR**—Thank you.

**Senator McLUCAS**—Professor White, I have not been a senator for very long so I do not have the historical association with this issue. Can you tell me about the Academy of Science, what your structure is and how your decision making processes work internally so that you can come to a view that the academy supports the replacement reactor?

**Prof. White**—The academy has a council and, under that council, there is an executive committee which runs the academy. The president, of course, is changed every four years. On that executive committee, there are three quaintly named people called secretaries—I am one of

them. We are concerned with particular areas of the academy's business. For me, that is science policy. It fell to me, first as chairman of the National Committee for Crystallography—that is a major constituency, as you may understand, for the use of these facilities—and then as science policy secretary, to prepare papers for the academy council so that they could be informed, first of all, and, secondly, make decisions and, indeed, take a position about matters such as this. That is what I do and I have been doing that for four years.

What happened in the case of the reactor is that, going back to 1994, a committee was formed which consisted of the best experts that we could find in nuclear and neutron science, radiochemistry and radiopharmaceuticals—fellows of the academy and others, with one or two members who were not necessarily pro-nuclear people at all. My view is that it is better to have the debate in a committee and have the whole thing exposed—we had that. What we came up with was, I think, something which was acceptable to the academy council as being a balanced view about Australia's needs, from a scientific and technological perspective. As you know, we underlined what we call the 'national interest' and put that as our first priority.

All of these things were gone through, reiterated and revisited. For example, in connection with the environmental impact statement, we revisited, in particular, the question of the disposal of the nuclear waste. It is a matter which is still on the table, as concerns the reactor, and the academy laid down various things which would have to be done to make sure that the decision to build such a replacement reactor would be successful—one of them, of course, is the appropriate disposal of the nuclear waste.

**Senator McLUCAS**—It has been put to me by a number of scientists and, more often than not, off the record—they do not wish to go on the record—that they could see a better use of $300 million, in 1997 dollars terms, than putting that sort of investment into, essentially, one thing; that you could use that money in a different way. Did the academy have that debate about linking the decision to replace a reactor with the cost and whether or not that money could be used in a different way? Did you not go to that issue of policy?

**Prof. White**—We certainly went to that issue. We think that it is essential for any nation to take macroscopic decisions as well as microscopic ones.

**Senator McLUCAS**—Good.

**Prof. White**—It is the job of the Australian Research Council and the National Health and Medical Research Council to look after the matter of priorities at the level of hundreds of thousands of dollars per annum, but it is the job of a higher authority in government to look after expenditures of millions of dollars per annum. We have a hierarchy in Australia of decision making. Although we believe that there is an urgent need to better finance the small science of Australia, what we would argue is that this particular item—indeed, there is talk of a synchrotron at the moment; you have probably heard of this—and objects of this kind are well beyond the scope of committees that are looking at how hungry they are for feeding the many mouths that need to be fed. We think that a nation does have to occasionally look at the wider picture and the longer term picture. It was in respect of that that we developed this idea of the national interest.

**Senator McLUCAS**—That goes to the issue of our place on the IAEA board. The academy has a view then that we need to have a reactor to sit on the IAEA board. Is that correct?

**Prof. White**—It goes well beyond that, I would say. That is a consequence of what the academy would have in mind as a vision for what this device might do. Perhaps the senator is not aware that it is quite likely that North Asia will become more nuclear in its power generation and things of that kind. I was chairman of a committee in Japan about two years ago which considered a very major project to do with whether you could destroy the waste from nuclear reactors by what is called spallation destruction. It is a totally new idea and it requires enormously heavy technology. The Japanese at the moment are about to decide on a $2 billion project to investigate this—not to actually do it, but just as an experiment. I sat on this committee and heard the Chinese, for example, speaking about how much coal they would need to burn in 2010 if they were to maintain their economic impetus. They said, 'We haven't enough coal,' even though China is rich in coal. So I have to say that there are major effects in North Asia. Just to illustrate that, Korea has now got a new reactor which is coming on line. Taiwan is, unlike ourselves, rebuilding from the ground up; they are retooling, if you like, their whole technological base to build a new one. Thailand is just buying a reactor. China is building a new reactor in Beijing.

**CHAIR**—Are these all research reactors or power reactors?

**Prof. White**—Yes, research reactors. So it is quite consonant that Australia should take a role in that.

**CHAIR**—But what about the argument that, given what is happening elsewhere in the world, we are really only just keeping our toe in the water by building one new research reactor, albeit that it is intended to be the world's best? It is such a small involvement compared to the other nations of the world, particularly those that are building power generation reactors as well, that the argument that we need to do this in order to maintain our place in the IAEA is really fallacious because at the end of the day, whether we have one or none—

**Prof. White**—If that were all that it were, it would be a poor argument.

**CHAIR**—It is an argument that has been put—along with others, but it has been put.

**Prof. White**—That may be. But the vision should be much wider than that. Imagine the following vision whereby this device is one of the best, possibly the best, in certain aspects in the world. Indeed, I would not be wishing to subscribe to it if it were not. And it can be, at least from the evidence I have seen, the best in the world for some things, so that people would say, 'We must go to Australia,' and travel from Japan, China or wherever, 'to do what we need to do.' Then what you are doing is bringing together the young people—scientists and technologists—of all of those Asian and related countries into our own sphere and mixing our own with them. That is, strategically, a much more important thing than sitting on the IAEA, in my view.

**Senator McLUCAS**—So that is what you mean by 'national interest'.

**Prof. White**—I am speaking about the intermeshing of what is happening in our region and that adds up to part of the case for national interest.

