ASHET News

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Newsletter of the Australian Society for History of Engineering and Technology

ASHET Management Committee for 2015

At ASHET's annual general meeting on 30 April 2015, a new group of office bearers and committee members was elected, to hold office until the annual general meeting in 2015.

Members of the new committee are:

President	Robert Renew
Senior Vice President	David Craddock
Vice President	Mari Metzke
Secretary	Andrew Grant
Treasurer	Eric Metzke
Committee Members	Malcolm Brady John Roberts Neil McDonald

Ian Arthur, who has been member of ASHET's committee since its formation in 2003 and who served as secretary for the first ten years, did not seek re-election in 2015. He remains an active member of ASHET and currently edits and produces *ASHET News*.

ASHET's new secretary, Andrew Grant

Andrew Grant joins ASHET' management committee as secretary. He has been a member of ASHET since 2004.

Andrew has been deeply involved in preserving, documenting and promoting Australia's transport heritage since 1980, chiefly as a senior curator at the Powerhouse Museum, Sydney.

His career began in the 1970s in Industrial Arts education in which he took a leading role through the introduction of new courses in design method. He graduated with a B.Sc.(hons) from the UNSW and later gained an M.Sc. in Industrial Arts with a thesis about the coachbuilding industry in Australia.

After retiring from the Powerhouse in 2012, Andrew has continued his involvement in transport history and preservation through heritage consultancy

Andrew Grant

ASHET Pies display now on tour

Following the launch of ASHET's graphic display *The meat pie: Australia's own fast food* at History House on 19 February, the display has now commenced a tour of NSW local libraries. Thirty eight libraries have now asked for a loan of the display to be on show for a period of up to a month each. We had not expected such a demand, and have now ordered a second set of display panels to allow us to fulfil most of these requests before the end of 2016.

The display in nine large panels tells the story of he Australian meat pie from the early days of the Australian colony when pies were made in local pastrycook's shops and sold by street vendors, to the present day when most pies are made in large factories and delivered frozen for sale in supermarkets.

The display was researched and compiled by ASHET members and designed by Judith Denby of Sitespecific. ASHET received a grant from the Australian government under its *Your Community Heritage program* to assist with the project.

ASHET's committee is now looking at the possibility of producing similar displays on other aspects of Australian technology history.

Pies display at Chatswood Library

Pies display at Penrith during July

The display will be on show at the Penrith Municipal Library for the whole of July.

On Wednesday 22 July at 6.30 pm in the Library there will be talks about the history of the meat pie and pie making by Anne Arthur and Tom Lindsay, musical entertainment the Meat Pie Continuum and a tasting of pies from the local pie makers Sargents Pies. This event is free.

Tickets are available from Penrith Library at 02 4731 2201 or email pcclib@penrithcity.nsw.gov.au.

Next ASHET events

Tuesday 14 July, 2015
Talk by Michael Adams
Lawrence Hargrave: Australian Father of Flight; the Centenary of his death

Lawrence Hargrave is generally considered one of the main contributors to eventual human flight. His inventions included the radial rotary engine and stable wing surfaces, as well as wing shapes of optimum lift. His meticulous scientific method paved the way for the Wright brothers and the first European aviators of the 20th century. Had he a suitable engine he probably would have flown, but he was ahead of that time. 2015 marks the centenary of his death. The new Sydney airport is expected to be named this year, and Hargrave is a front-runner, giving more poignancy to the presentation.

Michael Adams, founder of the Lawrence Hargrave Centre (LHC), will deliver his PowerPoint presentation on the evening of the actual Centenary of Hargrave's death, July 14 1915 and illustrate it with models commissioned by LHC.

LHC has erected a heritage display in Stanwell Park where Hargrave lived from 1893 and where he carried out his pioneering experiments with box kites and wing surfaces. LHC has commissioned several models of Hargrave's most significant contributions to aviation, and hopes these will eventually be housed for public display and easy access at Stanwell Park.

This is a joint meeting of ASHET, the Royal Australian Historical Society and the Lawrence Hargrave Centre.

