7 THE REINVENTION OF THE COMMISSION

7.1 Introduction

After the suspension of the Jervis Bay project it was apparent that the Commission was not going to act as midwife to the birth of nuclear power reactors in Australia. The period from 1971 to 1987 was one in which the Commission needed to re-establish itself and to reconsider the directions of its research. The early part of this period was marked by a number of changes, not just in Prime Ministers but of governments as well. This meant that any stable direction for the Commission would also disappear. This was also the period that marked a change in the public perception of the value of and necessity for nuclear power. Issues concerning the nature and purpose of big science, public funding of Australia's research institutions and the social, economic and managerial responsibilities of these research institutions also became prominent.

The single biggest challenge facing the Commission was the departure of Sir Philip Baxter as Chairman of the Commission. Baxter's retirement in 1972 preceded an even more significant change which was to affect the Commission: that of the election of the first Labor Government since 1949. Baxter's retirement led to a change in the structure of the Commission. The new Labor Government would make some far reaching changes in the role that the Commission was to play in the future. This new government wanted the Australian nation to derive more direct benefits from its mining activities and decided that the Commission should become the Government's agent in the area of uranium mining.

The work that had started on the enrichment of uranium would continue, as would research on other aspects of the uranium fuel cycle. The production of

radioisotopes and their applications would continue to grow and begin taking a pre-eminent role in the work of the Commission.

On the Australian political scene the unexpected became normal. The Labor victory in 1972 brought an end to Australia's involvement in the hostilities in Vietnam, though most of Australia's troops had been gradually brought back before the election and only a handful had remained. The Whitlam Government initially ruled in a near dictatorial style, rapidly instigating many initiatives. The Whitlam Government was returned after a forced early election in 1974 only to be dismissed by the Governor General eighteen months later, in November 1975. Whitlam was replaced by Malcolm Fraser (b 1930). Fraser immediately sought a double dissolution and was elected in his own right in December 1975. He remained in office until 1983.

The general election in 1983 brought another Labor Government into office, under the leadership of Bob Hawke (b 1929). It would be under the Hawke leadership that the last chapter of the Commission would be written. This section will deal with the period up to the Hawke victory.

7.2 A New Structure and The Whitlam Years

William McMahon remained as Prime Minister until the general election held in December 1972 which brought about a change in government. During the short period in which McMahon held his position, the Commission became an active member of the international uranium enrichment club and Australia was courted by a number of countries to form 'joint partnerships' in the area of commercial uranium enrichment[lxxiv].

[lxxiv] The work on uranium enrichment will be discussed in greater detail later in this chapter.

The new Labor Prime Minister was Gough Whitlam (b 1916). He had been elected to Parliament in 1952 as the Member for Werriwa, the electorate in which the Lucas Heights Research Establishment was located. In 1967, Whitlam replaced Arthur Calwell as leader of the Australian Labor Party and leader of the Opposition[1]. At the time of his election, Whitlam faced a nation which was suffering from increasing unemployment together with an inflationary economy which was being fuelled by increased overseas investments over which the Government was unable to exert any control[2]. The 'Long Boom' which had followed the end of the Second World War was coming to an end although few knew this at the time.

Whitlam believed that the new Labor government would not remain in office for long and was motivated to act quickly. Whitlam, his deputy Lance Barnard and the Governor–General formed the smallest executive council that Australia had known. In the period between his election in early December 1972 until the end of the Christmas break in early 1973, this executive council implemented many major policy issues[3]. One of these was to ratify the Non-Proliferation Treaty[lxxv] on 23rd January 1973[4] despite the fact that this Labor government was a supporter of nuclear power and Australia's participation in developing an industry based on the uranium fuel cycle[lxxvi]. Whitlam, like his Labor predecessor, Ben Chifley, had been influenced by Franklin Roosevelt's American New Deal and decided to apply this model to Australia. Whitlam saw education as '*the great instrument for the promotion of equality*[5]. Within months of being elected, Whitlam's government introduced a number of major

[lxxv] Gorton had signed the Non-Proliferation Treaty but had not ratified it. As a result of the ratification, Australia could now not gain access to any nuclear technology which it had not already been developing or had started some form of study. This ensured that Australia would never have nuclear weapons.

[lxxvi] It should be noted that the Labor Party's support of nuclear power and the uranium fuel cycle would change quite radically in 1977. This will be discussed later in this chapter.

changes which included the federal funding of schools, free university education and the recognition of Aboriginal land rights[6].

The new government directed that Government purchases be made preferentially from Australian-owned firms and vetoed some overseas take-overs of Australian companies[7]. It legislated that all new uranium projects were to be 100% Australian owned and that foreign participation in other mining ventures was not to exceed 50%[8]. This legislation would have profound effects on the Commission. Whitlam and his Minister for Minerals and Energy, Rex Connor, would introduce a number of changes to the Commission from which it would never really recover.

The period immediately following the cessation of the Jervis Bay project was one in which the Commission was attempting to find a new direction . The concept of an Australian reactor had not been entirely withdrawn from the Commission. There was still some talk of the plutonium-powered-fast-breeder reactors and the construction of the Critical Facility helped maintain this fiction. The Critical Facility was never actually used in the research program of the Commission and was quietly disassembled. It remained the major white elephant of the Commission. It would slowly dawn on the members of the Commission that Australia would never again consider the procurement of a nuclear power reactor. All talk of nuclear power in Australia had now stopped. The Commission gave a small group of scientists a watching brief on overseas developments in nuclear power production. This watching brief gradually became more superficial until it was little more than a data gathering exercise.

The Commission had purchased new premises at Gardeners Rd, Mascot, in early 1971, initially to house the power engineering group[9]. This meant that

the Commission had, in the early 1970s, three sites within Sydney: the head office at Coogee, the office at Mascot and the research establishment at Lucas Heights. The Commission continued with its developmental work in the enrichment of uranium. It now added to this by slowly becoming more involved with its work on the production of uranium hexafluoride, and commencing work on the production of uranium fuel elements and other aspects of the uranium fuel cycle. This was seen as part of a greater effort in which Australian uranium could be converted to a more refined product and, as such, sold for a much higher price. This period also saw the Commission establishing working parties with groups from countries such as Japan and France.

The Commission in 1972 was still dealing with the aftermath of the failed Jervis Bay Project. According to Moyal, many staff left to find appointments either overseas or in academia, however few of the staff actually left at this time. She further states that '*staff discontent was rife ... and that a large number of dedicated workers were 'disillusioned with the administration"*[10]. This type of response is not at all unexpected from a group of individuals who had worked hard to bring about a project which on the very eve of coming to fruition was cancelled by the powers that be. However, it should also be noted that not all parts of the Commission were affected in the same way. The Isotope Production Group continued throughout this period emerging relatively unscathed by the demise of the power project, as did the Neutron Scattering Group and several other groups.

This was also the end of the Baxter era. On 15th April 1972 Sir Philip Baxter retired as Chairman of the AAEC. Baxter's retirement was itself the subject of a Machiavellian plot. There had been some friction between Baxter and Timbs over the issue of the reactor tendering process for the Jervis Bay reactor.

However this friction spilled over into a situation in which Timbs suggested that Baxter be dismissed. Timbs had sought a meeting on 15th July 1971 with Dr J.W.C.Cumes who was First Assistant Secretary of the Department of External Affairs. Cumes recorded that:

> *'Timbs went over ... what he described as the abominable handling of the tender procedures for the proposed Jervis Bay Atomic Energy Power Plant. He described in detail the unbusinesslike and "unethical" behaviour of Sir Philip Baxter in handling the four main tenders from Britain, Canada, the United States and Germany. He said that Baxter had decided that the contract should go to Britain and, in the end, had arranged matters to achieve this ...*
>
> *Timbs made it clear ... that is was he himself who had seen the unfortunate procedures which Baxter had been adopting and who had made the facts known both to the other Commissioners of the AAEC and to the Minister (Mr Swartz). It was as a result of this that the decision had been taken to defer consideration of the proposed Jervis Bay Plant for 12 months ...*
>
> *Timbs emphasised that Baxter's relationships overseas were very bad. The Americans would have nothing to do with him ...The French and the Germans had no wish to have any dealings with him and it was only the British, with whom Timbs alleged that Baxter had been engaged in a "conspiracy", who were prepared to use him'*[11].

Alder contradicts this latter statement by Timbs by stating that '*the USAEC were <u>very</u> cordial, friendly to both of us* (Baxter and Alder). *I went to the US most years at least once and <u>never</u> detected any animosity to Baxter'*[12]. Continuing with notes;

'Timbs said that Ministers would like to terminate Baxter's appointment as soon as possible and, in any event, would not wish him to continue beyond February next year. The difficulty about terminating his appointment earlier would be that many of the recent events would perhaps be brought to public notice if termination were too precipitate'[13].

Three weeks earlier, on 22nd June, Cumes had received a phone call from Dr A.R.W.Wilson from the AAEC[14] who had rung to express his concerns 'in confidence' over Baxter's forthcoming visit to Washington[lxxvii]. Wilson expressed doubts over Baxter's ability to engage in such negotiations since Baxter was opposed to the Non-Proliferation Treaty. Cumes noted that Wilson had suggested that the Prime Minister should intervene in this situation and '*put some order into Baxter's activities*'[15]. Cumes sent a copy of his notes to his superior with the suggestion that it be passed on to the Prime Minister's Department. A hand written note on Cumes communication states '*Wow! I think someone had better get all the papers together and let us have a look at them*'[16].

On 11th June the Minister for National Development had issued a press release denying that Australia and Japan had come to any agreement concerning a proposal to construct a joint Japanese-Australian uranium enrichment plant (this will be discussed later in this chapter). Copies of the press release were sent to a number of government departments including External Affairs. Written on the cover of the release was '*Wow! Please send copies to posts involved. The AAEC really think they are a law unto themselves*'[17]. Baxter, it appeared, had few friends left in government circles and it would be only a matter of time before Baxter would be asked to leave.

[lxxvii] The purpose of Baxter's visit to Washington was to discuss possible co-operation between Australia and the US in building enrichment facilities in Australia.

The question of Baxter's successor was also under discussion. Timbs, in his earlier conversation with Cumes had stated that,

> *'among those whom he* (Timbs) *did not want to see succeed* (Baxter) *were Alder (a present member of the AAEC, whom Baxter prefers) and Titterton...he suggested that two others ... whom he would like to see as Chairman ... Dr A.R.W.Wilson, at present with the AAEC and Mr Struan Anderson'*[18].

Who was Dr A.R.W.Wilson? Wilson had been a member of Professor Martin's group from the University of Melbourne and had been part of the original Harwell team who met the first AAEC scientists when they arrived in Britain. Wilson was one of the first to return to Australia '*to assist in the early organisation of the Commission'*[19]. By 1970, Wilson had been promoted to the position of Deputy Director, Research Establishment working under instructions from Keith Alder. Wilson remained with the Commission until 1985 and worked in a number of areas but seemed to be mainly concerned with the Regulatory and External Relations Branch. It appears that Wilson was the only scientist within the Commission who attempted to undermine Baxter by approaching a public servant 'in confidence'. One could even suggest that he was Timbs' man. According to Hardy, Wilson had accompanied Timbs on the first Australian visit to the French uranium enrichment plant at Pierrelatte in 1971[20], travelling together would allow both men to assess each other and even to develop some type of strategy to change the Commission into an organisation more suited to their liking. Wilson had been a long time employee of the Commission and one wonders if his treachery was the result of some feeling of frustration at his inability to achieve promotion quickly enough.

Timbs would be in for a disappointment. Baxter did retire but he was replaced by R.W.Boswell who had a background in physics but was essentially a public

service bureaucrat[21]. According to Moyal, Boswell '*as a research scientist at CSIR, joined the Weapons Research Establishment, Woomera, in 1949; served as its director, 1958-65; was Permanent Head of the Department of National Development and concurrently Commissioner, 1965-8; and served as Deputy High Commissioner in London 1965-72*[22]. Boswell was an administrator who governed the AAEC through the division heads; he did not share the autocratic style of his predecessor but rather saw his position as an administrative one and wanted the Minister, himself, to make policies [23].

Rex Connor, the Minister for Minerals and Energy was the Minister responsible for the AAEC. Moyal claims that the relationship between the new Chairman of the Commission and the new Minister was somewhat distant compared to that of Baxter and his relations with his various Ministers. Baxter met frequently with them while Boswell tended to take a '*wait and see*' approach which gave those working for the Commission a mixed message. Some saw it as producing a '*low institutional visibility*' while others saw this as essential for a democratic scientific community[24]. According to Alder, the story is somewhat different; '*I* (Alder) *went with Bill Boswell for his first meeting with Rex Connor, soon after he became our Minister. Connor had Lennox Hewitt (his Permanent Head) and Harry Messel (his Chief Advisor). Connor dismissed us rudely ... saying "I'll send for you when I want you"*[25]. Boswell was effectively kept at arm's length by his Minister.

Boswell, as Chairman of the Commission, was responsible for the disbanding of the Uranium Committee of the AAEC[lxxviii]. There was no mention made as to why it was disbanded. Reference to the Committee stopped appearing in the AAEC Annual Reports in 1972 but, perhaps most intriguingly, is the fact that there was no announcement of its demise in the Annual Reports. It appeared that Boswell

[lxxviii] The Uranium Committee was one of the first committees established by the Commission and had a membership made up of individuals from the mining industry.

was going to leave his mark on the Commission. The membership of the Commission also changed shortly after Boswell became chairman: in January 1973 Mr L.F.Bott resigned as a member of the Commission to take up another public service post and was replaced on 11th January 1973 by Lennox Hewitt, Secretary of the Department of Minerals and Energy. Hewitt had served in the Prime Minister's Department under Gorton but had been 'demoted' to the Department of National Development when McMahon became Prime Minister. The Department of National Development was reorganised and renamed when the Whitlam Government took office.

Boswell had attempted to reform the Commission by giving it another type of structure. The first main change occurred shortly after Boswell became Chairman, when the Commission met in the presence of its Executive Officer, Maurice Timbs, who was also a member of the Commission. At this meeting, the Commission decided to remove the position of Executive Officer. This left Timbs in an untenable situation, he had simply been dismissed by the use of an administrative device. Timbs subsequently resigned in February 1973 to take up the position of Secretary of the Department of Services and Property. It appeared that Boswell was going to be a full-time Chairman and did not need the assistance of an Executive Officer, or at least not Timbs. Timbs who managed to eliminate the previous Chairman was himself removed by the new Chairman. The irony can hardly be more fitting.

The removal of the position of the Executive Officer was not a trivial change since the structure of the Commission was set out in an Act of Parliament and it could only be changed by amending this Act. This change was enacted in 1973 with the position of Executive Member being removed by an amendment of the Atomic Energy Act[26]. Another amendment to the Act passed at the same time was to give the Commission some flexibility as to the number of members it could have.

The new structure included '*a Chairman, a Deputy Chairman and not more than three other members*'[27].

A new AAEC structure was being further developed[28] and in February 1974 the reorganisation of the Commission changed from a hierarchical pyramid to a system of three branches:-

Administration
Nuclear Science and Technology and
Regulatory and External Relations[29].