**CHAIR**—Can we be certain that that will happen—that the brain drain will stop and probably be reversed?

**Prof. White**—It depends on how good the gadget is. If the gadget does have aspects—

**CHAIR**—It might also depend very much on how well we market ourselves.

**Prof. White**—Yes, I think so. But what happens in this area of science and technology is that people, to do the most difficult and the most challenging things, go to the place where the apparatus is best.

**CHAIR**—I know a few CSIRO scientists who would argue that if we could only find $20 million or $30 million for some investment in technology it would save them having to travel to the US or elsewhere to spend time on these giant—I do not know what you call them—

**Prof. White**—Synchrotrons.

**CHAIR**—Synchrotrons. The area I am familiar with here is in terms of biomolecular technology. They say, 'Look, just for $20 million or $30 million we could do so much more.'

**Prof. White**—The number is bigger than that, in my view.

**CHAIR**—This is just from one scientist who was telling me this. I will not name him but he is highly renowned.

**Prof. White**—But I am also involved in that picture. That is the synchrotron picture, as I am sure you are aware. In 1994, the National Committee for Crystallography—the committee that I chair—took a conscious decision that we would not push for a synchrotron in Australia at that time because we wanted to see how well our community grew and to see how well they would compete with people at international facilities for the time. That was not a bad thing to do to the Australian community—it made them show how good they are.

**CHAIR**—How much would one of those cost?

**Prof. White**—A synchrotron would cost $160 million to $180 million.

**CHAIR**—I was talking about something else. I understood that it was basically a very powerful microscope.

**Prof. White**—That is one of the descriptions that are usually applied to this. I think they might have been asking for a contribution to it.

**Senator McLUCAS**—Earlier, you talked about the academy having a view about disposal. You came up with a set of conditions that you essentially said that you would like to see met

before we proceeded. Maybe that ending is a bit different. Are those conditions publicly available?

**Prof. White**—It is in all of the submissions that we have made in the past.

**Senator McLUCAS**—In the past. I have not read those.

**Prof. White**—It has not been repeated here, but this document refers back to other submissions.

**Senator McLUCAS**—I will go and find those. In your view, have those conditions been met to this point?

**Prof. White**—Not yet, no. It is a question of what is in hand. The question of the disposal of high level radioactive waste needs to be addressed.

**Senator McLUCAS**—I do not know whether you have tracked the submissions that we have had from various people, such as, 'When is nuclear waste, nuclear waste and when is an item a spent fuel rod?' Do you or the academy have a view about a definition of nuclear waste?

**Prof. White**—I have not tracked that argument.

**Senator McLUCAS**—Essentially the view is that if we use silicide and the silicide product—

**CHAIR**—I think it probably applies to any spent fuel.

**Senator McLUCAS**—Probably any. There is a view that it is not waste—that it is actually a spent fuel rod and that cannot be described as nuclear waste. That seems to be an extremely pedantic argument but it has enormous ramifications in terms of its potential importation into Argentina, where it may be disposed of or kept for a long period of time.

**Prof. White**—I am familiar with something of that. I have seen things in the press statements about that. It seems to me that the technical definition of nuclear waste is the waste that is produced after reprocessing a few elements. A spent fuel rod is not yet processed in that manner. I would say that might well be the origin of the distinction that is trying to be made in that case.

**CHAIR**—How have spent fuel rods at Lucas Heights been regarded up to now? I have always understood them to be regarded as waste in the sense that they are left over and there is nothing that can be done with them unless they are shipped overseas and reprocessed or conditioned. But, in the absence of doing that, you have got to do something else with them. You have got to store them, and they have been stored for a long time at Lucas Heights. Given that they do not have any further usefulness here, isn't it reasonable for the community to think that this material is waste, if we use a loose definition? I am not using a definition but a general concept, because it is what is left over.

**Prof. White**—It is a semantic point, if you will excuse my saying so. There would be people who would take nuclear fuel rods that have been irradiated and convert part of them into something quite useful. That is the whole reason why reprocessing occurs, in that there is very useful and valuable material still in them. They would therefore not be considered as waste—something which you would wish to dispose of absolutely without doing something with them.

**CHAIR**—I think we have been doing that only in more recent years—the program to take the spent fuel rods from Lucas Heights and ship them to Dounreay in Scotland. Now I think they go to France. With this new reactor, initially the first couple of cores would go to Argentina, which is where this other issue arises.

**Prof. White**—Yes.

**CHAIR**—For a long time they were just stored at Lucas Heights because people did not know what else to do with them.

**Prof. White**—Yes. I think that they did not have a means of recovering the uranium that was still left in them for useful purposes. For example, at the reactor where I was a director in France, we absolutely wanted to recover the unused uranium in those and they were shipped to Savannah River in the United States to recover the uranium. We, in fact, built up a bank, if you like—a reserve of highly enriched uranium which would be then built into, and was built into, subsequent fuel elements.

**CHAIR**—A sort of nuclear recycling?

**Prof. White**—It is recycling. It is recycling of the enriched uranium 235.

**CHAIR**—That is my point. I was not trying to be clever there. But what do we do with waste these days? We either treat it as waste and dump it or whatever, or we now try to recycle it.

**Prof. White**—Yes, so there is a recycling capacity or capability for that. The recycling capability for silicide is rather less than it is for oxide in other types of fuels, as I am sure you would have discovered.

**Senator McLUCAS**—Did you have any comments about synroc, Professor White, and its usefulness and where we are up to in the synroc story?

**Prof. White**—I regret I cannot be useful on that.

**Senator McLUCAS**—Thank you.

**CHAIR**—As there are no further questions, Professor White, I thank you for your attendance this morning.

**Committee adjourned at 12.21 p.m.**