Venue: History House, 133 Macquarie Street, Sydney
Time: 5.30 for 6 pm
Cost; Includes light refreshments on arrival; RAHS and ASHET members $10, others $12
Bookings: phone RAHS on (02) 9247 8001 or email history@rahs.org.au

Thursday 27 August 2015
Talk by Rob Renew
The ATL factory in Meadowbank: making automatic totalisators for the world

When the ATL factory in Nancarrow Avenue Meadowbank was completed in 1947, it was claimed to be the most advanced precision engineering works in Australia. Its purpose was to make parts for automatic totalisator systems which were being installed by ATL at racetracks around the world, and it also made precision moulding dies, tools, gauges, and telecommunications equipment. In contrast to previous ATL factories, the internal layouts put great emphasis on separation of functions, efficiency, cleanliness, and employee comfort. The factory buildings were described as an outstanding example of Functionalist Style, an aspect of the Modernist movement in architecture. Since the demise of ATL in the 1990s the factory has been put to other uses and is soon to be demolished.

Rob Renew was previously Principal Curator (science & industry) at the Powerhouse Museum in Sydney. In 1994 he and Matthew Connell 'discovered' a collection of equipment, reports, brochures and photos in a Homebush warehouse – the remains of the entire company archives of Automatic Totalisators Limited, Australia's first and most successful manufacturer of special-purpose computing systems.

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Thursday 17 September 2015
Talk by Peter Shadie and Philip Hammon
The Bleichert Ropeway

Built by German engineers Adolf Bleichert & Company in the 1880s, the Bleichert Ropeway carried valued coal and oil shale across the Jamison Valley in the Blue Mountains. It was one of the first examples of industrial scale coal and shale oil mining infrastructure in Australia. In 2014 and 2015 the Blue Mountains World Heritage Institute in partnership with Scenic World and the National Parks and Wildlife Service undertook a comprehensive field survey of the remains of the ropeway. The survey was undertaken by the Federated Archaeological Information Systems project using a state-of-the-art tablet-based recording tool. Students from UNSW also developed a computer gamification of the ropeway to illustrate how it operated. The work has given insights into the ropeway's operation and how it failed and will guide further conservation and interpretation.

Peter Shadie has over 35 years' experience working in conservation both in Australia and abroad. From 1999 to 2010 he has worked on the International Union for the Conservation of Nature (IUCN)'s Global Protected Areas Programme. Peter was Executive Director for the 2003 IUCN 5th World Parks Congress and from 2006 to 2010 Head of IUCN's Protected Areas Programme in Asia, based in Bangkok and leading the Union's protected area work across 23 countries. Since 2010 Peter has been based in the Blue Mountains where he works as a freelance consultant on protected area and World Heritage. Peter is the Chief Executive Officer of the Blue Mountains World Heritage Institute. He has also been a Member of IUCN's World Heritage Panel and is an IUCN Senior Advisor on World Heritage. He is a member of the World Commission on Protected Areas and an advisor on a number of specialist groups.

Philip Hammon was born in Katoomba and raised with the Scenic Railway "in his blood". His father bought it in 1945, and Philip has spent many hours wandering the rainforest wondering at the Ropeway remains strewn around. In 2008 he and Phillip Pells wrote a book titled "The Burning Mists of Time" which captured the history of the coal and shale mining in the Katoomba area, but much more work was left to do on the ropeway itself. He and Charles Needham are currently reverse engineering the Ropeway to give a scientific background to the material remains.

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Nuclear energy and Australia

This article traces briefly the history of nuclear energy from its discovery by scientists in the early years of the twentieth century and then follows its history in Australia from the time early in World War II when Britain and America looked to Australia as a source of uranium for the atomic bomb that they were developing.

Soon after the end of the war, Australia became involved with nuclear energy on several fronts; as a site for Britain to conduct tests of nuclear devices in connection with its atomic bomb development; as an eagerly sought source of uranium by the British and American governments, which both believed there was likely to be a world shortage of material to make nuclear weapons and for peaceful applications; and as a centre for research and development that it was hoped would lead to the use of nuclear energy as an economical source of energy for electricity production and for various other peaceful applications in Australia..

