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A Critique of ANSTO's Submission to the Research Reactor
Review

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Introduction

The Australian Nuclear Science and Technology Organization (ANSTO) has recently submitted extensive documentation to a government-sponsored review committee.¹ The documents provide ANSTO's case for constructing a new research reactor. This critique, prepared at the request of Sutherland Shire Council, addresses parts of ANSTO's submission.² The critique was prepared at short notice and with limited resources. It is neither definitive nor exhaustive.

The author of this critique, Gordon Thompson, is executive director of the Institute for Resource and Security Studies. He is an Australian citizen and a graduate of the University of New South Wales, and received a PhD in applied mathematics from Oxford University in 1973. During the past two decades he has coordinated and contributed to many technical and policy analyses, often in connection with nuclear technology.

This critique does not take any position on the merit of constructing a new research reactor. Instead, it examines the case that ANSTO has made. It finds that case to be poorly structured and incomplete.

¹ *Submission to the Research Reactor Review* (Lucas Heights, New South Wales: ANSTO, February 1993).

² The parts of the ANSTO submission that were available to this author were: pages 2-19 to 2-53; pages 3-10 to 3-11; Working Paper 3 (*Evaluation of Research Output*); Working Paper 4 (*Commercial Benefits of Reactor Operations*); Working Paper 5 (*Social and National Interest Benefits*); and Working Paper 6 (*Need for a New Reactor*).

An Appropriate Approach to Assessing This Proposal

The construction and operation of a new reactor would represent a substantial fraction of Australia's publicly funded investment in science and technology over the coming decade. Thus, the reactor proposal should be considered in the context of national science and technology policy. ANSTO's submission should have provided this context but did not. Nor did ANSTO's submission provide the systematic discussion of alternatives that is needed to assess such a proposal.

At the broad level, Australia must decide on the level of public support for science and technology, and the relationship between public and private support. Then, it must decide on the allocation of public support to different areas, such as nuclear science and technology. Like all advanced industrialized countries, Australia has institutional mechanisms for making these decisions. Those mechanisms, and the priorities and budgets they have generated, should be the first topic of discussion in an assessment of this kind.

Within the realm of nuclear science and technology, there is a case for providing a neutron source such as a research reactor. Many other countries have made this decision. However, a range of alternatives to each proposed project should be systematically identified and characterized. The alternatives to a research reactor would include projects that do not involve substantial neutron production or that involve neutron production other than in a reactor. When reactor options are considered, different types and sizes of reactor should be examined, as should different sites.

A systematic process of this kind may seem tedious and bureaucratic to those who are already committed to a particular project. However, it serves the public interest and, if pursued vigorously, can bring fresh thinking to bear.

In the USA, the environmental impact statement (EIS) process provides for systematic identification and characterization of alternatives.³ A project in the USA with national significance equivalent to that of ANSTO's proposed reactor would undoubtedly be the subject of a detailed EIS. ANSTO's submission would not suffice.

Status of Nuclear Power Technology

When ANSTO's present HIFAR reactor was built, the Australian government anticipated that nuclear power technology would be employed in Australia. At that time the development and deployment of nuclear weapons was also an option under consideration. The weapons option has not been pursued but remains relevant to the construction of a

³ Note that there is considerable room for improvement in the EIS process in the USA.

new reactor, as explained below. Nuclear power technology has not been employed locally, but ANSTO argues that Australia should remain abreast of developments. This is an important part of ANSTO's case for the new reactor. It is therefore important to carefully assess the present and potential future status of nuclear technology, which ANSTO has failed to do in its submission.

The worldwide population of power reactors is now static and beginning to decline. It is not yet clear how this trend will go over the coming decades, but it is noteworthy that governments and the private sector are not investing in the new "inherently safe" reactor designs that many people see as the basis for a revived nuclear power industry.

It is clear that spent fuel reprocessing is uneconomic and will remain so for at least several decades. Germany has abandoned its plans for indigenous reprocessing and will probably cancel its reprocessing contracts with France and Britain. The British government is debating whether to open the THORP plant, which has been built at great expense. The adverse international security implications of Japan's commitment to a plutonium economy are becoming increasingly obvious.

Thus, indigenous reprocessing is not an option for Australia for the foreseeable future. Aside from the adverse economics, it is hard to imagine the world community allowing a small non-nuclear-weapon state to become deeply enmeshed in the international plutonium economy. The same strategic consideration argues against an indigenous uranium enrichment program.

This leaves Synroc as the only nuclear technology of significant commercial interest to Australia. There is a potential market for Synroc, but it should be noted that the demise of reprocessing will limit the size of that market. Most spent fuel will be stored for decades and may eventually be buried intact.

To realize the market potential that it does have, Synroc technology will need to be deployed in the countries that have engaged in reprocessing (either for civil or military purposes). Given the sensitive nature of the nuclear industry, this will not happen unless there is a partnership arrangement in each country. In that scenario, it is not obvious that the presence or absence of a new reactor at ANSTO will make much difference in the outcome.

Alternatives to the Proposed Reactor

Some alternatives are presented in ANSTO's submission. For example, there is discussion of Australian scientists using neutron sources in other countries and of importing radiopharmaceuticals to replace local production. However, the alternatives presented are limited and are not examined systematically.