The new administrative structure was to be the first of many. The Commission was now facing a period in which restructure was followed by a review followed by yet another restructure. Most of this would have little effect on the work of individual scientists but it had profound effects on the overall morale within the organisation. This lack of stability in both structure and direction of research programs would mean that staff at the Commission experienced greater scrutiny and disruption of their work than ever before. The new administrative structure was further strengthened by placing all the existing and all new research programs into a more organised structure such that:-

> *'Nuclear Science and Applications Program mainly involves applications of radioisotopes and radiation, nuclear techniques of analysis, and environmental science*[30].
>
> *'Uranium Fuel Cycle programs are ... concerned with the processing and upgrading of uranium. Increased effort is being devoted to uranium enrichment by centrifuge techniques ... Laboratory work on an alternative enrichment technique using lasers is also expanding'.*
>
> *'Power and Energy program is designed to maintain a perspective view of the role of nuclear power in the total energy scene*[31].

Membership of the Commission was also fluid in this period. During the 1970s there would be more changes in the membership in the Commission than there had been in the previous twenty years. In December 1974 Harry Messel, the Head of the School of Physics at the University of Sydney, was appointed as a Commissioner[32]. Messel, who had fought valiantly to get access to nuclear physics technology for members of his physics school, was now on the governing body of the organisation that had previously excluded him. Ward and Alder retired as Commissioners on 31st May 1975 since their terms of office came to an end and neither was reappointed. Ward was replaced as Deputy Chairman by Sir Lennox Hewitt. One could suggest that in these simple changes in personnel on the Commission the new Government had replaced all the 'old guard' with their own appointments.

The oil crisis of 1973 came about when the Organisation of Petroleum Exporting Countries (OPEC) decided, in October, to cut oil production in protest over America's support of Israel[33]. In addition, some OPEC members believed that oil which was vital to Western economies was being sold too cheaply. The consequence to both these factors was that the price of crude oil jumped by almost 300%. This oil crisis had profound effects world-wide, not just in Australia. Whitlam decided that Australia must be in a position in which it could be self-sufficient in terms of energy supply. This view resulted in a number of initiatives in the mining sector intended to protect Australia from this type of disruption in the future. As mentioned previously, Whitlam wanted Australians to hold at least a 50% equity in all uranium developments. Since few Australian companies had the required resources to achieve this, Whitlam's government seriously considered that the Commonwealth should acquire this equity itself.

The Whitlam government was returned to power at the 1974 elections, but although the government had passed all the stalled legislation at a joint sitting of

the two Houses of Parliament, it lacked a majority in the Senate which meant that the passage of many future bills would be impeded[34]. It now proceeded to act on its stated intentions to control all uranium mining ventures in Australia. The Government did not have sufficient funds in Treasury to buy out the mining companies which had been exploring for uranium deposits and were now ready to start mining many of these. Rex Connor remained in the position of Minister for Minerals and Energy which still had responsibility for the AAEC. He believed that the oil crisis could be met by Australia developing alternative sources of energy. Connor's program '*included a transcontinental natural gas pipeline, a petrochemical plant, three treatment plants to convert uranium into yellowcake ... and the purchase of a year's supply of Middle East oil to be stored against future emergencies*'[35].

Connor hoped to get the money to finance these projects in the form of a loan from the oil-rich Arabs. In November 1974, Connor made contact with a Pakistani middleman, Tirath Kemlani, who would act as a broker to help secure these loans. Connor convinced Whitlam that the loans should be approved since they would be 'temporary'. On the 13th December 1974 Whitlam sought an Executive Council meeting, but the Governor-General, John Kerr, was in Sydney and all attempts to contact him failed. Eventually Whitlam had the Executive Council meeting at the Lodge in Canberra late that night. The ministers present were Whitlam, Cairns, Connor and Murphy. Whitlam finally managed to contact Kerr the next morning to inform him of the Executive council meeting the previous night and of its decision. John Kerr signed the Executive Council minute, giving Connor authority to seek the loan[36]. Whitlam left for an overseas trip, leaving Cairns as acting Prime Minister. When a week had passed with no word from Kemlani, Cairns decided to have no more to do with him and shortly afterwards revoked Connor's authority to seek the loans[37].

At the end of January 1975, Connor had convinced his parliamentary colleagues to renew his authority to obtain these overseas loans. Still Connor waited for Kemlani but there was no communication from him[38]. The authority to obtain these loans was finally rescinded in May 1975 but, unbeknown to his parliamentary colleagues, Connor remained in contact with Kemlani though still no loans appeared[39]. While these loan negotiations were taking place, Connor was also working within Australia on plans to control all aspects of the mining industry. It finally turned out that Kemlani could not secure the loans as he had claimed and the resulting fiasco became known as the 'Loans Affair'[40].

Returning to Connor's plans for uranium mining in Australia, on 31st October 1974 Connor tabled a statement in Parliament '*outlining the Australian Government's program for the development of uranium resources in the Northern Territory ... the program was designed to return substantial economic benefits to Australia from the supply of uranium to Australia's overseas trading partners*'[41]. This plan required the Commonwealth Government to have an agent responsible for the development and sale of uranium deposits. Since the original 1953 Atomic Energy Act allowed the Commission to take control of any radioactive mineral deposits in Australia, the Commission was now to become the Commonwealth's agent in this matter and become a mining company:

> *'the Australian Atomic Energy Commission would participate, as agent of the Australian Government, in the mining and treatment and undertake the sale of uranium located in the Northern Territory. The commission would also undertake all new exploration in the future for uranium in the Territory*'[42].

On 6th March 1975 Connor made another statement to parliament detailing that, in the future, that in the Northern Territory '*private companies would be permitted to continue uranium exploration within the terms of the existing licences, and*

confirmed that all new exploration within the Territory would be undertaken by the Commission[43]. Essentially the Commonwealth wanted to monopolise all future developments in uranium exploration and development. The rationale was now not defence, as it was in the early 1950s, but one of economic independence.

The original Act that brought the Commission into existence gave the Commission power to undertake exploration, mining and treatment of uranium, and it also gave the Commission the freedom to encourage others to do the same[44]. The Commission, in the past, had encouraged mining companies to explore for uranium and the Commission had been involved in helping establish the mining and treatment plants at Rum Jungle and Mary Kathleen. But now the Commonwealth wanted the Commission to take on the role of a mining company: *'the Minister formally directed the Commission on 20th June 1975 to undertake in the Northern Territory exploration for uranium*[45].

The Commission was now left with few options. It was now not only a research and development organisation in the area of nuclear science, it was also a mining company which had to explore for uranium and develop any ore deposits that were found to be economically viable. The Commission's Annual Report for 1975 stated:

> *'to implement the Government's program ... the Commission has set up a Uranium Branch incorporating an Exploration Division and a Production Division. The Exploration Division consists of Planning, Assessment and Evaluation Departments located in Sydney, and an Operations Department in the Northern Territory. Bases are now being established in Darwin and Alice Springs. Commission exploration will be concentrated initially in the Alligator Rivers Uranium Field in the northern sector of the Territory, and in the Ngalia Basin in the south*[46].

This situation in which the Commission became a mining company was later formalised when the Commonwealth Government became part of the Ranger Uranium consortium through the Commission:

> *'The Australian Government has appointed the Commission its agent for future sales of uranium from all sources in Australia. Commitments for deliveries under the existing contracts held by the Ranger participants .... will be met by the companies firstly by negotiating deliveries from the stockpile of uranium presently held by the Commission, and later by production from the Ranger plant*[47].

The Commission, now following this Government policy, was given further impetus in extending its work in the uranium fuel cycle. *'Our policy is to treat and fabricate Australia's minerals in Australia to the greatest practicable extent*[48]. This included the possibility of uranium enrichment and hence the production of uranium hexafluoride.

The uranium deposits that were found in one area of the Northern Territory were close to an area of extreme beauty, Kakadu, which at this time was being considered for inclusion as a National Park where mining development would not be allowed. The issues of Aboriginal Land Rights came to the fore during this period. From 1918, Aboriginal Reserves had been protected from mineral exploration and mining. However, when preliminary exploration indicated that bauxite and possibly uranium could be found on these reserves, the Commonwealth changed the relevant legislation to allow both mineral exploration and mining to take place on aboriginal reserves. Paul Hasluck (1905-93) held the position of Minister for Territories from 1951-63 and it was he who had insisted that some form of compensation be paid to the aboriginal communities affected by both exploration and mining. The compensation came in the form of the Aboriginal Benefits Trust Fund which was established to receive mining royalties.

It is now considered that this act effectively established the principle of Aboriginal Land Rights[49].

The issue of Aboriginal land rights came to a head when Nabalco found bauxite on the Gove peninsula and wanted to develop these deposits. The Yirrkala peoples on whose mission the deposits were found contended that Nabalco had invaded their proprietary rights to the land[50]. The case of Milirrpum vs Nabalco Pty Ltd and the Commonwealth of Australia went before Justice Blackburn who found that the Yirrala people had no claim on the traditional lands in Australian Law as they could not prove that their ancestors had the same relationship with the land in question as they did[51]. The 'Terra Nullius'[lxxix] concept at the time of white settlement was applied in the judgement. The issue of land rights did not go away and the Woodward Royal Commission into Aboriginal Land Rights recommended, in 1974, that Aborigines be granted automatic title to the Aboriginal Reserves on which they lived and that an Aboriginal Land Commissioner be appointed to hear other land claims[52]. Woodward further recommended that entry to aboriginal land for mining, tourism or other purposes would be subject to the consent of the local community. However, the Aboriginal community's veto for mining could be overruled by the Federal Government[53].

The issue of uranium mining and the nuclear industry was also of concern at this time. Reports had come from Britain indicating that the nuclear power industry was not entirely safe. There had been some spills at fuel-processing plants in Cumbria in the UK resulting in some radioactive contamination. The arms race between the world super-powers was going on so vigorously that many believed that either side could destroy the world many times over. Various Australian

[lxxix] 'Terra Nullius' refers to the idea that the colonising British believed that the land which made up the Australian continent was not owned in the traditional European sense of utilitarian Crown or individual ownership and hence could be regarded as empty land or no one's land.

environmental groups jumped on the international bandwagon and started protesting about Australia's involvement in the mining and export of uranium. Uranium mining became 'a cause celebre'. It was against this background that *'On 16th July 1975 ... the Prime Minister directed the holding of a public inquiry into the development of the Ranger uranium mine ... to hold a public inquiry into whether Australia should develop its uranium resources or leave them in the ground'*[54].

This Public Inquiry became known as the Ranger Uranium Environmental Inquiry and '*began its public hearings on 9th September 1975 with Mr Justice R.W.Fox as Presiding Commissioner*'[55]. The Ranger Uranium Environmental Inquiry would sit for two years, survive a change in government and produce two separate reports, the first dealing with the question of whether Australia should mine uranium and thus become involved with the nuclear fuel cycle, and the second on the Ranger mine in particular. The issues concerning the Ranger Uranium Environmental Inquiry and its ramifications will be discussed in detail later in this chapter.

The lack of a majority in the Senate finally caused the fall of the Whitlam government. The crisis occurred on 11th November 1975, after 27 days of deadlock during which the Liberal Opposition deferred passage of the Supply Bill until the Government should call another General Election. Whitlam refused to call the election, resulting in the Governor-General John Kerr dismissing the Prime Minister. This event has become known in Australian History as 'the Dismissal' and is the only occasion in which the Governor-General has sacked a duly elected Prime Minister[56]. One could say that Whitlam's dismissal was part of a wider Greek Tragedy in which Whitlam had asked his Governor-General to dismiss two of his Ministers in the preceding months only to be dismissed himself[57].

7.3 The Fraser Years and More Change

The Governor-General called the leader of the Opposition to form the new Government. The new Prime Minister was Malcolm Fraser (b 1930), a grazier from Western Victoria. Fraser had taken over as leader of the Liberal Party in March 1975, replacing Billy Snedden who had been the leader of the party since the end of 1972. Fraser immediately requested that a double dissolution of Parliament take place and an election be called. Fraser won the resulting election in a landslide victory[58]. The new Fraser Liberal Government had a number different policies from its predecessor and set about reversing some of Whitlam's initiatives, specifically in the area of mining. Fraser believed that activities such as mining should be left in the hands of private industry to develop, not the Government, and consequently began to divest the Commonwealth of ownership of uranium mines. The Commonwealth Government and the Australian people were now no longer interested in a nuclear power industry and consequently the status and functions of the Commission were under review. Essentially the Fraser Government had no real idea as to what the functions of the Commission should be.

The new Minister responsible for the Atomic Energy Commission was Doug Anthony, the Leader of the Australian Country Party, the other party in the ruling coalition. Doug Anthony, because of his position in the Australian Country Party, was by convention also the Deputy Prime Minister. '*In February 1976, the Deputy Prime Minister and Minister for National Resources and Overseas Trade indicated that the Commission would be required to dispose of its shareholding in MKU*[xxx]*, in line with the Government's policy of not becoming directly involved in mineral exploration or development. It is envisaged that the Commission's shareholding would be disposed of to Australian interests*[59].

[xxx]MKU stands for Mary Kathleen Uranium.

The Commission was now put into the position in which it had to sell off all its holdings in Mary Kathleen Uranium. It would no longer be involved in exploration for uranium ores or in the processing of these ores and consequently no longer required the administrative infrastructure to support these activities. The Uranium Branch which had been established within the Commission to allow it to carry out these functions, and the staff recruited to this Branch which were located in the Northern Territory, were no longer required and hence '*the Uranium Branch was abolished in May 1979*[60]. The staff employed within this Branch were either redeployed back to Lucas Heights or made redundant. This was at a time when redundancies in the Australian workforce, and particularly the public service, were still virtually unheard of[lxxxi].

William Boswell, the Chairman of the Commission, died on 17th February 1976. Sir Lennox Hewitt, the Deputy Chairman, '*accepted the general responsibilities as chairman*' until a new chairman was appointed. On 27th May 1976, the Deputy Prime Minister announced the appointment of Professor D.W.George as the new Chairman of the Commission. Don George was Vice–Chancellor of the University of Newcastle and had previously been P.N.Russell Professor of Mechanical Engineering at the University of Sydney. Don George had also briefly served on the AAEC Safety Review Committee, a position from which he resigned after accepting the Chairmanship of the Commission.

Amongst the changes that occurred within the Commission, the Safety Review Committee was also reformed. C.Cummins who retired after serving on the Committee for 15 years and was replaced by D.J.Stevens, Director of

[lxxxi] The issue of uranium mining will be discussed in greater detail later in this chapter.

the Australian Radiation Laboratory who was appointed as Chairman. P.L.T.Ibery and J.A.Telford were also appointed to the Committee[61]. The following year saw the membership of the Safety Review Committee increase with the appointment of S.J.Krister to it[62].

Changes occurred in other parts of the Commission, the Atomic Energy Advisory Committee was also reviewed. The Annual Report of 1977 noted that '*Following a review of arrangements for external advice, the Commission concluded that the concept of a single widely-based committee was unsuited to its current needs. On the advice of the Commission, the Minister for Natural Resources agreed that the Commission's Atomic Energy Advisory Committee should be disbanded, effective from 31st March 1977*[63]. The Commission had effectively removed all of its subcommittees and had restructured the only advisory committee still in existence.

Keith Alder was returned as a Commissioner and Sir Bernard Callinan was also appointed to the Commission. Sir Bernard was a Commissioner of the State Electricity Commission of Victoria[64]. Two years later, Mr A.J.Woods, Secretary of the Department of National Development, was appointed Deputy Chairman of the Commission, following the resignation of Sir Lennox Hewitt on 11th April 1978[65].