The article is in two parts because it is too long to fit in a single issue of *ASHET News*. The part published in this issue takes us to around 1950, by which time there was a vigorous program of exploration for uranium in Australia; the British had exploded nuclear devices on islands off the Western Australian coast and on the mainland; mining and processing uranium on a commercial scale had begun in Australia; and plans were afoot for an atomic research establishment.

The British were soon to be delivering electrical power to the grid generated from nuclear energy, and the Americans were soon to launch a nuclear powered submarine. The Australian government was anxious not be left behind in the commercial application of nuclear power.

The second part of the article, to be published in a future issue of *ASHET News* takes the history of nuclear energy in Australia up to the present day.

The Basics

2,400 years ago Democritus, a Greek philosopher, conjectured that the world is made for indivisible substances called atoms. This was the generally held view amongst scientists until the beginning of the twentieth century. Over the first forty years of the twentieth century, scientists gradually developed an understanding that atoms are divisible, and consist of a core, the nucleus, composed of neutrons and protons, surrounded by a cloud of electrons. The protons and neutrons forming the nucleus are held together by the 'strong force' that acts between them. It acts over an extremely short distance and is far more powerful than the force of gravity. Also acting on the particles that carry an electrical charge, (a positive charge for the protons and a negative charge for the electrons) is the electrical force that attracts particles with unlike charges and repels those with like charges. In stable atomic nuclei the attractive 'strong' force between the particles overcomes the electrical repulsive force between the positively charged protons.

Isotopes are variants of a particular chemical element that have the same number of protons in their nucleus but which have different numbers of neutrons. It is the number of protons in the nucleus (the atomic number) that determines the chemical properties the element. An atom of a particular element always has the same number of protons in its nucleus but the number of neutrons may vary widely. The atoms in naturally occurring elements are generally a mixture in constant proportions of several isotopes. In nuclear physics, isotopes are important because different isotopes of a particular element can behave in very different ways even though they have the same chemical properties.

The atomic nuclei in most but not all naturally occurring substances are stable. Radioactivity in a substance is an indication that it contains isotopes that are unstable and undergoing change that is producing the radiation. Scientists in the late nineteenth century observed this instability in elements such as radium. In the early years of the twentieth century many other sources of natural radioactivity were observed. Further work showed that instability could be induced in certain isotopes by bombarding them with neutrons, heating them to an extremely high temperature or inducing their atoms to collide at high velocity.

Understanding radioactivity

In 1896 French physicist Henri Becquerel discovered that uranium emitted radiation that could darken a photograph, and that radium and polonium were also radioactive. Work by Marie Curie and her husband Pierre hypothesised that the radiation had its origin in changes in the atomic nu-

About the author

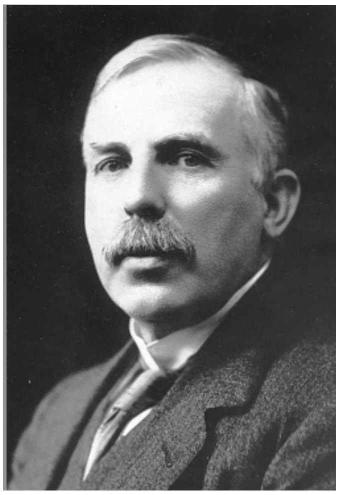
Ian Arthur joined the Australian Atomic Energy Commission at Lucas Heights in 1957, and worked there as an engineer on its High Temperature Gas Cooled Reactor (HTGR) research program. He was seconded to work for two years in Britaiin with the United Kingdom Atomic Energy Authority at Risley, Lancashire, on the design of a prototype Steam Generating Water Reactor (SGHWR) for electricity generation. On his return to Australia he continued to work on the HTGR project.

In 1964 Ian joind General Atomic at La Jolla, California to work on the design and construction of a prototype HTGR power station at Fort St. Vrain, near Denver, Colorado. He also headed a team working on the design of a 1000MW HTGR power station, for which General Atomic obtained orders from several electric utilities. All of these orders were cancelled following the Three Mile Island accident in 1979 in which a completely different type of nuclear power station was involved, but which resulted in a halt to orders for nuclear power plants in America for several years.