To illustrate, consider the possible use of a proton accelerator as a neutron source. There may be many good reasons to ultimately reject this alternative, but its inclusion would show that ANSTO is open to fresh thinking.

A proton with an energy of about 2 GeV will, upon hitting a thick lead target, generate about 50 neutrons of various energies. This property has, over the years, led many people to think of using an accelerator to breed fissile material or make tritium for nuclear weapons. Indeed, the US Department of Energy is supporting an investigation of the tritium-producing capabilities of a radio-frequency linear accelerator based on the design of the Los Alamos Meson Production Facility.⁴ In the Australian context, it will be noted that a device of this kind would expand the scope of the scientific research that is now possible.

Potential Role of a Research Reactor in Producing Materials for Nuclear Weapons

It is generally assumed that Israel has a substantial nuclear arsenal.⁵ Plutonium for these weapons has been produced in a French-supplied research reactor with a nominal capacity of 24 MW. It also appears that tritium has been produced in the reactor and incorporated into Israel's weapons. Tritium, used as a "booster", improves the performance of a nuclear weapon.

In 1981 Israel destroyed a 40 MW French-supplied research reactor in Iraq, alleging that it was intended to support an Iraqi nuclear weapons program. Information that came to light after the 1991 Gulf War indicated that Iraq did indeed have an active nuclear weapons program, despite being a party to the Non-Proliferation Treaty (NPT).

During the 1960s there was open debate in Australia about developing and deploying nuclear weapons, and Australia was initially a reluctant party to the NPT.⁶ Since then Australia has become an energetic supporter of the NPT and the South Pacific Nuclear-Free Zone Treaty. Indeed, Australia's non-proliferation stance is good by prevailing international standards.

It seems likely that the relevant Australian authorities have a contingency plan for producing nuclear weapons. Such a plan would be a kind of "insurance policy" against the collapse of the international non-proliferation regime, and its existence would be compatible with efforts to sustain and strengthen that regime. Indeed, it has been rumoured that Canberra has a policy of not being behind any nation in the region in its

⁴ *Nuclear Science: Consideration of Accelerator Production of Tritium Requires R&D* (Washington, DC: US General Accounting Office, June 1992).

⁵ For an example of the considerable literature on this subject, see Leonard S Spector, *The Undeclared Bomb* (Cambridge, Massachusetts: Ballinger Publishing Company, 1988).

⁶ Personal communication of the author with a former US government official who described the difficulty of persuading his Australian counterparts to support the NPT.

potential capability to produce nuclear weapons. In this connection it will be noted that Indonesia now has a 30 MW research reactor.

If Australia has a contingency plan of this kind, it follows that ANSTO must have a role in the plan. The present 10 MW HIFAR reactor would feature in the plan, as would the proposed new reactor, whose capacity will apparently be in the range 14-20 MW.

ANSTO makes no mention of nuclear weapons in the documents reviewed here. At present, it is not clear if the Australian government or the review committee itself will place this issue on the agenda of the review. There may be a spoken or tacit agreement by these parties to exclude the issue from public discussion. That would be a mistake. Other governments are aware of the strategic implications of a new Australian reactor and will draw their own conclusions, whatever is said publicly. Thus, placing a taboo on this subject will not serve Australia's security interests. It will, however, undermine democracy in Australia.

Prestige

There are various arguments in ANSTO's submission that reduce to the issue of prestige. For example, concern is expressed that failure to build a new reactor will threaten Australia's seat on the Board of Governors of the International Atomic Energy Agency (IAEA). This may be true, but it is worth noting that the IAEA is an organization that desperately needs major reform.⁷

Australia could gain considerable prestige and serve the international interest by campaigning for IAEA reform, whether or not it sits on the Board of Governors. It is by such actions that Australia will acquire prestige, not by being a small-scale player in the nuclear technology arena.

Commercial Operations

Language and data contained in ANSTO's submission show that commercial considerations do feature in its planning. However, the discussion does not meet the standards of a truly commercial enterprise. Market projections appear to be little more than guesses, and there is no systematic compilation of anticipated revenues and expenses.

ANSTO should be required to present a detailed business plan for its commercial operations. Activities that are supported by public funds should be identified as such and justified accordingly.

⁷ Gordon Thompson, *Strengthening the International Atomic Energy Agency* (Cambridge, Massachusetts: Institute for Resource and Security Studies, September 1992).

Recommendations

It appears that there is no urgency in replacing HIFAR. Thus, the review committee should decline to accept ANSTO's submission and should request a new version. That version should reflect the changes mentioned in this critique and other improvements identified in the review process to date.

In its future operations, the review committee should take care to provide ample time for contributions and responses by all interested parties. It should also consider the commissioning of independent analyses and the making of small grants to interveners with limited means.⁸

⁸ In 1987 the author was involved in the Ontario Nuclear Safety Review, an independent commission supported by the Ontario government. The total budget for this exercise was about \$1 million (Canadian). Several consultants were contracted, including the author, and small grants were made to many citizen groups to support their submissions to the review.