The findings of the Ranger Uranium Environmental Inquiry were published during this period. The first report was published on 28th October 1976 and reported on generic policy issues as to whether Australia should mine and export uranium. The second report was released on 25th May 1977 and examined the impact of the Ranger proposal on the local area[66]. Details of these reports and their effect on the Commission will be discussed later in this chapter.

Keith Alder was appointed to the new position of General Manager of the Commission on 5th August 1977[67]. Alder had been the Director of the Research Establishment at Lucas Heights from the early 1960s and, except for a brief period during the Whitlam Government, virtually ran the day-to-day organisation of the Commission. *'Following the appointment of Mr K.F.Alder as general Manager of the Commission ... the position of Head, Nuclear Science and Technology Branch was advertised ... The Commission appointed Professor S.T.Butler... previously Professor of Theoretical Physics in the University of Sydney. Professor Butler commenced duty on 5th October 1977[68].*

Professor Stuart Butler (1926-1982) was born in Adelaide where he received his early education. He completed his doctorate at the University of Birmingham from where he went to work at Cornell University, New York. In 1953 he returned to Australia to take up a position at the ANU. Butler was, within a year, recruited by Messel for his School of Physics at Sydney University. Butler was also actively involved in education. Specifically, Butler served on both the Science Syllabus Committee and the Science Examination Committee of the Board of Senior School Studies, eventually chairing both committees. He resigned from all these positions when he accepted the position at the Commission[69].

The Commonwealth Government was still attempting to find its own direction with respect to the issues of nuclear energy and a national energy policy and consequently *'in February 1977, the Deputy Prime Minister ... announced the establishment of a National Energy Advisory Committee to advise the Commonwealth Government on energy matters and to assist in the formulation and development of a national energy policy for Australia ... the*

chairman of the Commission, Professor D.W.George was appointed to the eighteen member committee[70].

The international situation concerning nuclear energy was also in flux. The US had decided, some years before, to allow the commercial development of uranium enrichment and fuel reprocessing, but '*President Carter's anti-proliferation policies led to a moratorium on commercial fuel reprocessing, greater emphasis on research to find more acceptable means of radioactive waste disposal, and lower emphasis placed on the fast breeder reactor development program. These proposed changes in policy have created a general uncertainty within the industry*'[71]. These uncertainties in the US nuclear industry had even more profound effects in Australia where the Commonwealth Government was still to decide what Australia's policies in this area were to be.

The Government decided that the AAEC should come under the responsibility of two Ministers and hence two Commonwealth Government Departments. On '*20th December 1977... the Minister for National Development, the Honourable Kevin Newman ... became responsible for administering the Atomic Energy Act 1953. The Minister for Trade and Resources, the Right Honourable J.P.Anthony became responsible inter alia for the commercial development and marketing of minerals (including uranium)*'[72]. There now followed the first of many amendments to the original Atomic Energy Act 1953 under which the AAEC was created and functioned. Over the next few years there would be more amendments to this Act than there had in the previous thirty years. The working environment, especially for the Chairman and the General Manager of the Commission, was now very difficult, to say the least. The Commission as a whole began to suffer from low morale which had started with the cancellation of the Jervis Bay project but which was now

greatly exacerbated by the continual reviews and changes to the functions of the Commission.

The first of the changes to the Atomic Energy Act 1953 was to accommodate the Commission's involvement on the Ranger Uranium Mining Consortium: '*The Atomic Energy Act 1953 was amended in 1978... The Atomic Energy Act 1978 provides :*

- *a firm specific base for the Commission to enter the Ranger Uranium Project*
- *a firm specific base for the Commonwealth to grant authority for the Ranger Uranium Project to proceed*
- *a firm and specific base for the application of safeguards pursuant to Australia's obligations under the Nuclear Non-Proliferation Treaty and the consequent Safeguards Agreement between Australia and the International Atomic Energy Agency*'[73].

The Atomic Energy Amendment Act 1978 also broadened the definition of 'atomic energy' to '*any form of energy released in the course of nuclear fission, nuclear fusion or other nuclear transmutation*'. This was to allow the Commission to commence and continue with research into nuclear fusion as a possible energy source for power production. The Commission at this time had also started work in the area of solar energy and was attempting to work in other areas of power production.

The Government was not satisfied with just one amendment to the Atomic Energy Act 1953; it required a second amendment, and so in '*November 1978, the Commonwealth Government introduced into Parliament the Atomic Energy Amendment Bill (No2) 1978*'[74]. This was assented to on 4th December 1978. This second amendment gave the Commission the authority to mine

radioactive substances on behalf of the Commonwealth, gave consideration to Aboriginal land rights and extended the authority given to the Commission over the Ranger Uranium Project.

The Commonwealth Government had not finished with the Commission just yet. *'In May 1979, the Commonwealth Government introduced into Parliament the Atomic Energy Amendment Bill 1979. The main purposes of this Bill were to enable the Commonwealth to guarantee the repayment of monies borrowed by the Commission for its contributions to the Ranger Joint Venture'*. This bill was assented to on 14th June 1979[75]. Later that year, the Commission was given a new Minister: '*Senator the Honourable J.L.Carrick became the Minister of State for National Development and Energy ... on 8 December 1979*'[76].

The Commonwealth had still not decided on its policies with regard to the future and functions of the Commission and it was reported in the Commission's Annual Report 1981 that '*the Government was of the view that the existing Atomic Energy Act did not provide an appropriate basis for the development, regulation and control of nuclear activities and that the necessary legislation to ensure that the Government's national obligations were honoured would be prepared in close consultation with the States. Work on the development of the necessary legislation is currently in progress*'[77]. To achieve its purpose, the Government produced yet more amendments to the Atomic Energy Act 1953. In 1980 there were two amendments passed to the Atomic Energy Act. The first, the Atomic Energy Amendment Act 1980, legislated that the Commonwealth would not authorise anyone to mine radioactive materials without the consent of the relevant State Government. The second, the Atomic Energy Amendment Act (No2) 1980, dealt with the issue of securities. It came into being on 11th September 1980. This Act

allowed '*the Commission to borrow funds by dealing in securities and permit the assignment to Energy Resources of Australia Ltd (ERA) of the authority to carry on operations in the Ranger Project Area. The amendment ... was made necessary by the possibility of delay in assigning the Commission's interest in the Ranger Uranium Project*'[78]. The Commission was still not free from future legislation but the next amendments to the Act would come from a different government with different agenda.

The Government, in 1978, had established yet another committee, the National Energy Research Development and Demonstration Council (NERDDC) to which Professor Stuart Butler was appointed[79]. The work of a committee of this council would have far reaching consequences for the Commission;

> *'On 2 November 1978, the Honourable Kevin Newman, M.P., Minister for National Development, announced that a review of the research and development activities of the Australian Atomic Energy Commission would be undertaken by a committee of the National Energy Research, Development and Demonstration Council (NERDDC)... the report of the Committee is expected to be completed early in the 1979-80 financial year... the terms of reference of the committee are as follows:*
>
> *To examine and report on –*
>
> *A. The AAEC Research Establishment's present energy research and development (R&D) programs including details of scientific and technical infrastructure and deployment of scientific and technical manpower...*
>
> *B. The capacity of the Research Establishment to re-orientate, as necessary, its R&D role and to deploy both existing and new resources to meet the Government's energy policies ...*

C. The identification of any factors which could inhibit any redeployment and use of Research Establishment resources in non-nuclear energy R&D activities ...[80].

The Committee from NERDDC met during 1979 and produced its report in the latter part of that year. The final report

'*arrived at a number of wide-ranging conclusions and made numerous recommendations, including that the Research Establishment at Lucas Heights should continue as the major centre for nuclear research and development in Australia but that Lucas Heights be empowered to undertake non-nuclear research and development and in doing so strongly emphasise the development of non-nuclear technology*[81].

This may seem to imply that the AAEC status quo was supported, since the Commission by this time had branched into research into other forms of energy sources but that was not the intent. The intent of the report became apparent when, in 1981, CSIRO was moved to Lucas Heights to do this non-nuclear energy research[82].

The Annual Report of 1981 summarised the NERDDC report;

the'*NERDDC Review Committee recommended a refinement of the nuclear research effort and the building up of non-nuclear energy research, to be managed by a restructured Commission under an amended Act permitting research activities in all energy-related matters...*

the Government decided that the AAEC should concentrate on nuclear research at Lucas heights as a first class nuclear research establishment, and that non-nuclear energy research by ... CSIRO should be co-located at Lucas Heights with the AAEC.

The new arrangements involved a reallocation of existing resources in the AAEC's Research Establishment at Lucas Heights between the Commission and a new Institute of Energy and Earth Resources to be established within CSIRO. The Institute will combine existing CSIRO energy research with appropriate manpower, buildings and equipment transferred from the AAEC. A significant proportion of the new CSIRO Institute of Energy and Earth resources will be co-located at Lucas Heights. The transfer of Commission staff to CSIRO is to take place for as many as possible by 1 September 1981, the transfer to be completed within a further 12 months[83].

It is not clear whether the Review Committee of NERDDC was a truly independent body or whether the Committee was simply carrying out the Government's unpublished policies. The report could also have been a tool to determine how much community and scientific support there may have been for the Commission. Many in the Commission saw this report as a 'vote of no confidence' in the Commission and its work. It was a bitter blow to those who had worked so hard for so many years on projects which were ultimately cancelled through lack of Government support. For many it was a sad ending to almost thirty years of high hopes and grand plans. The net result for the Commission was the loss of a number of well-trained staff, the loss of resources in the form of buildings and equipment and the loss of sole occupancy of the Lucas Heights site. It appeared that the Government was either engaged in attempting to destroy the Commission or, at the very least, in removing most of the viable future research projects from the Commission so that eventually it would just die.

The Commission was not particularly happy with the co-location of the two scientific organisations and it '*would have preferred an arrangement which continued its single management of the site and the diversified program*'[84]. The implementation of the NERDDC Review finally came in late 1981 when on

> *'3 December 1981, the Minister for National Development stated that the primary emphasis of the AAEC's activities in future should be on research and development in nuclear science and technology. The new CSIRO Institute of Energy and Earth Resources would concentrate on non-nuclear energy research development and would share laboratories and facilities at Lucas Heights ... the AAEC would continue to undertake research and development in nuclear energy, particularly in relation to uranium mining processing and enrichment*'[85].

The 1980 Annual Report was the last to be issued from the Head Office at Coogee since *'the Commission's Head office is to be moved from Coogee to Lucas Heights. This move will be made as soon as practicable*'[86]. The staff from Coogee were moved either to Mascot or to Lucas Heights which now became the Head Office of the AAEC. The Coogee site would eventually be sold but the Commission would not be the beneficiary of the sale. The Lucas Heights site was renamed Lucas Heights Research Laboratories on 3rd September 1981[87]. There were also changes to the membership of the Commission; Harry Messel retired on 4th December 1981 and Keith Alder retired on 15th January 1982, Professor Max Brennan was appointed to the Commission on 12th January 1982[88]. Max Brennan, who was at the University of Sydney at the time of his appointment, recalled that he believed his appointment may have come from '*Harry Messel, who was Head of the School, was a Commissioner, and so he would have suggested me*'[89].

Keith Alder also retired as the General Manager of the Commission and *'the Commission announced a new executive structure. The Director Research Establishment, Emeritus Professor S.T.Butler, became the Chief Executive Officer of the Commission. Professor Butler died after a short illness on 15 May 1982. Dr D.G.Walker was then appointed by the Commission, Acting Director and Chief Executive Officer until further notice*[90]. The position of Executive Officer had been abolished, possibly to remove Maurice Timbs, but the position was now re-established. The incumbent of this newly established position would not be a public servant, as had been the case in the early Commission but a scientist and an employee of the Commission. Both Butler and Walker were Commission staff rather than public servants.

The Three Mile Island accident occurred in 1979.Three Mile Island was a commercial nuclear power reactor situated at Three Mile Island on the East Coast of the USA. The accident resulted in the release of some radioactive material, but this 'spill' was localised. The Commission's Annual Report noted that on '*28th March 1979 there occurred the most serious accident yet to have happened at a commercial nuclear power station*[91]. This accident added even more concerns in the public mind as to the safety of nuclear power reactors. The fact that by this time there were several hundred nuclear power reactors in operation around the world and that there had been only one such accident and that no one, on or off the Three Mile Island site, was in any way harmed, counted for nothing in the hysteria on the perceived danger of such reactors. The Three Mile Island accident would pale into insignificance less than a decade later when another accident would virtually seal the public's mind against nuclear reactors of all types.

The exclusion zone around Lucas Heights had remained at 1.6 km. By the early 1980s there was an increased demand for residential land around

Sydney and the area outside the Lucas Heights exclusion zone was still under some restrictions as to its use. *'In February 1983 ...the Commission decided that the continued operation of the HIFAR reactor requires no restrictions on the use of land outside the 1.6 kilometre radius zone*[92]. Consequently much of this restricted land was released for residential development in the thriving new suburb of Menai. Much of the development that occurred near Menai was the result of the Commission finding no justification, on the grounds of safety, from maintaining the restrictions around the exclusion zone. This has not stopped environmental groups from complaining that the reactor was built in the middle of a residential area. They conveniently forget that the residential areas grew up and encroached upon the reactor site. They also forget that in Europe, then and now, nuclear power reactors and research reactors are found in or near large cities.

Malcolm Fraser, who had survived the elections of 1977 and 1980, called a general election which was to be held on 5th March 1983. Coincidentally, on that same day, as the election was called, Bob Hawke challenged Bill Hayden for the leadership of the Australian Labor Party and won[93]. Fraser was replaced as Prime Minister when the Labor Party under the leadership of Bob Hawke (b 1929) won the election[94]. Hawke had elevated a young career politician, Paul Keating (b 1944), to the position of Treasurer. Keating, as Treasurer, would change the face of much of Australian science and his impact on the Commission would see its termination.

7.4 Uranium Mining

The early 1970s in Australia were marked by a minerals boom. As a result of wide ranging exploration, Australia was found to have commercial quantities of a number of sought-after minerals, uranium being one of them. The period

commenced with virtually no uranium mining and finished with the discovery that Australia possessed around 40% of the world's deposits of economically recoverable uranium ore. How Australia would develop these resources was to be an issue that concerned both the Whitlam and Fraser governments and to some extent is still a political issue some thirty years later.

The oil crisis of 1973 initiated a search, world wide, for other forms of energy production. Initially, nuclear power seemed as if it would be the solution but the evolution of the environmental movement meant that there would also be a search for other forms of energy production. The Commission noted in its 1972 Annual Report that '*there was no production of uranium in Australia during the period (1971-2), the Rum Jungle operation having been closed down in 1970-71... Exploration reached a record level during the year ....Important new discoveries including some exceptionally high-grade ore ... in the Alligator Rivers area of the Northern Territory'* had been made[95]. Australia had fulfilled all outstanding uranium contracts and now was investigating its uranium endowment.

As has already been discussed, the Commonwealth Government under Whitlam's leadership wanted the Australian people to benefit from any mining venture, especially from uranium mining. To this end the AAEC became the government's agent in both the exploration and mining of uranium. The price of uranium had risen to the extent that

> *'in 1974, Mary Kathleen Uranium Ltd decided to reopen its mine at Mary Kathleen, North Queensland, and to finance recommissioning of the mine, mill and associated township by means of a 12-for-one share issue ... the Commission underwrote the new share issue to ensure that the proportion of Australian ownership of the company would not be reduced ... as a consequence of the new issue. The Commission*

subsequently took up those shares not subscribed for by shareholders and ... holds 41.6% of the shares of the company. Conzinc Riotinto of Australia Ltd took up its full entitlement to retain a 51% equity in MKU.[96]

The AAEC now not only had shares in a uranium mining company but

'as a result of the commission's shareholding in Mary Kathleen Ltd, the Australian government was entitled to appoint three Directors to the Board of MKU. In January 1975, Mr Boswell ... and Sir Lennox Hewitt ... were appointed as Directors. Mr J.A.R.Egerton ... was appointed in February 1975[97].