Ian returned to Australia in 1971 and since that time has not worked in the nuclear energy industry, although he has retained an interest in its development.

Ian Arthur

Frederick Soddy



Ernest Rutherford

cleus. In 1901 Ernest Rutherford, Professor of Physics at McGill University in Canada, and his student Frederick Soddy, studied the radioactivity of uranium and found that three kinds of radiation were being produced, that they named alpha, beta and gamma radiation, along with the release of energy. In 1902 Rutherford and Soddy produced a "Theory of atomic disintegration" to account for their observations.

Soddy wrote in popular magazines that radioactivity was a potentially inexhaustible source of energy and offered a vision that it would be possible to 'transform a desert continent, thaw the frozen poles, and make the whole earth one smiling Garden of Eden." Soddy also saw that atomic energy could possibly be used to create terrible new weapons.

Rutherford continued his research on radioactivity and the structure of the atom for the rest of his career and received a Nobel Prize in 1909. Soddy first suggested the idea of isotopes in 1913, and received a Nobel Prize in 1921. Soddy's articles provided the inspiration for the H.G.Wells' 1914 novel *The world set free*. In 1914 J.J.Thomson found the first evidence of multiple isotopes existing in stable elements.

In 1929 Mark Oliphant, an Australian working under Rutherford in the Cavendish Laboratory at Cambridge University, observed nuclear fusion, a process in which two light atomic nuclei can be induced to fuse, forming the nucleus of another element, along with the release of a large amount of energy. Scientists have seen nuclear fusion as a future source of energy for industry. Much work has been done, and continues, on overcoming the practical difficulties involved, leading to the tongue in cheek forecast that harnessing fusion as a source of industrial energy is always thirty years in the future. A fusion reaction involving two isotopes of hydrogen, deuterium and tritium, is the source of energy for the hydrogen bomb. In 1932 English physicist James Chadwick identified the neutron, for which he received a Nobel Prize in 1935. In 1933 physicist Leo Szilard conceived the idea that if a neutron induced nuclear reaction itself produced neutrons which could then cause further reactions the process might be self-perpetuating. In 1938 Otto Hahn and his assistant Fritz Strassman demonstrated in Germany that bombarding uranium with neutrons produced fission.

Fission is a process in which the bombarded nucleus of a heavy atom such as uranium can be induced to split apart into two parts of approximately equal atomic weight. In the process free neutrons are also produced along with the release of a large amount of energy. In 1939 Lise Meitner, who had worked with Hahn, and her physicist nephew Otto Frisch, published a paper explaining the theoretical mechanism involved in nuclear fission. The fission of each U-235 nucleus produced two or three neutrons, indicating the possibility of a chain reaction.

The idea of a nuclear weapon

Three European scientists working in America, Leo Szilard, Edward Teller and Eugene Wigner, persuaded Albert Einstein to sign two letters in 1939 and 1940 to the President Franklin Roosevelt about the recent discoveries in fission and the possibility of Nazi Germany building atomic weapons.

In 1940 Otto Frisch and Rudof Peierls at Birmingham University predicted that about 5kg of pure Uranium-235 would make a powerful atomic bomb. They suggested ways in which the bomb could be detonated and how the Uranium-235 could be separated from natural uranium. They set their findings out in a memorandum and gave a copy to their professor Mark Oliphant. He passed it on to Henry Tizard, chairman of a top level defence committee of the British government, who formed a special committee, the MAUD Committee, to consider and report on the implication of the memorandum. Members of the committee, chaired by Sir George Paget-Thomson, included Oliphant, James Chadwick, Patrick Blackett, Philip Moon and John Cockcroft, all distinguished nuclear scientists. It produced two reports in 1941 titled '*Use of Uranium for a Bomb*' and '*Use of Uranium as a Source of Power*'.

