LUCAS HEIGHTS & MEDICAL RADIOISOTOPES

Anti-nuclear & Clean Energy (ACE) Campaign
Friends of the Earth, Australia
www.foe.org.au/anti-nuclear

Friends of the Earth

Does Australia need a nuclear research reactor to produce medical isotopes? The short answer is 'no'. An alternative strategy would be to close the existing reactor at Lucas Heights in southern Sydney combined with:
1. Greater reliance on imported radioisotopes;
2. Ongoing use of the existing cyclotrons in Sydney, Melbourne, Perth and Adelaide and others that are likely to be built in Australia;
3. Further research into advanced, non-reactor radioisotope sources such as cyclotrons, with the aim of sharply reducing demand for imported, reactor-produced radioisotopes (so other countries don't have to deal with the adverse impacts of reactors such as intractable radioactive waste management problems); and
4. Greater use of alternative clinical modalities such as MRI, and Computerised Tomography.

None of these four strategies alone will suffice, but combined, they are more than adequate.

The above strategies are tried and tested. Over 250 cyclotrons are operating around the world. Many countries - including Australia - import isotopes. Alternative clinical modalities are well advanced - in fact they are used far more frequently than nuclear medicine. So there's no risk involved in closing the existing reactor without replacement.

IMPORTATION

You might hear the argument that radioisotopes with short half-lives cannot be imported. True, but almost all of the short-lived radioisotopes used in nuclear medicine are produced in cyclotrons, not research reactors. With no research reactor in Australia, over 99% of nuclear medicine procedures would be unaffected, using either cyclotron-produced radioisotopes or imported radioisotopes. As for the small number of rarely-used radioisotopes that would not be available, alternative clinical technologies can easily fill this gap.

The Lucas Heights reactor was closed for three months from February-May 2000 and many doctors - including the President of the Association of Physicians in Nuclear Medicine - did not even know about the closure of the reactor! ANSTO staff members wrote to Sutherland Shire Council during the reactor shutdown noting: "ANSTO's radioisotope production has suffered no dislocation as a result of the shutdown, since bulk supplies of radioisotopes are purchased from the big international players in Canada and South Africa."

Properly funded research into alternative radioisotope production technologies and alternative clinical technologies will enable reduced reliance on imported reactor-produced radioisotopes.

More than three-quarters of all nuclear medicine procedures carried out around the world use imported radioisotopes. Countries largely reliant on imported radioisotopes include advanced industrial countries such as the United States, Britain, and Japan; in these countries nuclear medicine is widely practised and technically sophisticated despite the heavy reliance on imported radioisotopes.

CYCLOTRONS

Cyclotrons beyond to a class of machines called particle accelerators - electromagnetic devices that accelerate charged particles to enormous velocities. The particles can then be directed to hit a target and thus produce radioisotopes.

Because they are powered by electricity rather than the uranium fission reaction of a nuclear reactor, cyclotrons have important advantages:
* they generate only a tiny fraction of the waste of research reactors (typically less than 10%, and none of the spent fuel containing fission products and transuranics);
* they pose no risk in relation to nuclear weapons proliferation; and

* cyclotrons are much safer (for comparison, there have been five fatal research reactor accidents according to the International Atomic Energy Agency).

Most nuclear medicine procedures are diagnostic (90-99% depending on the country). Only a small minority (1-10%) of nuclear medicine procedures are palliative (pain-relieving) or therapeutic.

About 75% of all nuclear medicine procedures use the radioisotope technetium-99m. There are several non-reactor methods of producing this, but none of these techniques is in routine use.

A research team at the University of British Columbia (Canada) is making progress developing non-reactor methods to produce technetium-99m. Using the Triumf cyclotron, they produced enough Tc-99m in six hours to enable about 500 scans, thereby creating a "viable alternative" to the NRU reactor which is scheduled to close in 2016. Clinical trials involving 50−60 patients are expected to begin in 2015. If the three-month trials are successful, the university says, one of Triumf's cyclotrons "would likely be dedicated to medical isotope production", possibly as soon as 2016.

OTHER ALTERNATIVES

The alternative clinical technologies that compete with nuclear medicine include magnetic resonance imaging, X-radiology, computerised tomography and ultrasound. Moreover, the competition is not only between imaging techniques; there are also many chemical and biological alternatives to radioisotopes for *in vitro* studies and research.

In 2000, the President of the Australian College of Radiologists told a Senate inquiry that the potential to reduce demand for reactor produced isotopes through greater reliance on cyclotron-produced isotopes is constrained by the federal government policy "specifically barring" the use of cyclotron-based Positron Emission Tomography (PET) as a substitute for conventional nuclear medicine.

Professor Hicks from the Peter MacCallum Cancer Institute said that PET had proved more accurate than any other diagnostic technology in diagnosing tumors, and that it had saved hundreds of lives and thousands of dollars and had the potential to revolutionise cancer treatment.

QUOTABLE QUOTES

Former ANSTO scientist Murray Scott states:
"The most publicly appealing rationale for a replacement reactor is the provision of medical radioisotopes. ... But of all the programs associated with the replacement reactor this operation also carries the greatest risk, the greatest potential for massive contamination release and the most significant future weapons proliferation potential."

Dr. Geoff Bower, then President of the Association of Physicians in Nuclear Medicine, was asked if it would be 'life threatening' if Australia did not operate a reactor to produce medical isotopes on ABC JJJ radio in late 1998: He said:
"Probably not life threatening. I think that's over-dramatising it and that's what people have done to win an argument. I resist that."

Professor Barry Allen, former chief research scientist at ANSTO, states:
"It's reported that if we don't have the reactor people will die because they won't be getting their nuclear medicine radioisotopes. I think that's rather unlikely. Most of the isotopes can be imported into Australia. Some are being generated on the cyclotron. But on the other hand a lot of people are dying of cancer and we're trying to develop new cancer therapies which use radioisotopes which emit alpha particles which you cannot get from reactors. And if it comes down to cost-benefit, I think a lot more people will be saved if we can proceed with targeted alpha cancer therapy than being stuck with the reactor when we could in fact have imported those isotopes. ... The question is really what the taxpayer of Australia wants. Do they want new therapies or do they want the reactor to be the centre of all research?"

MORE INFORMATION

Medical Association for the Prevention of War, 2004, "A New Clear Direction: Securing Nuclear Medicine for the Next Generation",
www.mapw.org.au/download/new-clear-direction

Friends of the Earth:
www.foe.org.au/anti-nuclear/issues/oz/lh