The Commission now had both its Chairman and Deputy Chairman on the Board of Directors of a mining company. To all intents and purposes one could now consider the Commission as being a mining company and Australia was now mining uranium again. By 1976 it was expected that Australia would start exporting yellowcake from the newly revived Mary Kathleen mine[98]. The production of yellowcake from uranium ore would commence once the treatment plant at Mary Kathleen had been recommissioned towards the end of 1975[99].

The Commission, as a government agent, also became actively involved with uranium exploration and hence *'an agreement was announced in June 1975 between the Commission and Central Pacific Minerals N.L., Magellan Petroleum Australia Ltd, Agip Nucleare Australia Pty Ltd and Urangesellschaft mbH and Co KG for a joint uranium exploration venture in the Ngalia Basin'*[100]. It should be noted that exploration for uranium had been part of the original brief given to the Commission in 1953.

The Government's decision that demanded a minimum Australian 75% equity in uranium companies and Australian control[101] meant that many overseas mining companies were unwilling to undertake the risky venture of exploration if there were insufficient returns for this activity. The Commission noted the mining companies' reluctance for exploration without possible profit in 1975 when it stated that *'the year saw a reduction in the level of company uranium exploration and no new ore bodies were reported by companies exploring in Australia'*[102] and the following year *'exploration for uranium decreased in Australia during 1975-76 as compared with previous years. This was in contrast to an increase in uranium exploration in the Western World generally. Most of the companies that had discovered viable deposits did not proceed with further drilling to increase reserves'*[103].

The Commission was now forced to engage in its own uranium exploration and *'following a direction of the Minister for Minerals and Energy in June 1975 that the Commission undertake exploration in the Northern Territory for uranium ... the Commission recruited an exploration team ... for its Uranium Branch Exploration Division'*[104]. The Uranium Branch, as has already been discussed, was located in the Mascot offices of the Commission in Sydney as well as having offices located in the Northern Territory, in Darwin and Alice Springs. The change in Government following the Whitlam dismissal meant that, within months of being established and staff being recruited the Commission's Uranium Branch was closed down.

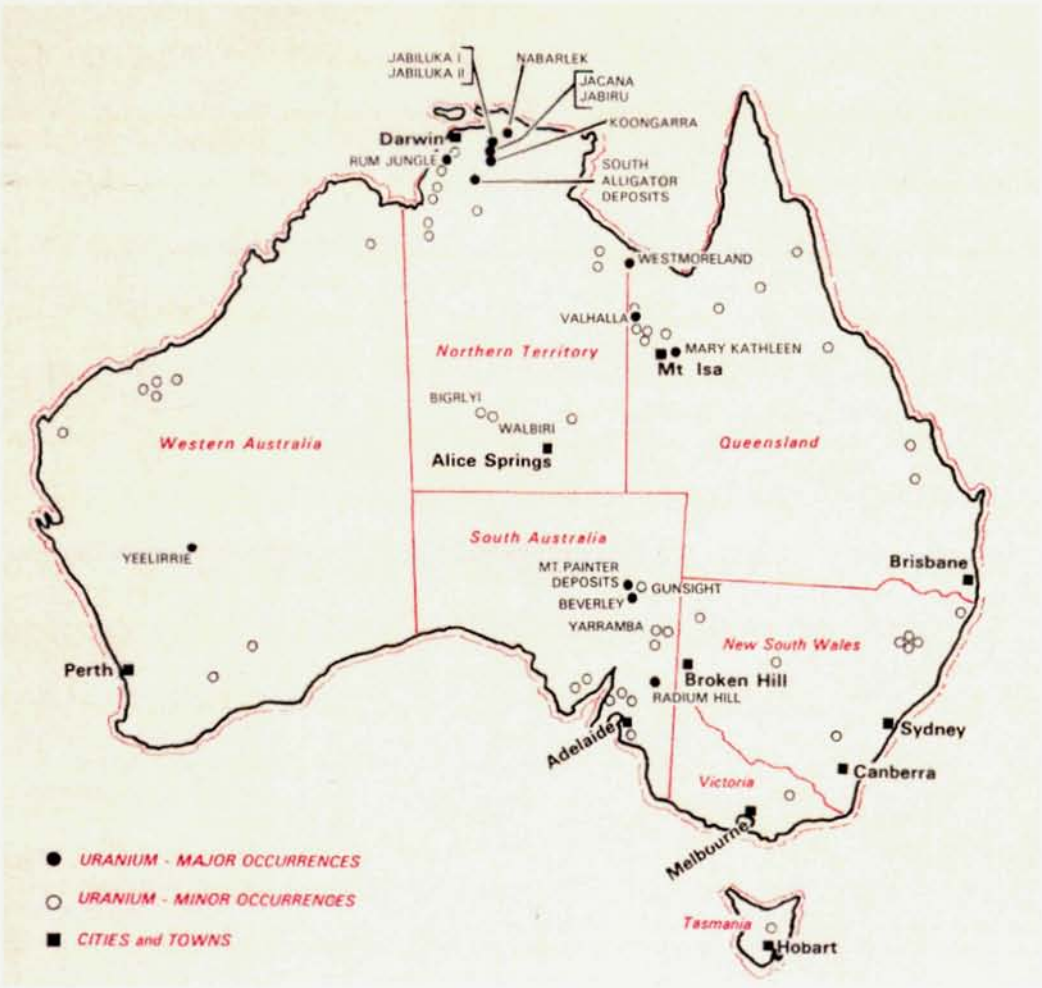

Figure 7-1 Map of Uranium Deposits

P30 AAEC Annual Report 1975

The Liberal Government's policy on mining was the complete reverse of its Labor predecessor. Hence *'on 1 February 1976, the Deputy Prime Minister ... said that the Government believed exploration for uranium in the Northern Territory should be a matter for private enterprise and not the Commission... accordingly, the Commission's uranium exploration program will be phased out over a number of months'*[105]. Later that month *'the Deputy Prime Minister ... directed the Commission to dispose of its beneficial interest in the Ngalia Basin*[lxxxii] *exploration venture'*[106]. The Commission's role in exploration was also to cease and *'the Commission's exploration program which began in the Alligator Rivers Province and the Daly River basin, Northern Territory, in*

[lxxxii] Ngalia Basin is located in the Northern Territory.

1975, continued at a reduced level during the 1976 field season'[107] until finally *'in accord with the Commonwealth Government's policy that exploration for uranium in the Northern Territory should be a matter for private enterprise and not the Commission, the Commission discontinued exploration in the field during June 1977'*[108].

The Commission's Annual Report of 1977 noted that *'the first shipment of uranium concentrate (yellowcake) from the Commonwealth Government stockpile held in store at the Commission's Research Establishment, Lucas Heights, took place in June 1977'*[109]. Little mention had been made of this stockpile at Lucas Heights and how it came to be there. Alder tells the story

> *'after contracts for sale of the product from Rum Jungle to the Combined Development Agency were completed the Commission decided to continue operations and process the balance of the good ore on or near the mill, putting the product into a stockpile for future sale. After the closure of the Rum Jungle plant the stockpile of yellowcake ... was moved to Lucas Heights for safe storage'*[110].

A very large warehouse was built in the early 1970s at Lucas Heights in which this yellowcake was stored in drums[lxxxiii].

According to Alder, the Commission had been placed under great pressure by Rex Connor to sell this stockpile to finance the share purchase of Mary Kathleen Uranium and the development of the Ranger mine[111]. The financing of both the share purchases and the exploration for uranium did not come from the Treasury, as according to Alder, the Commission was expected to borrow the money for all these new activities. Consequently the Commission borrowed in the range of a hundred million dollars[112].

[lxxxiii] It should be noted that uranium is an alpha emitter and hence storing it in drums in a large warehouse is reasonably safe.

In June 1977 the first shipment of the uranium stockpile was exported. The Commission had loaned the stockpile to Queensland Mines, Peko Mines Ltd and the Electrolytic Zinc Company of Australasia so that these companies could honour their uranium export contracts. The contracts for the mining, processing and export of the uranium ore had been approved by the previous Labor Commonwealth Government and duly signed. However, there had been delays in both gaining Commonwealth approval for these mines and in developing them, with the result that when the contract came due there was no uranium oxide ore to export[113]. This yellowcake was initially sent to the UK to be converted to uranium hexafluoride and then sent to the US for enrichment before finally being sent to Japan, the purchaser of the uranium, where it was used for power production[114].

Western Mining Corporation Ltd was another mining company that made a number of discoveries in this period. In 1976 the Commission noted that *'after a period of little activity on its Yeelirrie uranium deposit in Western Australia, Western Mining Corporation Ltd ... decided to construct a pilot plant at Yeelirrie ...the pilot plant should be in operation by the end of 1977'*[115]. Western Mining was also involved with uranium exploration in South Australia where it undertook exploration *'in the Fromme Embayment, on Roxby Downs near Andamooka, near Tarcoola and at Lake Gilles to the west of Iron Knob ... the Olympic Dam prospect on Roxby Downs was discovered by Western Mining Corporation Ltd'*[116]. Olympic Dam at Roxby Downs is today one of Australia's major uranium mining areas.

During this period a number of other mining companies were involved in exploration. The results of this exploration produced the mines which are

currently being exploited and others which are still awaiting either government approval to start mining or awaiting the capital required to commence mining. These include the Jabiluka deposits discovered in 1971 by Pancontinental Uranium Mining Ltd.

7.5 The Ranger Project

The Ranger Project was one of the most complex projects that ever involved the Commission. Uranium was discovered in what was later to become the Ranger ore body in 1969 by the joint venture of Peko Mines Ltd and the Electrolytic Zinc Company of Australasia. The Ranger deposits, as mentioned previously, were located on Aboriginal lands and were also near the Kakadu area. The joint venture partners and the Commonwealth Government were anxious to start developing this resource.

Rex Connor, the Minister for Minerals and Energy, tabled a statement in the House of Representatives on 31st October 1974 which outlined the Government's policy on the development of uranium deposits in the Northern Territory. The Northern Territory had a number of uranium deposits which were located near each other, the Ranger deposits, Nabarlek and Koongarra. The Nabarlek deposit was located on an Aboriginal Reserve and consequently needed the consent of the Aboriginal community before any form of development could take place. The Koongarra deposit was located near the proposed Kakadu National Park and was to come under further scrutiny. The Ranger deposit was the deposit which could most realistically be developed in the short term.

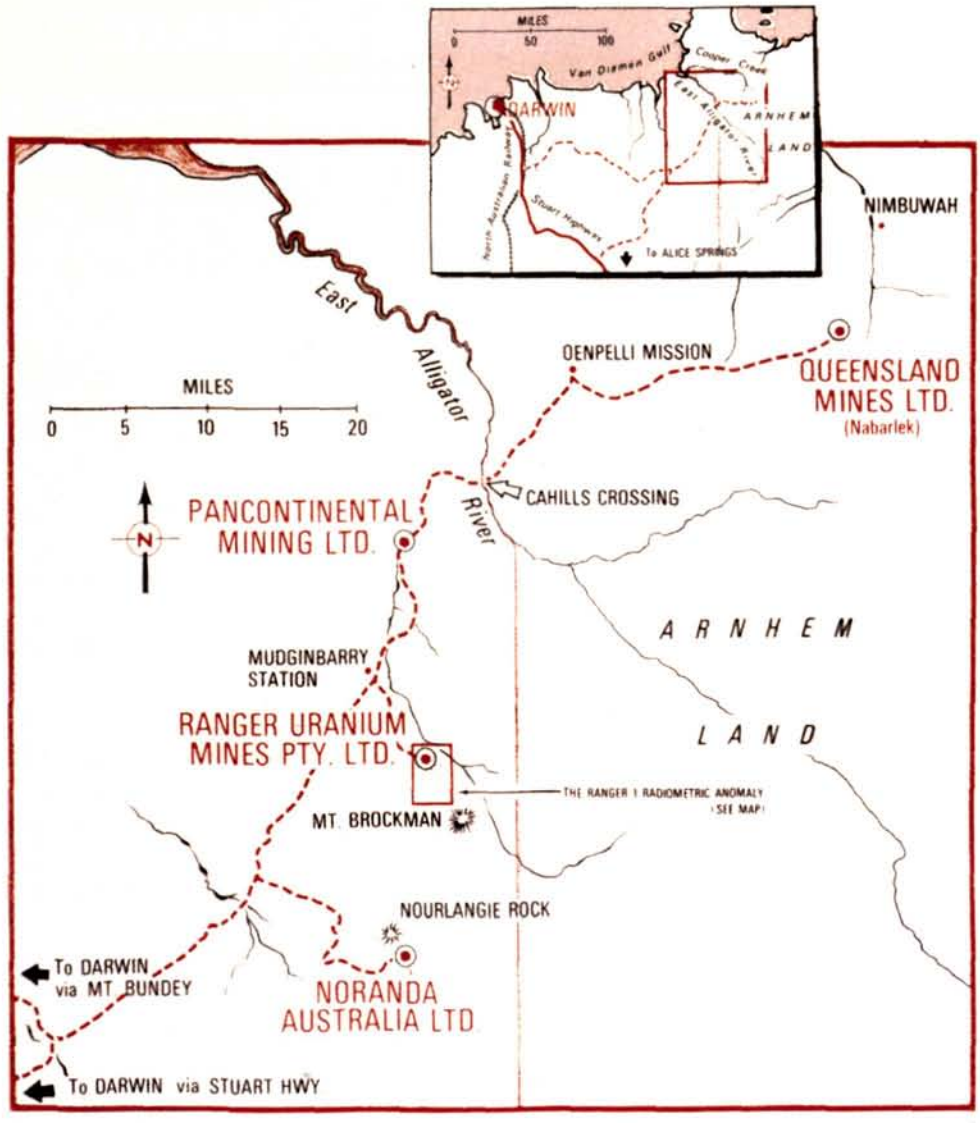

Figure 7-2 Ranger Map

P61 AAEC Annual Report 1972

Connor's statement of 31st October 1974 included the following plan for the Ranger deposits:-

> *'the Commission would mine ore from the Ranger deposits in conjunction with the Ranger participant companies …*
>
> *'a uranium milling plant, financed by the Commission and the Ranger participants, would be established in the Northern Territory to treat ore from the Ranger deposits …*

'uranium oxide produced at the Ranger treatment plant would be used to meet existing approved contracts of Peko Mines Ltd Electrolytic Zinc Company of Australasia Ltd and Queensland Mines Ltd and the remainder would be sold by the Commission ...
'the government had decided that a company which had undertaken successful exploration would receive the net proceeds from the sale by the Commission of 50% of the uranium oxide obtained from that deposit'[117].