The reports contained details including cost estimates for making bombs and recommended that the work was urgent and should proceed in conjunction with the Americans, who were not at that time at war. It noted that plutonium might be more suitable for a bomb than uranium, and recommended that work on a plutonium bomb be continued in Britain. The second report concluded that controlled fission of uranium held significant promise for the production of heat for industry and isotopes for medical and industrial use. It referred to using heavy water and possibly graphite as moderators in a nuclear reactor to slow down the fast neutrons produced by the fission reaction and facilitate their capture by uranium nuclei in a controlled chain reaction that could produce power on an industrial scale. They recommended that this work on civilian use of nuclear energy be deferred until after the war. Oliphant took the reports to America in August 1941 and discussed them with senior scientific administrators in government and in the National Academy of Sciences. He stressed the urgency of the bomb project and the need for American participation if it was to proceed with the necessary speed. The Americans were impressed but appeared more interested in nuclear energy for power than for bombs.

The Manhattan project

Pearl Harbour in December 1941 changed everything and within a short time the Manhattan Project was under way. Its objectives were to produce both uranium and plutonium bombs in the shortest possible time. A team of British scientists was sent to America to work on the project. The team was headed by James Chadwick and included Oliphant and also Philip Baxter seconded from ICI in Britain. Baxter had been working on producing gases based on uranium that would be used in the enrichment process that separated the fissile U-235 from the non-fissile components of natural uranium.

The world's first nuclear reactor, Chicago Pile-1, was built as an early part of the Manhattan Project, to demonstrate the practicality of the concept of a controlled nuclear chain reaction. The project was undertaken by Leo Szilard and Italian born physicist Enrico Fermi. The chain re-

Mark Oliphant

James Chadwick

Leo Szilard

Enrico Fermi

action was initiated on 2 December 1942. It used natural uranium rods embedded in graphite blocks that served the purpose of or slowing down ('moderating') the fast moving neutrons produced in the fission reaction. Cadmium control rods which absorbed free neutrons could be inserted to slow down or stop the chain reaction, or partly withdrawn to speed it up. The amount of energy produced in the reactor was very small and there was no cooling system or radiation shielding.

The first plutonium device was exploded in New Mexico on 16 July 1945. The first U-235 bomb was dropped on Hiroshima on 6 August 1945. It was considered that it did not need testing. The first plutonium bomb was dropped on Nagasaki on 9 August.

Nuclear power for electricity production

In 1946 the US Atomic Energy Commission began a program at Oak Ridge to develop nuclear reactors for electricity production. The team included Hyman Rickover, a senior naval officer who saw the possibilities for a nuclear submarine. A project to develop one became a high priority and assumed priority over producing electric power for civilian purposes. The first nuclear submarine, named the *Nautilus*, was launched in 1954. Its reactor was moderated and cooled by high pressure water and used to generate electricity for propulsion. The fuel was enriched uranium. Since then a total of over 400 nuclear submarines have been built by several countries. Similar reactors are used in nuclear powered aircraft carriers and in a small number of other surface craft including nine Russian ice-breakers.

The Oak Ridge team developed a reactor for land based electricity production based on the same pressurised water reactor (PWR) technology as the submarine. The Shippingport reactor, commencing operation in 1957, was the world's first power reactor to be built for civilian purposes. PWRs became the dominant type of nuclear reactor for power generation throughout the world.

In Britain the government decided in 1947 that it should develop its own nuclear weapons, and that they should include both U-235 and plutonium bombs, as had the Americans. It built a uranium enrichment plant at Capenhurst that began operation in 1953, and reactors at Windscale that commenced operation in 1950 to produce plutonium. The government looked to Australia as a source of uranium and also as a place to carry out tests. The first test of a British nuclear device was in the Montebello Islands off Western Australia in 1952, making Britain he third country in the world to explode a nuclear device after America in 1945 and Russia in 1949. Further tests were carried out by the British on the Australian mainland at Maralinga.

Britain was the first country in the world to harness nuclear power for electricity generation on a commercial scale with its reactors at Calder Hall and Chapelcross, the first of which was opened by the Queen in 1956. The reactors were graphite moderated and fuelled with natural uranium. They served a dual purpose of generating electricity and producing plutonium for the weapons program. The Russians had generated electricity from a 5MW nuclear power plant in 1952.

