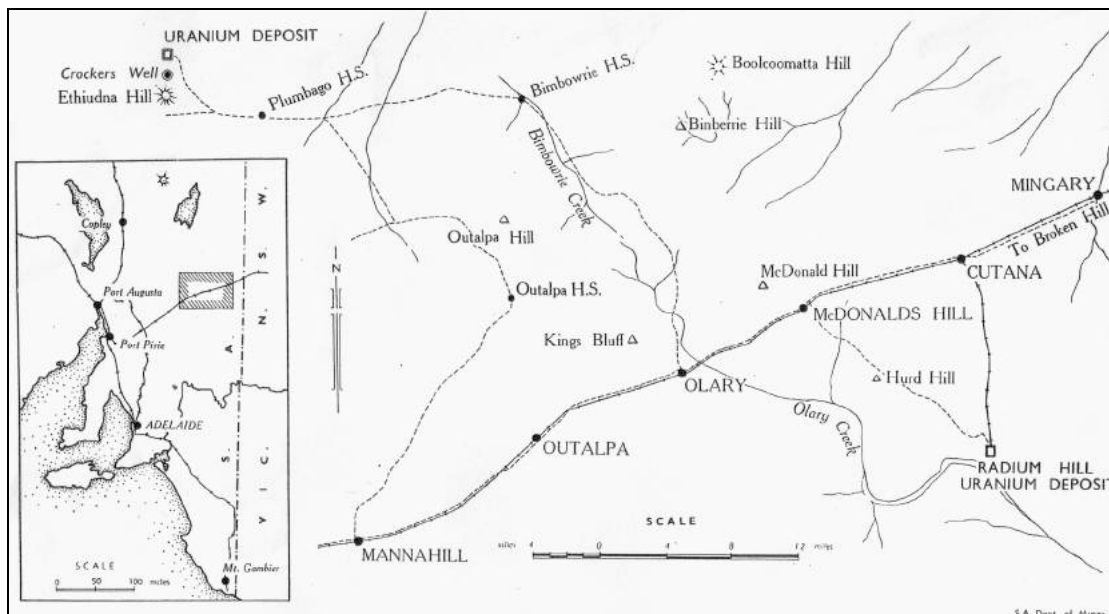


Radium Hill: Bindi To Boom Town

By KEVIN R. KAKOSCHKE

As was common at the turn of the twentieth century, new mining settlements grew in a very *ad hoc* manner around a mine, transportation route or water supply. Radium Hill was no exception. Explored in this article will be the evolution of the Radium Hill Mine from relatively primitive beginnings to the development of supporting infrastructure that included a planned town with modern services of power, water, accommodation, communication and transportation. From the tender age of 16-years when the author started work at Radium Hill in March 1953 as an apprentice, until he left when the mine closed in December 1961, great changes were observed. However, the peace and tranquility of this location with its mulga, saltbush and a carpet of bindi, set in an ancient desert landscape had been broken at a much earlier date.

Figure 1: Location of Radium Hill (460km North East of Adelaide and 110Km South West from Broken Hill)¹



Source: PIRSA, Division of Minerals and Energy, South Australia

In 1906, a prospector named Arthur J. Smith travelled to the site in his horse and cart, camped at Teasdale's dam and on the 20th March pegged a claim on what he

thought was a wolfram or tin oxide lode. Smith carried ore samples to Adelaide by train that Easter and they proved to be radio-active. A young geologist from Sydney named Douglas Mawson was working at the Adelaide University and named the uranium/radium bearing mineral 'Davidite' after Professor Edgeworth David who had had a major influence on his geological career. It was Mawson who proposed the name Radium Hill for the site.

The location was on the Outalpa Station run and seeing opportunity, owner Albert J. McBride, who had share dealings with mines at Broken Hill and Kalgoorlie, jumped into his horse and trap on hearing of the discovery and rushed nearly 50km across country to the find in the hope of expanding his fortune.² Prospectors and small companies pegged many claims along the line of lode that stretched for a distance of about 3km and among them Arthur Smith, the man who first discovered the lode, developed his 'Smith's Cartnotite Mine'. Such was the interest that two Swedish brothers by the name of Olson 'jumped' ship at Port Adelaide and actually walked 460km to Radium Hill in the hope of finding work at this 'wonder metal' mine.³ Interest was further stimulated when Smith sent an unusual specimen of cuprite ore from his mine to Sheperd's Bush, London, for the 'Franco British Exhibition' held there in 1908. The specimen was awarded a 'Diploma for Gold' medal.⁴ To ascertain scientific and commercial potential, both Smith and Mawson [later Sir Douglas Mawson] sent samples around the world, with Lord Rutherford and Madam Curie being among recipients. Markets appeared for the new 'wonder' material and between 1910 and the outbreak of World War 1 in 1914, when mining ceased, the ore was sent by ship to Germany where the radium was extracted and the uranium oxide by-product used for colouring ceramics and as an alloy for hardening steel in the Krupp Steel works where it was probably used in the manufacture of munitions.⁵ Newspapers of the time eulogized the mineral's potential:

It will mean that foreign nations will be obliged to seek from us the power wherewith to heat and light their cities, and find means of defence and offence ... The small space required for storing radium would be infinitesimally small in comparison to that required for the storing of oil, coal or coke ... Its full value and resources should be exploited by the people for the people of Australia.⁶

There were also great hopes that radium would lead to improvements in quality of health and if there were few if any medical facilities available at the mine, the product

itself showed medical promise. As noted in 1913 by Dr Herman Lawrence, Australian radium ‘has been found effective in treating cancer cases.’⁷ He went on to say:

The Radium Hill Co. South Australia, sent a ten milligram specimen of radium bromide to me, asking me to examine same therapeutically. ... I also treated cases of keratoses, rodent ulcers, epithelioma, ... and the results have been very satisfactory. ... its being used in the treatment of inoperable malignant growths and likewise being applied after operations for cancer, etc., in order to try and prevent a recurrence of the disease, there should be plenty of demand for all that can be produced in Australia, and as I understand the radium carrying ore exists (at Radium Hill) in large quantities, it may yet be a valuable export.⁸

While the potential for the product was still being explored, problems emerged on the field. At his mine, Smith’s workers sank a shaft 90 feet on the underlay where it struck brackish water while in 1907. His finances exhausted, mining was stopped. Mawson also failed to fully exploit the potential of his mining activities, for as he informed Maurice Mawby [later Sir Maurice Mawby] in 1940:

From the beginning of the field (Radium Hill) I have been intimately connected with the developments. ... I received a half share in the field in those early days and worked on it for two years, hoping to find a way of extracting radium at a profit. I had not solved the problem when I went to Antarctica with Shackleton. When I returned I found that our claims had been jumped by a publican from Broken Hill.⁹

Basic Conditions

Even though the conditions in the early days were difficult, families settled near Teasdale’s dam, or on the banks of the nearby dry Olary Creek in their tents or humpies. Conditions were primitive, as there were no Royal Flying Doctor service in those days and one wonders as to the hardships faced by the mother of the aptly named RADIUM Keith Lively¹⁰ who was born at the mine in 1913! Distance at the time was also a problem with transportation of supplies and ore being carried by horse and cart to Olary railway station that was 40km away along rough tracks.

However, following the formation of a number of companies, including one by Arthur Smith, the mines re-opened in 1923. At that stage, motor vehicles made their appearance as a means of transport for men and materials. Mine buildings and accommodation were also more substantial than before World War I even though the outside dunny [toilet] was made from reclaimed railway sleepers. Despite the appearance of motor vehicles, supplying the needs of the workers and families remained

problematic and as was the case on many early mine sites, diets were heavily augmented with reliance on rabbits (Figure 2) and kangaroos as a main source of fresh meat. Not until 1950 did the situation improve when the South Australian Engineering and Water Supply Department used its earth moving plant and equipment to upgrade the dirt road from Olary out to Radium Hill.

Figure 2: *Rabbit stew for dinner? Left to right: A.J. Smith Snr, A.J. Smith Jnr, Fourer Brothers, A. Smylie, Porter Jarman.*



Source: Courtesy Radium Hill Heritage Museum

A sense of urgency

Due to the metallurgical difficulties in economically and successfully extracting radium from the complex titanium-rich ore, the mines closed again in 1931 signaling the end of *ad hoc* development of the Radium Hill Mine and services. It was the advent of World War 11 and developments associated with the atomic bomb that really stimulated resurgence in interest in the mine. A sense of urgency developed and both British and American governments attempted to obtain supplies of uranium at any cost for military purposes. Mt. Painter and Radium Hill in South Australia were two of the few deposits known to exist anywhere in the world. A 25-year old geologist named Reg Sprigg conducted a geological survey at Radium Hill in 1944, the results of which indicated the potential for future uranium production.

In October 1945, the South Australian Government led by the astute Premier, Thomas Playford, legislated to reserve to the Crown all rights and property in uranium and thorium. Not to be outdone, the Federal Parliament under the Prime Minister, Ben Chifley passed a Bill in July 1946 under which uranium and other similar substances throughout the Commonwealth became the Commonwealth's property.¹¹ Despite the public political friction, both Governments were urged on by the British and American Governments to join forces to establish the urgently needed uranium reserves of South Australia and the subsequent development of Radium Hill. Subsequently, as explained below, inter-country and inter-government involvement saw development of the Mine.