This policy was not one that had been carefully thought through with all the parties making their contributions to its development. Instead it reflected the early days of the Whitlam Government which was essentially a 'rule by decree' form of government. The story of what occurred behind the scenes is told by Tony Grey in his book 'Jabiluka' and recounts the events which led to the establishment of this unique partnership. '*George Mackay and John Proud ... were the chief executives of the Ranger uranium joint-venture partners ...on October 27 the two industrialists were summoned ... to the Prime Minister's Lodge in Canberra. They were invited to dinner*'[118]. The other guests at the dinner included the Deputy Prime Minister and Rex Connor. After the meal the two were ushered into '*a large room where Sir Lennox Hewitt and officials form the AAEC were waiting*'[119]. Whitlam began the negotiation as to the quantity of the ore body that the Ranger partners were allowed to keep and what percentage of the capital costs the government would be prepared to give to the project. After some time it was agreed that the Ranger partners would be allowed to keep 50% of the profits from the ore body. '*The government agreed to put up 70% of the capital costs and the companies were insisting on 75% ... Finally, at about 1.30 am Whitlam offered to split the difference. The other side agreed and the parties settled on the odd figure of 72.5%. Then the bureaucrats insisted that a memorandum of*

understanding to be drawn up that night and printed ...The document was prepared and the parties signed it in the Lodge at 3 am'[120].

The agreement was signed just days before Connor made his statement in Parliament. The new company, Ranger Uranium Mines Pty Ltd would be governed by a Board of Directors in which *' one half of the directors on the Board ... were to be nominated by Peko mines Ltd and the Electrolytic Zinc Company of Australasia Ltd ... and the other half by the Commission. The mine, mill and the necessary infrastructure would be financed by the Ranger participants and the Commission in the respective proportions of 27.5% and 72.5%'*[121]. This type of agreement in which the mining company would take all the financial risks in exploring for uranium deposits, determining the viability of a possible mine and yet be able to claim only 50% of the profit from such a venture was very short sighted or idealistic on the part of the Government. Private industry wants to make a maximum return on any capital investment, not to have half its profits taken by away by the Government.

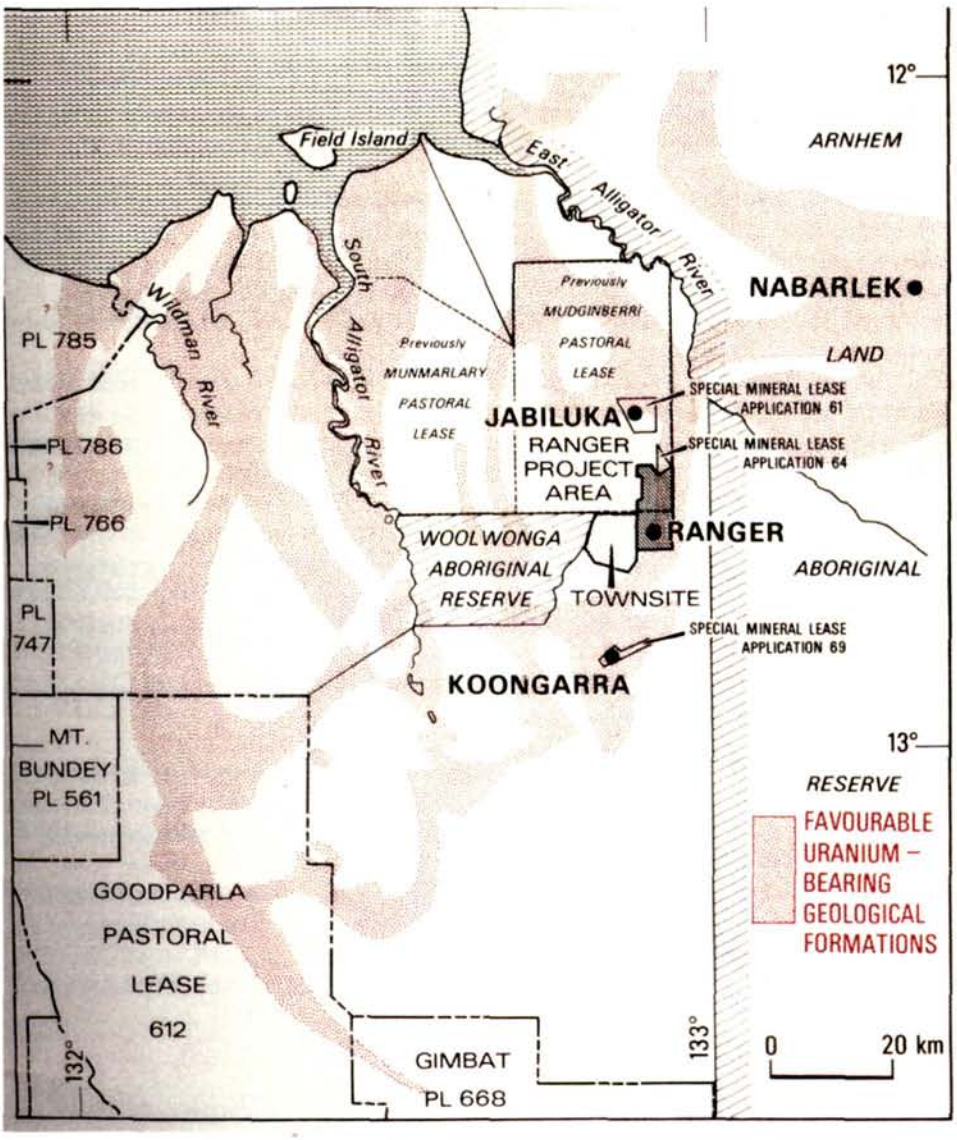

Figure 7-3 Ranger Uranium Mine Site

P55 AAEC Annual Report 1978

The Commission and the other members of the Ranger mining venture now were forced to postpone any further developments. The issues of Aboriginal Land Rights and the mining of uranium near an ecologically sensitive area were in the public arena. As has been previously mentioned, the Government, in 1975, established the Ranger Uranium Environmental Inquiry. The Inquiry produced two reports, the first was concerned with whether uranium mining should occur in Australia and what role Australia should take in the uranium fuel cycle. It was presented in 1976. The second report considered whether uranium mining should take place at Ranger and was presented in 1977. Both

reports were presented well after the Whitlam dismissal and the Fraser Government was forced to wait for both reports before it could consider what the new Government's policy on uranium mining would be.

The first report brought down fifteen principal findings and recommendations. It is of interest to note that most of these are phrased in the double negative and include:-

> *'the hazards of mining and milling uranium ... are not such as to justify a decision not to develop Australian uranium mines*
> *'the hazards involved in the ordinary operations of nuclear power reactors ... are not such as to justify a decision not to mine and sell Australian uranium*
> *'any development of Australian uranium mines should be strictly regulated and controlled'*
> *'no sales of Australian uranium should take place to any country not party to the NPT'*
> *'the government should immediately explore what steps it can take in reducing the hazards, dangers and problems of and associated with the production of nuclear energy'*
> *'policy with regard to the export of uranium should be the subject of regular review'*
> *'a national energy policy should be developed and reviewed regularly'*
> *'a program of energy conservation should be instituted nationally'*[122].

The final recommendation called for a public and parliamentary debate for the whole community to discuss the issues involved.

The second report was published in May 1977 and included an assessment of the impact of uranium mining not just on the environment and the proposed national park but also the impact it would have on the nearby aboriginal

community. The report recommended the establishment of a national park in the area '*That a major national park be established in the region'* and that *'the Kakadu National Park be declared.. the whole of the area ... be declared at the one time'*[123]. The recommendation to establish a national park in close proximity to large uranium deposits had further implications. The first was deciding the boundaries of the park, '*that the Land Rights Act be amended so as to move the southern boundary of the Ranger Project Area ... further away from Aboriginal sacred sites'* and the second was to establish ownership of the surrounding country; '*that Aboriginal title be granted, the national park established, and the necessary control mechanisms set up, before substantial amounts of construction work is done on the Ranger project or substantial numbers of people are brought into the area'*[124]. Finally it was important to ensure that mining would not take place in a national park, *'that if uranium mining proceeds, the Ranger .... area be excluded from the national park, and that, if the Pancontinental proposal proceeds, the area of its lease also be excluded'*[125].

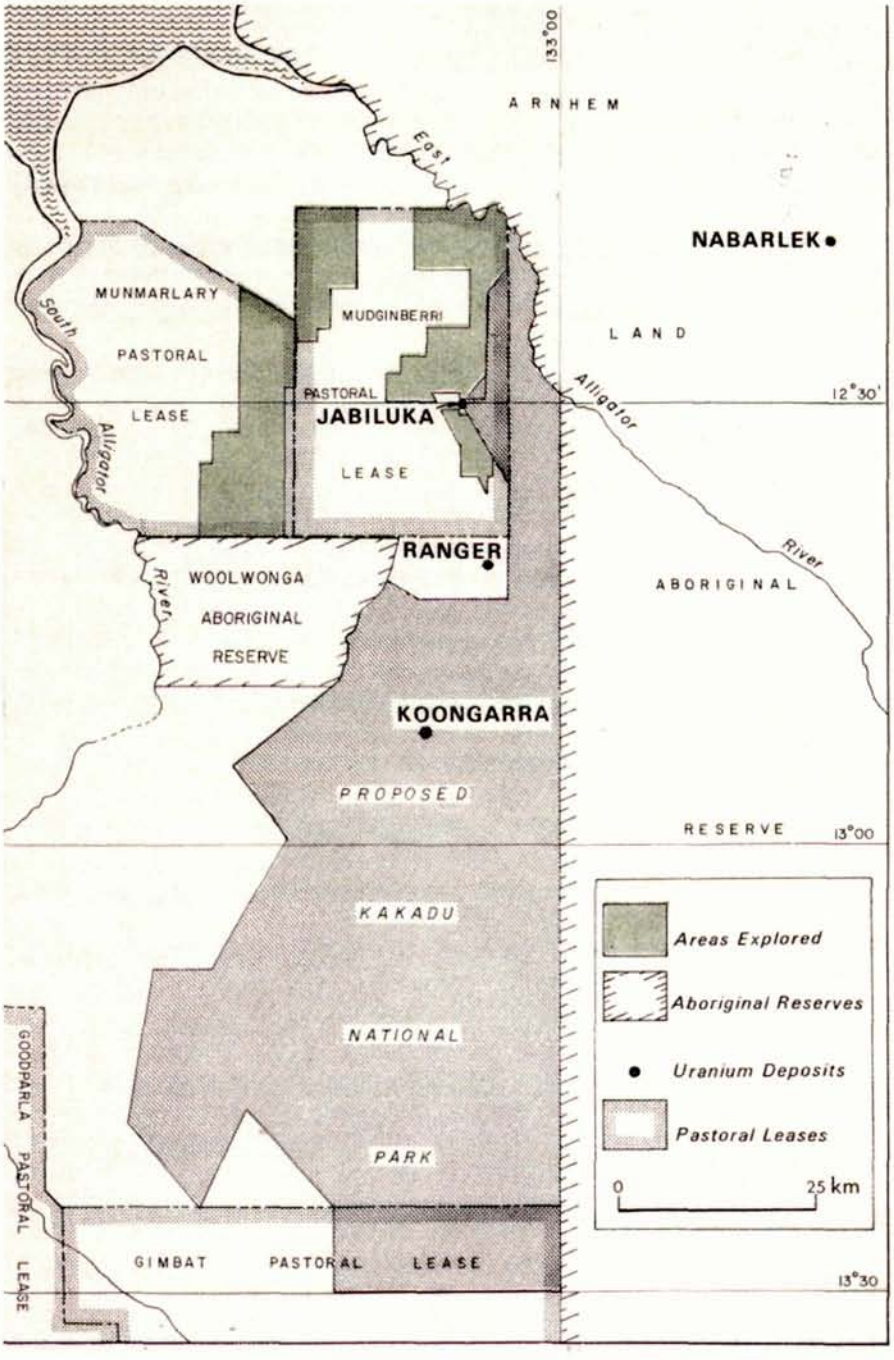

Figure 7-4 Proposed Kakadu National Park

P38 AAEC Annual Report 1976

The area near the uranium deposits was now to be declared as either Aboriginal land, a National Park or mining lease. The recommendations for the development of the uranium deposits suggested that two of the then known deposits were not to be developed in the immediate future: *'that exploitation of the Koongarra deposit not be permitted, at least for the present'*

and '*that the Noranda mine not be developed at least for the time being*'[126]. The report further recommended that

> '*the construction of mines in the Region be commenced sequentially at appropriate intervals ...that authority not be given for both for the Ranger proposal and the Pancontinental proposal to proceed at the same time. As between the two proposals, the Ranger mine should be allowed to develop first ... That a decision that mining should proceed at Ranger be taken in conjunction with decisions respecting Aboriginal land rights and the national park ...That if the Ranger proposal is allowed to proceed, no other mining, with the possible exception of that proposed by Pancontinental, be allowed in the region, west of the Arnhem Land Reserve, for the time being at least*'[127].

The way was now open for the Ranger joint venturers to develop the Ranger uranium mine with the assurance that it would be one of the few suppliers of Australian uranium to the world.

The Fraser Government was now bound by an agreement signed during the Whitlam period. The Government honoured a commitment to which it had been bound by its predecessor and organised for a new agreement to be made between the joint venturers. The new agreement was made and signed on 9th January 1979, in which Peko-Wallsend Operations Ltd, Electrolytic Zinc Company of Australia and the Australian Atomic Energy Commission would '*carry on as Joint Venturers, on behalf of the Commonwealth, for a period of 26 years*'[128]. This agreement allowed for the joint venture

> *'to carry on operations ... for the following objects:*
>
> *(a) The discovery, development, proving up and mining of uranium ore deposits on behalf of the Commonwealth within the Ranger Project Area,*

(b) The construction, operation and maintenance of a mine and treatment plant for the production of Ranger Uranium concentrates and other mineral products,

(c) The delivery to the Commonwealth or its nominee of concentrates of Ranger uranium ore and other mineral products produced from the treatment plant,

(d) The provision and operation within the Ranger Project Area of facilities, equipment and services directly related to, and reasonably required for, the foregoing, and

(e) The treatment in the treatment plant on a toll basis of uranium bearing ores mined outside the Ranger Project Area'[129].

The joint venturers established, in their agreement, on 9th January 1979 a new entity '*Ranger Uranium Mines Pty Ltd to develop the deposits in the Ranger area and appointed that company to manage the Project'*[130]. The Ranger Project was now established and the work to develop the uranium resources through mining the ore and production of uranium oxide started. The mining town of Jabiru would be required to house the Ranger workforce; *'The Jabiru Town Development Authority Act of the Northern Territory came into force in January 1979. This Authority is responsible for the development of the Jabiru Town'*[131].