Nuclear energy in Australia

In 1944 the British government asked Australia, which was known to have some uranium, to explore for deposits that could support a weapons program. The Chifley government agreed to establish an exploration program and in 1946 legislated to provide that all uranium discovered would be the property of the government. It stopped short of providing a guarantee that future discoveries would be reserved for Britain. The British government, anxious to keep the Australian on side, offered seven fellowships for Australians to work at the newly established nuclear energy laboratories at Harwell.

The Australian government had already been alerted to the likely future importance of nuclear energy. In 1941, Mark Oliphant, visiting Washington to alert the American government to the contents of the MAUD reports, had called on the Australian Ambassador, Richard Casey, and told him of English work on uranium and the possibility of using nuclear energy for 'war purposes and industry'. At Oliphant's request, Casey sent a secret memo to David Rivett, Chief Executive Officer of the Council for Scientific and Industrial Research (CSIR), who was then engaged in war-related work. Rivett began a campaign to gain Australian access to atomic research overseas. He had little success. However Prime Minister Curtin and his ministers, when alerted to the industrial possibilities of nuclear energy, took an immediate interest. Then in 1945 when the war ended after the bombs had been dropped on Japan, the Australian media became enthusiastic about the possibilities of nuclear energy for defence and industry.

In London Oliphant told Dr. H.V.Evatt, Australia's Minister for External Affairs, what he knew of Britain's plans for nuclear energy. Evatt was enthusiastic, and typically concerned that Australia should not be left behind. Early in 1946 Prime Minister Chifley invited Mark Oliphant to be a technical adviser to the Australians attending the UN discussions on international control of nuclear weapons. Encouraged by Evatt, John Dedman, the minister responsible for CSIR, approached Cabinet with a plan to begin research on the industrial uses of atomic energy and established an Atomic Energy Advisory Committee. Dedman declared publicly his confidence both in atomic energy and in Australia's ability to obtain the necessary technology. At the same time, the government was pressing ahead with its search for uranium, largely through the Bureau of Mineral Resources which it established in 1946.

In 1949 the Chifley government reorganised CSIR to remove sensitive information from its jurisdiction and renamed it CSIRO. In the same year it establihed an Industrial Atomc Energy Committee, chaired by Oliphant, to advise the government on the industrial use of atomic energy.

Nuclear power for South Australia?

Chifley's was not the only Australian government at this time with an interest in nuclear energy and in seeking Oliphant's advice. Tom Playford, Premier of South Australia, saw nuclear power as a possible way of encouraging industrial development in South Australia, which lacked high quality resources for producing electric power. Small amounts of uranium had been found at Mount Painter and in 1946 these were the only known uranium Potentially commercal resources in Australia. In 1947, claiming that the Australian government's assessment of these deposits was incompetent, Playford directly approached the British government with an invitation to inspect them and to enter into a joint development project. The British declined. Further work confirmed that the Mount Painter uranium was not worth developing, but by 1948 500 tons of recoverable reserves had been found at Radium Hill, and Playford claimed they were sufficient to support a nuclear industry. In 1950 he was still seeking the support of the Australian government in a new approach to the British government and in 1951 made another direct approach to Britain with plans for a joint development project. Once again he was turned down.

Playford then turned to the Americans, and was able to secure a contract under which the South Australian government would contribute $1 million to develop a 200 tons per year project; the American government would lend $4 million and would purchase the uranium at a surprisingly high price. Playford had deliberately excluded the Australian government from the negotiations and it was not until December 1951, after Playford had reached agreement in principle, that the American State Department provided copies of the documents to the Australian Ambassador in Washington, Sir Percy Spencer, that the Australian government became aware of Playford's final success in his search for a buyer of the Radium Hill uranium. Mining continued for seven years until the deposit was worked out. In the end Playford had failed to establish a lasting nuclear energy industry in South Australia.

In the years that Playford was trying to interest the British and the Americans to help develop Radium Hill, the Australian government had continued to explore for uranium and offered rewards to successful prospectors. Australia's first major uranium deposit, at Rum Jungle in the Northern Territory, was discovered in 1949, just after Menzies had succeeded Chifley as Australia's Prime Minister.