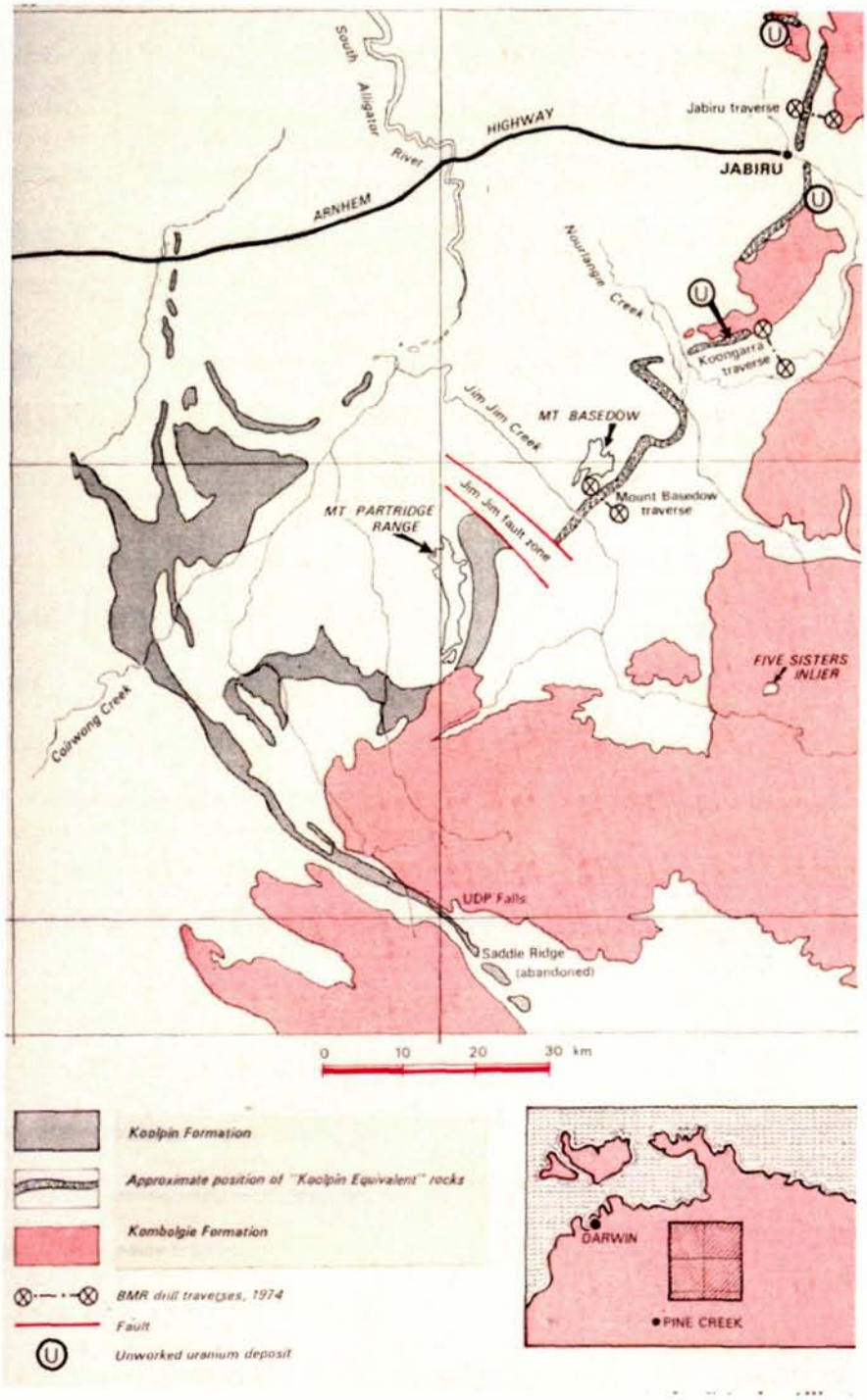

Figure 7-5 Location of the Jabiru Township

P37 AAEC Annual Report 1975

The Commission was now a mining company again. As has already been discussed, the Commission had divested itself of its share in Mary Kathleen Uranium in 1976 but barely three years later the Commission was back in the mining business. However this would not be the case for long as the Liberal

government's policy on mining ownership would allow the Commission to withdraw from its mining commitments. In August 1979, the Government announced that it planned to divest itself from Ranger Uranium Mines and stated that '*it would consider proposals for the acquisition of its interests in the Project*'[132]. The proposal which gained government approval was the establishment of a new mining company which would have two equal major shareholders and a number of smaller shareholders. In December 1979, the Government announced that it would accept this proposal and the new company, Energy Resources of Australia Ltd (ERA) was set up in Canberra as a separate mining entity in 1980.

The two original partners in the joint venture, Peko-Wallsend Operations Ltd and the Electrolytic Zinc Company of Australia Ltd became the major shareholders in ERA, each with a 30.4% share. The new mining company had a small percentage of its equity owned by overseas investors (25%) and local investors (14.2%). The AAEC sold its shares in Ranger Uranium Mines Pty Ltd to ERA. Ranger Uranium Mines Pty Ltd then became a subsidiary of ERA[133]. The deed of agreement between the parties of the joint venturers, ERA and RUM, was signed on 12th September 1980[134]. The Electrolytic Zinc Company of Australia Ltd share of RUM has since been taken over by North Broken Hill Holdings Ltd which subsequently merged with Peko. This newly merged company was later taken under the control of Rio Tinto which had taken over North Ltd. The Commission had finally been freed from its involvement with uranium mining and the production of uranium oxide.

7.6 The Enrichment Work Continues Regardless

The scientific work of the Commission during this period involved a continuation of work in centrifuge enrichment techniques and later the

development of laser enrichment, work on the production of uranium hexafluoride from yellowcake, radioisotope manufacture, thermonuclear studies and upgrading of the two nuclear reactors. Most of this work was directly related to future uranium mining and the establishment of an Australian nuclear fuel cycle industry to enable Australia to sell a more profitable product to nuclear power authorities overseas. The motive for this type of research in the 1970s was purely financial.

The Enrichment Program which had started in 1966 was first mentioned in an AAEC Annual Report in 1968, and was briefly discussed in the previous chapter. By 1970 the work on enrichment at the Commission had developed to the stage where centrifuges had been designed, developed and tested[135]. Much of this work was still secret since there was still the threat of nuclear weapons development but now the issue of commercial secrecy became important also. If one is to make money from a technological development, one does not give away too many details to one's competitors. Enrichment by the centrifuge method was a new technology and was a commercial 'secret' in the sense that knowledge of this method was now in the public domain and hence no longer a military secret, but the details on this type of enrichment were still very much held in confidence by those groups which were researching in this area.

The development of enrichment, both within the Commission and further field on the international stage, are best described from the beginning. Initially, in the late 1960s, Australia was exploring the possibility of developing an enrichment industry to provide fuel for Australian nuclear power reactors. However, when the Jervis Bay project was cancelled, the enrichment work within the Commission continued virtually undisturbed and hence is being described in this chapter.

In early 1971 when Maurice Timbs was in Vienna, he was communicating with Baxter over a forthcoming submission to Cabinet on the issue of establishing a commercial uranium enrichment facility in Australia. He summed up the situation on this issue in a cablegram dated 3rd February 1971,

> *'We have large deposits of uranium ... we have also cheap power: but these two assets do not necessarily give us an assured market nor a competitive edge needed to establish a profitable market ...*
>
> *I am convinced that as a supplier country we must take cognisance of the fact that the major markets for enriched uranium for the next 2 or 3 decades at least will be Europe, Japan and the USA and the scope for economic investment in enrichment technology in Australia would be in association with one or more of these regional areas'*[136].

A fortnight later Timbs sent another report back to the Commission, in this report Timbs describes a visit he made to the French diffusion enrichment facility at Pierrelatte. He had noted in an earlier communication from Vienna that both the British and the Americans were surprised that the French would issue such an invitation, specifically, '*this was received with some degree of incredulity*'[137]. Timbs' report stated that the '*French were most co-operative and helpful. Virtually nothing withheld*'[138]. The French were aware that Timbs was a public servant who had no technical expertise and hence was not regarded as a possible security risk. Timbs then concluded with a proposal that had been put forward by Director of the French Atomic Energy Commission who *'speculated on the possibility of establishing such an enterprise* (commercial enrichment plant) *in Australia on a joint basis'*[139]. This proposal appeared to be a genuine offer for a joint enterprise in which Australia would be able to sell enriched uranium to France and some of the

capital to establish the plant to do this would come from France. The French plan was to establish a diffusion enrichment plant but Australia had been working on the centrifuge process. The French asked the Australians for secrecy to be maintained in their future discussions[140].

The French at this time were expanding their nuclear power generation and required more enriched uranium. Their existing plant could provide some of this but an increase in the production of enriched uranium was also required. The Pierrelatte plant was a small enrichment plant producing highly enriched uranium mainly for military purposes. Britain was in a similar situation and the US was the only supplier of commercial quantities of enriched uranium for nuclear power stations. In short the US had a virtual monopoly in this area.

In March 1971, two Australian newspapers, 'Sydney Morning Herald' (17th March) and 'Australian Financial Review' (23rd March), discussed the Commission's enrichment program, the French need for enriched uranium, and the tripartite agreement between Germany, the Netherlands and the UK to establish an enrichment plant. This latter plant would also use centrifuge technology. Australia as a possible supplier of enriched uranium was now a subject for public discussion.

The Commission decided to send two of its more senior personnel, Keith Alder and Grant Miles, for consultations concerning '*future requirements and anticipated sources of supply for enriched uranium in Japan, West Germany, Belgium, Italy, Spain and Switzerland*'[141]. Timbs was to attend the IAEA meeting in Vienna and would later join Alder and Miles for part of the European leg of their tour which was to occur in June and July 1971. The first stop for Alder and Miles was Japan, but there things went terribly wrong. The discussions were to be exploratory in nature and neither party was expected

to make any commitment to the other. Japan had been developing nuclear power as an alternative to the pollution-causing fossil fuel power stations. But Japan needed increasing amounts of enriched uranium to fuel these new power stations. Japan did not want to be reliant on a single producer of enriched uranium and was searching for other sources of nuclear fuel. Japan was also considering the possibility of establishing enrichment plants. A possibility existed for an Australia-Japanese joint venture to construct and operate such a plant.

According to Alder,

> *'We faced nine power generation utility vice-chairmen, and behind them rows and rows of advisers and officials ... what we had not realised was that one of these rows contained representatives of the press, including one from Australia. Our Japanese hosts had omitted to mention this'*[142].

The next day the press in both Australia and Japan reported that Australia was going to build a commercial uranium enrichment plant to supply Japan with fuel for their reactors. The two scientists with the help of Australian diplomats in Japan immediately sent a report back to Australia. But by this time the Minister for National Development had been forced to publish a press release denying any truth to the newspaper reports (this had already been mentioned earlier in this chapter). The remainder of the tour was relatively uneventful. The two scientists travelled to Germany, Italy, France and Britain, and included visits to the different enrichment facilities in both France and Britain. Alder concluded that '*all the countries visited would welcome the possibility of partial supply of their enrichment needs from Australia. On the one hand they were worried about the US monopoly and possible strategic use of it – on the other, they did not want to jeopardise long term supply from the US*'[143].

Shortly after the newspaper reports from Japan, the Minister for National Development received a cablegram from the Director of Atomic Energy Affairs in the US State Department, stating that the US would be willing to share its uranium enrichment technology but that countries such as Australia, Japan and Canada would have '*to register their interest with the United States authorities*'[144]. The cablegram invited the Minister to address the issue with various representatives in the US on his forthcoming visit. The result of these discussions was an invitation to a select group of countries to attend a series of meetings in early November 1971 in Washington. The Americans proposed to share some of their enrichment technology at these meetings.

A USAEC press release on 21st June 1971 explained the rationale behind the US decision to hold these Washington talks. In part the press release states that the government would allow a select group of US companies to undertake enrichment work on behalf of the government since '*private industrial firms in certain foreign countries, such as Germany and the Netherlands, are now working in the uranium enrichment field; thus, it is believed appropriate that US companies become involved in the enrichment program at this time*'[145]. It appears that the US realised that it could no longer maintain a monopoly on commercially produced enriched uranium and wanted to have a share of this increasing market. On 16th July 1971 the US issued a statement that it was,

> '*prepared to undertake exploratory talks ... on the possibility of making United States gaseous diffusion enrichment technology available outside the United States, under appropriate financial and security arrangements, for the construction of additional enrichment capacity on a multinational basis*'[146].

Australia questioned the US concerning the invitation list to the Washington talks. Trevithick, the Acting Director, Atomic Energy Affairs Office of the US State Department was reported to have stated that South Africa had been excluded from the talks because invitations were only offered to countries which at some time in the past had indicated that they wished to share technology with the US and that, *'South Africa had never given such indication'* and that the *'United States doubted whether other countries would be happy sharing United States enrichment technology if it also meant partnership with South Africa'*[147]. The US rationalised the notion of dividing the Washington talks into two groups, a European group and Pacific Basin group, since the US had assessed that *'international demand for enriched uranium in the foreseeable future is likely to support only two major enrichment plants offshore from the United States and that these would best be situated in Western Europe and the Pacific Basin respectively'*[148].

The US issued invitations to the six member nations of Euratom[lxxxiv] and to Australia, Canada, and Japan as the Pacific Basin nations to attend the Washington talks. The two sets of nations did not want to be split into two groups and suggested that they be allowed to send observers to the sessions in which they were not participating. The US agreed. The first session was held on 1-2 November 1971 for the Pacific Basin countries and the second session was held two weeks later on 16-17 November[149].

The Australian delegation was a little disappointed with the result of the talks. The final report from the Australian delegation to the Minister states,

> *'the talks did not disclose any significant new data in the technical and economic fields over and above what had already been published ...*

[lxxxiv] The six members of Euratom in 1971 were Belgium, France, West Germany, Italy, the Netherlands and Britain.

The information provided will do little, if anything, to help us assess the prospects for an enrichment plant in Australia'[150].

Baxter's draft letter to the US, however, stated '*our delegation found the meetings most helpful and appreciated the patience and willingness shown by senior staff in answering questions and in clarifying the information presented'*[151]. The reality appeared to be one in which the US gave away very few secrets but was willing to finance the establishment of a diffusion enrichment plant outside the US. Australia was not going to miss an opportunity whereby someone else would finance what could be a very expensive venture. Australia would continue with discussions with the US but Australia would also explore other partnerships as well.

Diffusion enrichment was by now becoming a very expensive outdated technology. The Atoms for Peace Conference held in Geneva in September 1971 showcased the new centrifuge enrichment technology which *'created a very strong impression and that there were even signs that the French determination to pursue the development of the diffusion process might well be weakening'*[152]. Australia had been developing a centrifuge enrichment technology, as were a number of other European countries.
Commercial centrifuge enrichment development in Europe dated back to March 1970 when three countries signed an agreement to develop this technology as a joint venture. The three countries were West Germany, the Netherlands and Britain and the Commission noted that *'Great Britain, the Netherlands and West Germany agreed on arrangements for enrichment using the gas centrifuge ... two trinational companies were formed'*; the prime contractor with its head quarters in West Germany would build enrichment plants in the Netherlands and Great Britain and the operating company would be based in London[153]. The two companies were CENTEC which would build the enrichment plants, and URENCO which would operate these enrichment

plants. CENTEC had built pilot plants at Capenhurst in Cheshire and Almelo in Holland both of which were operated by URENCO.

Australia during 1971 was quite sure that a uranium enrichment plant would be established somewhere in Australia in the not-too-distant future. The next step was to decide where this enrichment plant should be built. The requirement was simply a reliable and cheap power source and Victoria, Queensland and New South Wales could supply this. The Prime Minister (McMahon) wrote to the Premiers of these states outlining the government proposal of developing a uranium enrichment plant and asking if they would be interested in participating in the venture. They all were. The Prime Minister also wrote to the other state premiers informing them of the government's proposal and stated that they would be kept informed of all future developments. All except one state premier was supportive of this notion. The Premier of Tasmania, however, wanted to have Tasmania considered as a possible location for an enrichment plant. Such a plant would provide employment and Tasmania was desperate to develop industries to employ its population[154].

The Commonwealth government would continue exploring the possibility of a multinational uranium enrichment venture, having discussions with the US, the French and the Japanese. Relations with France would eventually turn sour when the Labor government took office and opposed the French nuclear tests in the Pacific. The US partnership would never eventuate but the US would help fund some experimental work on enrichment.

In June 1973 the Commission became a member of the Association for Centrifuge Enrichment which had been established in May of that year, *'AAEC joined the Association for Centrifuge Enrichment 'by invitation"*[155]. The

Association for Centrifuge Enrichment (ACE) had been established by the European Tripartite nations to '*assess the technical and economic features of the centrifuge process and the methods of financing, construction, siting and operation of centrifuge plants*'[156]. These nations had all been working on centrifuge enrichment processes in secret '*but had decided to pool their resources and to use the best features of the national machines to develop the future commercial models*'[157]. Australia joined the other ACE member nations which included France, Canada, Japan, Belgium, the Netherlands, the United Kingdom, Sweden, Spain and West Germany.

The association met every three months at Eton in the UK. Keith Alder, who was Australia's representative on this association, stated '*during the ACE study it was quite clear that the members most interested in the CENTEC-URENCO technology were Japan and Australia*'[158]. The Association for Centrifuge Enrichment was formally terminated in September 1974, when the study had been completed. All the commercial secrets in this area had been shared by the participating countries and now it was time to develop this type of enrichment process commercially by the member nations. In November 1974 it '*was announced that Japan would cooperate with Australia in studying the possibility of uranium enrichment in Australia*'[159].

This study was initiated by Rex Connor who had placed it under the control of his department. However, it did not get under way until after the Whitlam dismissal and the new Minister was forced to allow it to proceed. In May 1976 the AAEC was formally instructed to participate in this joint study with Japan and during the next two years a number of visits to Japan and from Japanese delegations would take place.

The AAEC Annual Report of 1976 indicates the positive feelings that were held for a possible commercial enrichment plant being established in Australia; *'it was realised that a modular cascade concept would offer considerable advantages in a commercial plant. In this concept a number of machines are grouped together in a module in such a way that they can produce the required product'* and *'the Commission considers that it is technically feasible to design and build a major pilot plant in Australia incorporating several thousand machines'*[160]. This joint study with Japan continued until 1978 when the final report was submitted and the project died. Alder reported that '*from our point of view the ideal outcome would have been a partnership between Australia, Japan and URENCO. However the study report simply vanished into government circles late in 1978 and no more was heard of it'*[161].

The Uranium Enrichment Study Group was established in 1976 '*to examine the feasibility of establishing an enrichment industry in Australia'*[162]. This group had the support of the government when 'The Deputy Prime Minister ... said in a speech ... on 29th March 1976: *'we wish to see uranium processed to the maximum extent practicable in Australia. The Government would want to see private enterprise participate as fully as is possible the development of uranium hexafluoride and enrichment industries in Australia'*[163]. The Minister wanted private industry to express an interest in this and the Commission noted that it had received expressions of interest. This initial group was led by Tyree Industries but was deterred by the complexity of the security and inter-governmental arrangements required. Later a large group called the Uranium Enrichment Group of Australia (UEGA) was formed, consisting of Broken Hill Proprietary Ltd (BHP), Colonial Sugar refining (CSR), Peko-Wallsend (Peko) and Western Mining Corporation[164].

The findings of this initial study group were so encouraging that, on 2nd January 1980, the government announced that the Uranium Enrichment Group of Australia would carry out a study to assess the viability of establishing a uranium enrichment industry in Australia[165]. By the end of the year the group had concluded that it would be feasible to establish a commercial enrichment plant, that centrifuge enrichment was the better commercial option (than diffusion technology) and that a more detailed study would be required[166]. The detailed study did indeed take place with the AAEC being asked to give its technical advice to the joint venturers. The Uranium Enrichment Group of Australia produced its final report in September 1982 in which it recommended that an enrichment plant be built using the technology offered by URENCO-CENTEC and that it be sited either near Adelaide or Brisbane[167]. Needless to say this project was also abandoned after the March 1983 federal elections; Labor ideology wanted nothing to do with nuclear energy.

The work on centrifuge enrichment was complemented by another newer form of enrichment technology: laser enrichment. This was still in its infancy when the Commission first started work in the area, and at this time it was also highly classified. The first mention of the Commission being involved in any form of research into the laser enrichment processes was in the Commission's Annual Report of 1976. However, work on laser enrichment had started much earlier, possibly as early as 1971. The buildings occupied by the laser enrichment project at Lucas Heights at this time were guarded by Commonwealth Police so as to bar entry to those not involved in the work.

There were two possibilities for isotope separation using lasers: AVLIS and MLIS. AVLIS (atomic vapour laser isotope separation) was developed in the US. It used a stream of uranium atoms in a vacuum which were selectively

photoionised[lxxxv] using photons of approximately 600 nm generated by tunable rhodamine dye lasers pumped by pulsed copper-vapour lasers. This process can, in theory, produce almost complete isotope separation in one step but the problems associated with establishing the correct conditions for this to occur are extremely difficult. The Americans have now abandoned the AVLIS project, after spending huge sums on its development since they began in the early 1970s. The Commission initially explored this option but decided against it, preferring instead the molecular laser isotope separation method (MLIS)[168]. The MLIS method dissociates a gaseous uranium compound by infra-red lasers. This was the area to which all the Commission research was directed. The volatile molecules most studied were the uranyl fluorinated diketonates. These volatile uranium compounds were selectively dissociated by line-tuned carbon dioxide lasers. Regardless of the differing experimental conditions, or the compounds used, or the type of laser employed, a promising separation of the isotopes was never achieved[169].

The AAEC Annual Report of 1976 stated that '*two major types of process for uranium have been reported in which atomic or molecular species are irradiated with one or more lasers ...the advantages of the use of atomic vapour are that there is adequate separation of the spectra of the U^{235} and U^{238} isotopes and that suitable lasers are available for laboratory studies. The disadvantages include the difficulty of producing uranium vapour and the relatively low efficiency of lasers in the visible and ultra-violet spectral regions. The other process using a molecular species such as uranium hexafluoride, is believed to be theoretically possible but has not yet been demonstrated convincingly at the laboratory scale. One problem is the lack of suitable lasers in the required infra-red spectral region ... during the last two years uranium enrichment has been demonstrated experimentally on the milligram scale in*

[lxxxv] See Appendix 2

the commission's laboratories with several compounds using a pulsed carbon dioxide laser'[170]

During the late 1970s centrifuge and laser enrichment work continued, as did the work on conversion of yellowcake into uranium hexafluoride[171]. However by 1980 the laser enrichment work was no longer regarded as secret and those involved were allowed to publish their findings[172]. Finally with the election of a new government *'the Commission's long term program of uranium enrichment using centrifuge technology continued during the year, but is now being scaled down'*[173]. The following year (1984) the Commission noted *'The Centrifuge Enrichment Project Division was disbanded and most staff transferred to Nuclear Technology Division'*[174]. Work on laser enrichment went into retreat and work on the conversion of yellowcake into uranium hexafluoride also came to a halt.

The enrichment project was not the only area of research within the commission at this time. Ann Moyal noted that by 1973 attention was now focused on isotope production and growth of medical and industrial applications of radioisotopes[175]. Radioisotopes were now being regularly used in medical applications both in diagnoses and in therapeutic areas. This increased demand led to the development and application of new radioisotopes. One of the greatest advances that the Commission developed was the technetium 99m generator in the early 1980s. Technetium 99m is a short lived gamma-emitting radioisotope which can be used to bind with a number of organic molecules and hence can be metabolised to preferred locations or organs within the body. A scan can then be produced of that organ using a gamma camera to produce an image. Increased concentrations of technetium 99m usually indicate some form of disease and hence a positive diagnosis may be made.

The major problem with technetium 99m is that its half-life is so short that transporting the radioisotope to another city was not possible until the generator was developed. The generator consisted of molybdenum 99 which had been produced in HIFAR. This molybdenum source has a longer half-life of approximately three days and decays by beta emission into technetium 99m. Technetium 99m in turn decays by gamma emission and has a half-life of six hours[lxxxvi]. The technetium 99m can be 'milked' from a molybdenum source into a saline solution and then reacted with the requisite organic molecules at the hospital and then ready to be injected into the patient. The generator was designed so that it was a single unit ready for transportation and suitably shielded. The Commission noted that *'A sterile version of the AAEC technetium-99m generator is ready for general marketing'*[176] and a year later *'work is in progress on several projects aimed at improvements in the manufacture and performance of technetium-99m generators'*[177]. Today these generators are sent throughout Australasia and South-East Asia. See figure 7-6 for diagrams of the technetium-99m generator.

---

lxxxvi ${}^{99}_{42}Mo \rightarrow {}^{99}_{43}Tc + {}^{0}_{-1}e$

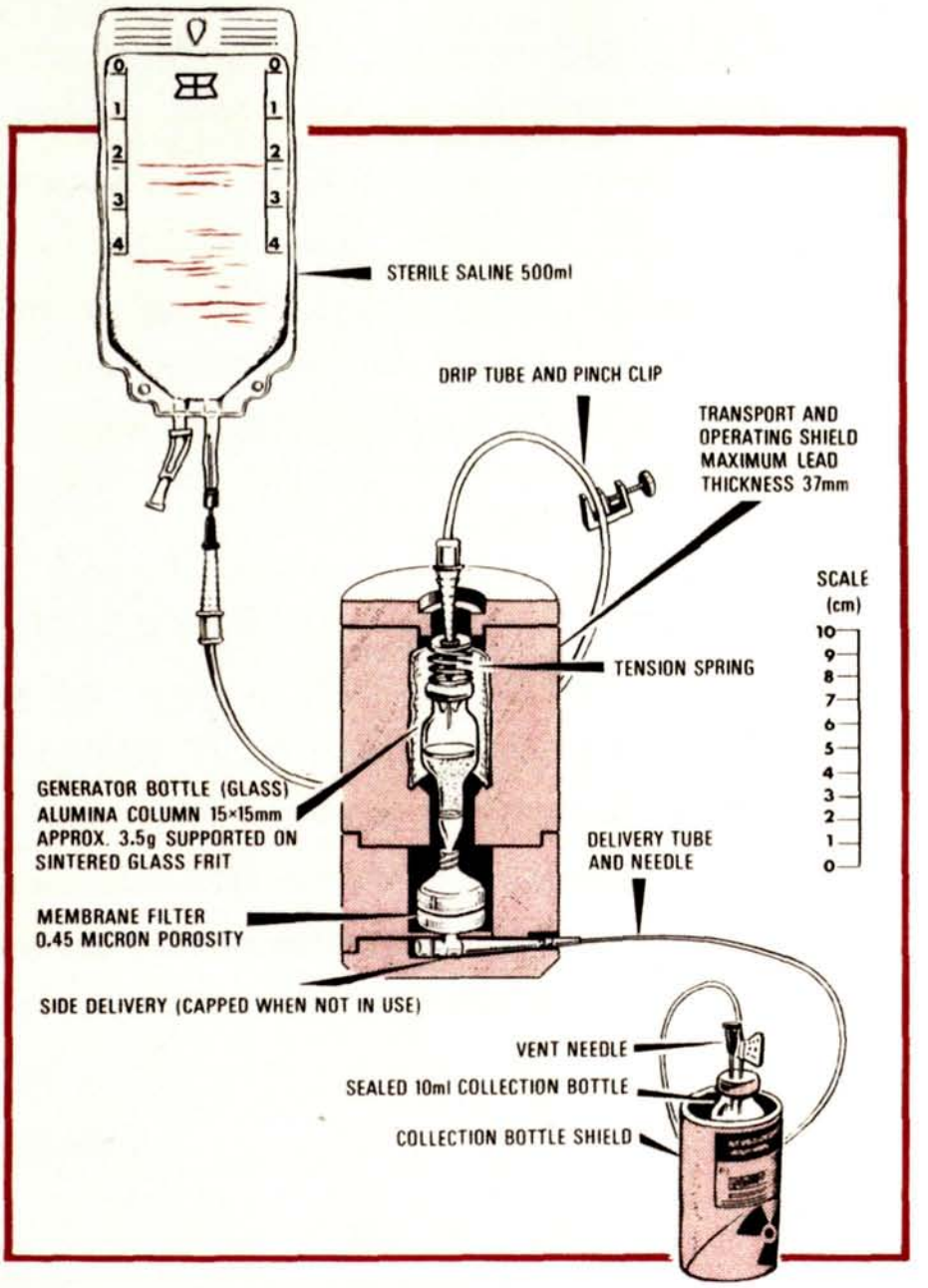

Figure 7-6 Technetium 99m Generator

P113 AAEC Annual report 1972

A design study for a new reactor was started as there was a concern over the future of HIFAR considering the increased demand for radioisotopes. This meant that a review into replacing HIFAR or at least into the purchase of an additional reactor was made in 1975-76 (this was the first of many such reviews that would occur during the next twenty years), *'consideration was given to the concept of using a small open-pool type of reactor to carry the*

bulk of the radioisotope production load, leaving HIFAR to take the research load and to be a stand-by facility for radioisotope production ...a single-pool reactor of medium power (35MW thermal) would cost much less to operate, would offer greater flexibility and could have an overall plant availability equivalent to the original concept of a two-reactor system involving HIFAR ... a conceptual design for a medium-powered, open pool reactor to meet all forecast needs is being prepared with the assistance of the research divisions'[178].

The following year both MOATA and HIFAR were still in operation and the design study for new reactor continued[179]. Finally *'in August 1977, the Commonwealth Government approved a Commission proposal to commence a design-cost study for a new reactor'*[180]. Needless to say the outcome of this study suggested that it was better (and cheaper) to upgrade the HIFAR facilities and that there was no need for a new reactor. A new reactor would now not be considered until 1996 when a change in government saw the need for a replacement reactor revitalised. MOATA was quietly decommissioned in the mid 1990s.

Figure 7-7 HIFAR

P52 AAEC Annual Report 1984

In 1977, the Commission noted that research into controlled thermonuclear reactions was continuing and solar energy conversion studies commenced and that a '*Japanese paper on the action of light on a titanium oxide single crystal producing hydrogen and electricity ... this was verified by experiment*'[181]. Much of this work would later be taken over by CSIRO and the universities.

7.7 Synroc

An interesting and somewhat incidental discovery was that of Synroc, a synthetic rock form made artificially to mimic mineral structures that remain geologically resistant to change through weathering or other natural processes. This discovery was made by Professor A.E.Ringwood from the Australian National University in Canberra in 1978. According to Hardy, the material first came to the attention of the Commission when Stuart Butler

joined the Commission as the new Director of the Research Establishment[182]. The Synroc process permitted the safe storage of fission products from nuclear reactors and other radioactive wastes with long half-lives. These highly radioactive materials could be embedded into a mineral structure from which they could never escape into the environment.

The problem of storing long-lived radioactive waste had long been discussed with great concern. There were suggestions to bury this waste in disused mines or some other such repository, but there is always the possibility of the radioactive isotopes leaching out into the environment. France embedded its nuclear waste in vitreous compounds which can hold the waste radioisotopes in a relatively inert form. These vitreous compounds can then be placed in underground repositories.

Synroc is a ceramic, a mixture of several titanate compounds which can be tailored to immobilise specific radioisotopes. The main minerals which comprise Synroc are hollandite, zirconolite and perovskite. Hollandite can be used to immobilise cesium, potassium, rubidium and barium; perovskite can immobilise strontium, barium and plutonium; and zirconolite can immobilise plutonium and other actinides[183]. The Synroc process involves the production of a solution containing the radioactive waste materials from the fission process. This high-level radioactive liquid waste is reacted with other materials to produce a non-soluble mineral residue. Water is then removed from this residue producing a powder. Once the Synroc powder is produced, it must be compressed into a solid rock form. This is accomplished by placing the powder in a bellows shaped barrel which is then heated and compressed to produce a very dense ceramic disc containing the radioisotopes within the matrix of the mineral ceramic material. It is these solid discs that can then be safely stored in larger containers and placed in repositories underground.