Developments under the Menzies government

Within a month of assuming office Menzies reconvened the Industrial Atomic Energy Policy Committee, with the brief of advising Cabinet on 'all aspects of our atomic energy program'. At Oliphant's suggestion Philip Baxter, who had been recently been appointed to the chair of chemical engineering at the newly formed NSW University of Technology (later the University of New South Wales), was invited to join the committee. Baxter, as research manager of ICI's Central Laboratory in Britain at the beginning of World War II he had provided had provided samples of uranium hexafluoride to James Chadwick for research on producing an atomic bomb, and was later seconded to Oak Ridge in America to work on the Manhattan Project. Baxter later became Vice Chancellor of the University of New South Wales and Chairman of the Australian Atomic Energy Commission. From the time of his arrival in Australia he soon became the country's leading protagonist for the development of a nuclear energy industry in Australia and the government's principal adviser on nuclear energy.

By December 1951 the Bureau of Mineral Resources had completed its assessment and concluded that they were sufficient to support a mining and processing project, but not enough to support a nuclear power industry. The quality of the reserves was far higher than those at Radium Hill. The Americans were keen to support a project and purchase the products to support its weapon program. Much haggling ensued and an agreement was signed in January 1953 between the Australian and the American governments.

Meanwhile Britain, which had been developing its own atomic bomb, was looking for a suitable site for its testing, scheduled for 1952. The initial idea had been to use the American test site, in Nevada, but British-American tensions over security were high, especially after the Russians had tested their first bomb in 1949. So in 1951 British Prime Minister Clement Attlee approached the Australian government about testing in Australia. Menzies agreed in principle to the proposal, and visited London to discuss details. While there he asked about the possibility of a joint U.K/Australia project to build a large industrial reactor and proposed that the director of Britain's nuclear research establishment at Harwell, Sir John Cockcroft, should discuss this with Oliphant. Two months later Attlee wrote to Menzies advising him that investigations had established that the Monte Bello Islands off the Australian coast would be a suitable test site and making a formal request for permission to use the site and for Australian assistance in preparing it and in conducting the test. A few days later, before he received a formal response to his requests, Attlee sent a telegram to Menzies declaring readiness to collaborate with Australia in the industrial development of atomic energy 'to the best of our ability'. He advised that the complete separation of power and military programs would not be possible and that a worthwhile program could not be undertaken without the use of classified information. He would need Australian agreement that any program in the industrial field would need to be classified to the extent that was necessary to satisfy rules agreed to between Britain, America and Canada. Menzies delayed formal agreement to the test site until after elections in September.

After the election, Menzies moved to meet Attlee's security requirements by disbanding the IAEPC and replacing it with a new Atomic Energy Policy Committee, to advise on defence and policy aspects of atomic energy, including exploration for Australian ores and the development of uranium resources. The committee was responsible to the Minister for Supply, and consisted of a representative of the Department of Supply as chairman, and representatives of the Department, of Defence, Treasury, Defence Production and National Development, and CSIRO.

A primary priority for the committee was the need for uranium by Britain and America. The committee also considered that urgent action was needed to establish an Australian program for participation in atomic energy research and development. Sir John Cockcroft, who was in Australia to supervise preparations for the test at Monte Bello, met the committee in September 1952, and also met with Menzies. Cockcroft emphasised the need for Australia to make an original research contribution. He explained that for security reasons Britain could give information to Australia only if it were needed in connection with an Australian atomic energy project.

An immediate outcome was the formation in September 1952. of the interim Australian Atomic Energy Commission (AAEC). The AAEC was formally established under the Atomic Energy Act, 1953, with wide powers to conduct activities related to nuclear energy.

This is a convenient point to end this first part of the article, which will be continued in a later issue of *ASHET News*.

Sources and further reading

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A convenient and generally up to date source that provides a starting point for reading and research on almost any topic.

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A detailed history of the Australian Atomic Energy Commission, written by a scientist who worked there from 1971 to 1987.

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Philip Gissing, *Sir Philip Baxter, Engineer: The Fabric of a Conservative Style of Thought*, PhD thesis, University of NSW

A comprehehsive and well referenced biogrpahy of Philip Baxter, including his involvement with nuclear energy.

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