The Synroc invention seemed like a dream come true. A method of embedding radioactive waste in a form from which it could never escape. The Commission announced Synroc in its Annual Report of 1980 in the following way; *'The Synroc waste form, proposed by the Australian National University (ANU), is based on identification of several minerals known to have resisted alteration in a geological environment for many millions of years, and which can accommodate a wide range of radioactive elements in their crystal structures'*[184]. The Commission did not need to be sold on this concept and *'In March 1982, the Commission requested Government funding ... for the construction and operation of a near full-scale, non-radioactive SYNROC Demonstration Plant at Lucas Heights'*[185] and *'A non-radioactive SYNROC pilot plant is being designed and constructed as a joint project in collaboration with Professor A.E.Ringwood of the Australian National University, inventor of SYNROC'*[186]. By the following year *'The demonstration, non-radioactive SYNROC fabrication plant was designed and construction is underway'*[187].

The Commission noted that *'densification of SYNROC powder by the novel bellows hot-pressing technique was successfully demonstrated on a commercial scale'*[188]. Within two years the Commission announced that *'construction of the SYNROC demonstration plant was completed in June 1987, the full commissioning will take place in 1987/88. The plant will demonstrate the feasibility of fabricating SYNROC containing simulated radioactive waste on a commercial scale'*[189]. See figure 7-8 for a schematic diagram of the Synroc demonstration plant at Lucas Heights.

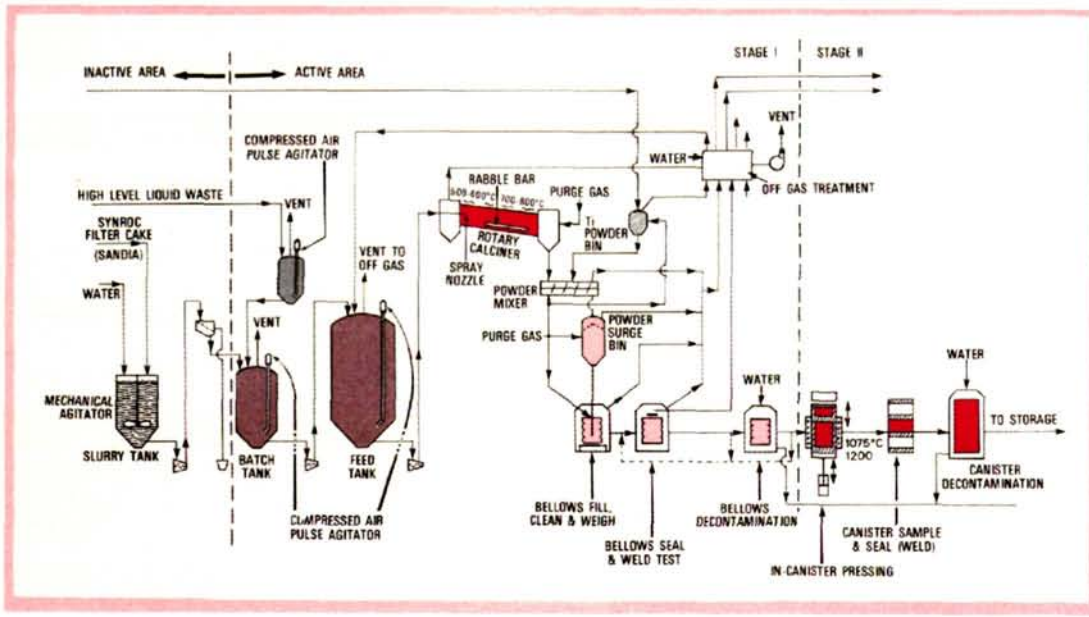

Figure 7-8 Schematic Diagram of the Synroc Demonstration Plant

P24 AAEC Annual Report 1983

The Synroc plant was commissioned in 1988 and was being evaluated by ANSTO and with the assistance of the UKAEA at Harwell, the Japan Atomic Energy Research Institute and with the Italian instrumentality ENEA.[190] Today the Synroc plant remains at Lucas Heights unused and no further developed. Visitors to the Research Establishment are taken to see this pilot plant which ran for only a few months and has since remained still. Whilst much negotiation and research into the production of Synroc has taken place, no development has occurred and no commercial interests have followed up this unique Australian development.

7.8 Conclusion

Australia possesses the largest uranium deposits in the world, yet due to some ill-founded government (and here one can include both the major political parties) policies this resource is sold overseas as a basic minimally refined product; yellowcake. Australia had the potential to not just mine the uranium but to process it into a form that could be used as fuel (ie convert

yellowcake into uranium hexafluoride and then enrich the uranium for reactor purposes and finally process this enriched uranium into reactor fuel rods). Australia could then have offered to buy back the spent fuel, reprocess and encapsulate the waste in Synroc. Australia had the potential to control the uranium fuel cycle for all its uranium exports, not only earning much needed foreign capital but also controlling to some extent what became of the uranium exports. But today Australia does none of this and remains a world's source of high quality uranium oxide.

---

[1] p683-4 Davison, G. Hirst, J. MacIntyre, S.
[2] p214 Bolton
[3] p215 Bolton
[4] p382 Moyal
[5] p220 Bolton
[6] p683-4 Davison, G. Hirst, J. MacIntyre, S.
[7] p216 Bolton
[8] p249 Bolton
[9] p116 AAEC 19th Annual Report 1971
[10] p379 Moyal
[11] National Archives of Australia A1838/2 720/4/9/1 Part 1 'Uranium Enrichment – French Feasibility Study'
[12] notes from Keith Alder
[13] National Archives of Australia A1838/2 720/4/9/1 Part 1 'Uranium Enrichment – French Feasibility Study'
[14] National Archives of Australia A 1838/2 720/4/9 Part 1 'Uranium Enrichment'
[15] ibid
[16] ibid
[17] ibid
[18] A 1838/2 720/4/9/1 Part 1
[19] p15 Alder
[20] p40 Hardy 1993
[21] p380 Moyal
[22] p380 Moyal
[23] p380 Moyal
[24] ibid
[25] notes from Keith Alder
[26] p380 Moyal
[27] Atomic Energy Act 1973
[28] p11 AAEC 22nd Annual Report 1974
[29] p380 Moyal
[30] p12 AAEC 23rd Annual Report 1975
[31] p14 AAEC 23rd Annual Report 1975
[32] p384 Moyal
[33] p218 Bolton
[34] p683-4 Davison, G. Hirst, J. MacIntyre, S.
[35] p232 Bolton
[36] p89-92 Kelly, P. 'November 1975; the inside Story of Australia's Greatest Political Crisis' Allen and Unwin 1995
[37] p232-3 Bolton
[38] p234 Bolton
[39] p239 Bolton

[40] p396 Davison, G. Hirst, J. MacIntyre, S
[41] p10 AAEC 23rd Annual Report 1975
[42] p11 AAEC 23rd Annual Report 1975
[43] p11 AAEC 23rd Annual Report 1975
[44] Atomic Energy Act 1953
[45] p11 AAEC 23rd Annual Report 1975
[46] p12 AAEC 23rd Annual Report 1975
[47] p40 AAEC 23rd Annual Report 1975
[48] p41 AAEC 23rd Annual Report 1975
[49] p67 Cawte
[50] p195 Bolton
[51] p19 Attwood B. (editor) *'In the Age of Mabo'* Allen and Unwin 1996
[52] p158 Cawte
[53] p235 Bolton
[54] p145 Grey,T. 'Jabiluka; The Battle to Mine Australia's Uranium' The Text Publishing Company, Melbourne 1994
[55] p33 AAEC 24th Annual Report 1976
[56] p190 Davison, G. Hirst, J. MacIntyre, S
[57] p239 Bolton
[58] p267-8 Davison, G. Hirst, J. MacIntyre, S
[59] p34 AAEC 24th Annual Report 1976
[60] p110 AAEC 27th Annual Report 1979
[61] p108 AAEC 25th Annual Report 1977
[62] p131 AAEC 26th Annual Report 1978
[63] p108 AAEC 25th Annual Report 1977
[64] p103-4 AAEC 24th Annual Report 1976
[65] p126 AAEC 26th Annual Report 1978
[66] p40-1 AAEC 25th Annual Report 1977
[67] p106 AAEC 25th Annual Report 1977
[68] p126 AAEC 26th Annual Report 1978
[69] Watson-Munro, C.D.
[70] p108 AAEC 25th Annual Report 1977
[71] p11 AAEC 26th Annual Report 1978
[72] p125 AAEC 26th Annual Report 1978
[73] p126 AAEC 26th Annual Report 1978
[74] p109 AAEC 27th Annual Report 1979
[75] p109 AAEC 27th Annual Report 1979
[76] p112 AAEC 28th Annual Report 1980
[77] p10 AAEC 29th Annual Report 1981
[78] p10 AAEC 29th Annual Report 1981
[79] p24 AAEC 26th Annual Report 1978
[80] p113-4 AAEC 27th Annual Report 1979
[81] p113 AAEC 28th Annual Report 1980
[82] p10 Alder
[83] p9 AAEC 29th Annual Report 1981
[84] p10 AAEC 29th Annual Report 1981
[85] p9 AAEC 30th Annual Report 1982
[86] p10 AAEC 29th Annual Report 1981
[87] p11 AAEC 29th Annual Report 1981
[88] p11 AAEC 29th Annual Report 1981
[89] Binnie Interview with Brennan 2000
[90] p10 AAEC 29th Annual Report 1981
[91] p16 AAEC 27th Annual Report 1979
[92] p64 AAEC 31st Annual Report 1983
[93] p270 Bolton
[94] p302 Davison, G. Hirst, J. MacIntyre, S
[95] p8 AAEC 20th Annual Report 1972
[96] p12 AAEC 23rd Annual Report 1975
[97] p33 AAEC 23rd Annual Report 1975

[98] p31 AAEC 23rd Annual Report 1975
[99] p34 AAEC 24th Annual Report 1976
[100] p12 AAEC 23rd Annual Report 1975
[101] p36 AAEC 24th Annual Report 1976
[102] p36 AAEC 23rd Annual Report 1975
[103] p36 AAEC 24th Annual Report 1976
[104] p37 AAEC 24th Annual Report 1976
[105] p37 AAEC 24th Annual Report 1976
[106] p39 AAEC 24th Annual Report 1976
[107] p37 AAEC 25th Annual Report 1977
[108] p38 AAEC 25th Annual Report 1977
[109] p42 AAEC 25th Annual Report 1977
[110] p60 Alder
[111] ibid
[112] p62 Alder
[113] p61 Alder
[114] p42 AAEC 25th Annual Report 1977
[115] p36 AAEC 24th Annual Report 1976
[116] p40 AAEC 25th Annual Report 1977
[117] p11 AAEC 23rd Annual Report 1975
[118] p125-6 Grey
[119] p127 Grey
[120] p128 Grey
[121] p31 AAEC 23rd Annual Report 1975
[122] p185-6 Fox R., 'Ranger Uranium Environmental Inquiry' Commonwealth Government Printer 1976
[123] p328 p334 Fox,R 'Ranger Uranium Environmental Inquiry; Second Report' Australian Government Printing Service, Canberra 1977
[124] p 328-9 Fox 1977
[125] p330 Fox 1977
[126] p330 and 335 Fox 1977
[127] p325-335 Fox 1977
[128] Ranger Uranium Project, Atomic Energy Act 1953 Authority under section 41
[129] p37 AAEC 27th Annual Report 1979
[130] p38 AAEC 27th Annual Report 1979
[131] p39 AAEC 27th Annual report 1979
[132] p19 'Energy Resources of Australia Ltd, Prospectus' October 1980
[133] www.iuc.com.au/emine.htm
[134] Ranger Uranium Project, A Deed and Ranger Uranium Project, Agreement 12 September 1980
[135] p380 Moyal
[136] Australian National Archives A1838/2 720/4/9 Part 1 'Australian Atomic Energy – Uranium Enrichment
[137] ibid
[138] National Archives of Australia A1838/2 720/4/9/1 Part 1 'Uranium Enrichment – French Feasibility Study'
[139] ibid
[140] ibid
[141] A1838/2 720/4/9 Part 1
[142] p52 Alder
[143] notes from Keith Alder
[144] A1838/2 720/4/9 Part 1
[145] ibid
[146] National Archives of Australia A1838/2 720/4/9 Part 3 'Australia Atomic Energy – Uranium Enrichment'
[147] A1838/2 720/4/9/1 Part 1
[148] ibid
[149] National Archives of Australia A1838/2 720/4/9/1 Part2 'Uranium Enrichment – French Feasibility Study'

[150] National Archives of Australia A1838/2 720/4/9 Part 6 'Australia Atomic Energy – Uranium Enrichment'
[151] ibid
[152] National Archives of Australia A1838/2 720/4/9 Part 4 'Australia Atomic Energy – Uranium Enrichment'
[153] p22 AAEC 18th Annual Report 1970
[154] A1838/2 720/4/9 Part 6
[155] p10 AAEC 21st Annual Report 1973
[156] p 50 Hardy, 1996
[157] p58 Alder
[158] p59 Alder
[159] p44 AAEC 23rd Annual Report 1975
[160] p44-6 AAEC 24th Annual Report 1976
[161] p65 Alder
[162] p102 Hardy 1996
[163] p41-2 AAEC 24th Annual Report 1976
[164] p172-3 Hardy 1999
[165] p106 Hardy 1996
[166] p110 Hardy 1996
[167] p120-1 Hardy 1996
[168] p6 Pryor A, 'Personal memories of Two Advanced Uranium Enrichment Projects at Lucas Heights in the Years 1972-1980'
[169] p6-9 Pryor 1980
[170] p48 AAEC 24th Annual Report 1976
[171] p43-4 AAEC 25th Annual Report 1977
[172] Eberhardt, J.E., Hoare, I.E., Johnson, D.A., Knott, R.B., Pryor, A.W., and Waugh, A.B. 'Multiphoton Dissociation of some volatile Uranyl Complexes' in 'Chemical Physics' 72 (1982) 41-49 and 51-59
[173] p22 AAEC 31st Annual Report 1983
[174] p12 AAEC 32nd Annual Report 1984
[175] p380 Moyal
[176] p35 AAEC 32nd Annual Report 1984
[177] p29 AAEC 33rd Annual Report 1985
[178] p90 AAEC 24th Annual Report 1976
[179] p95-7 AAEC 25th Annual Report 1977
[180] p110 AAEC 26th Annual Report 1978
[181] p65 AAEC 25th Annual Report 1977
[182] p183 Hardy 1999
[183] Jostsons, A 'Synroc-Progress and Future Prospects' Proceedings Australian Nuclear Association Conference, 24-25 October 2001'
[184] p36 AAEC 28th Annual Report 1980
[185] p23 AAEC 31st Annual Report 1983
[186] p21 AAEC 31st Annual Report 1983
[187] p11 AAEC 32nd Annual Report 1984
[188] AAEC 33rd Annual Report 1985
[189] p18 ANSTO Annual Report 1987
[190] p34 ANSTO Annual Report 1988