Figure 3: *Mines Dept. Truck outside Parliament House, Canberra*



Source: Courtesy Radium Hill Heritage Museum

In September 1947 the first diamond rig was on site at Radium Hill to drill the deposit and was manned by driller Joe Bottger and his offsider Jack Nader.

They had a two man tent, 400 gallon water tank for domestic and drilling purposes, an International truck and a drill rig. The site was surrounded by empty beer bottle boxes. Pride of place in their tent was a beer box dining table surrounded by four beer box dining chairs. A beer box writing desk separated the two beds. At the other end of their tent a beer box pantry and beer box rubbish bin almost completed the scene, except for the kerosene fridge which didn't seem to fit the picture.¹²

By 1949 the initial drilling and geological program indicated uranium metal reserves of approximately 700 tons, enough for a potential mine.¹³ Facilities for the 40 men now on

site included a mess hall, dormitory, tents, two man cubicles, refrigerator and a 32-volt generator for electric lights.

Due to the shortage of new equipment, required items were sourced from wherever, including the Naval surplus stores at Rydalmere, New South Wales. In 1949, a South Australian Government, Mines Department truck No. 41, loaded with such equipment parked in front of Parliament House, Canberra (Figure 3), seemed to highlight the inter-government differences of who should control the mining of uranium.¹⁴

Pushing Forward

The young, workaholic and well-qualified Director of Mines, Ben Dickinson ‘was not a typical public servant for his time, he broke more regulations than you could imagine’, to get the Radium Hill Project up and running.¹⁵ Ben would go up to Premier Tom Playford’s apple orchard on a Sunday morning to discuss obtaining money for a project, ‘ninety percent of the time he got it’.¹⁶ On other occasions he felt that the State Public Service Board was not attuned to the needs of his Department and ‘... it was a brick wall that had to be broken down’.¹⁷ His 1950 prospective development, research and costs programme for the project was far reaching in vision:

August 1950, Adelaide Laboratory concentrates 1-1.5% U308 @50-500lbs/week
June 1951, Radium Hill Sample mill concentrates, 2tons/day
January 1952, Sample Mill concentrates, 5tons/day
June 1952, Sample Mill concentrates, 10tons/day
January 1954, operation of treatment mill on half tonnage, 20tons/day
January 1955, Radium Hill treatment mill at full scale production, 40tons/day
AND
June 1954, commencement of an experimental nuclear reactor design
January 1960, commencement of nuclear reactor construction.
January 1962, experimental nuclear reactor on stream.
Overall costs for uranium production and an experimental nuclear reactor, estimated at 18,000,000 pounds.¹⁸

Radium Hill was also a pet project of the State Premier, Tom Playford, ‘and he was always available to Dickinson if we wanted anything done in a hurry or coordinated with another Government department ... a telephone call and it was done.’¹⁹ Dickinson seconded/head-hunted young experts from other government departments, private companies and overseas agencies to head or work in the various teams needed to fast track the project. Besides Reg Sprigg in the geology field, there were men like 29-year-

old Norton Jackson for the metallurgy division and Terry Rodgers, a 33-year old mining man as field manager. Murray Stock aged 23-years, assisted by Ex-Lancaster bomber pilot 'Nash' Gerke headed the mechanical and electrical requirements section, and a 24-year old architect from the Housing Trust, Lloyd Chambers designed accommodation facilities.

As can be imagined, the paper work for such a project was enormous and the official correspondence system relating to the project was overpowering. Besides adhering to the conditions of the contract secrecy agreement, in 1953 it was mandatory for 'seven copies ... [to be] taken of all correspondence, the original distributed to addressee and various copies to originator, assistant general manager, general manager, head office, Radium Hill filing, and head office filing'.²⁰ Besides needing a security pass to enter Radium Hill, the secrecy agreement insisted upon by the Americans also banned privately owned cameras from being on the site. Fortunately a number of early photographs were taken by Murray Stock, the site manager to record the progress of the mine's construction activities.

Resulting from the 1952 contract with the British and American Governments, their 'Combined Development Agency' bore the major costs of the Radium Hill Project. Stipulated was that from 1954 onwards, over the seven year period of the contract, items were to be written off. The Agency also paid for the mine's operation and an amount for the uranium produced. This was a big win for our negotiators. Radium Hill was thus unique in the annals of Australian mining history because the financing, exploration, development, mining, processing, management, purchase and end use of the mine product was conducted within the cartel comprising, State, Commonwealth, British and American Governments. Besides being an early example of value adding to the mine product, there was no private company involvement and no middleman.

After the success to extract uranium from the complex ore by Norton Jackson and his team, the provision of an adequate supply of water became a high priority in the mine and town's development. Reg Bridge investigated the site for a dam situated on Olary Creek capable of storing 1,000 million gallons but the presence of saline springs, high rate of evaporation, creek siltation and low unreliable rainfall proved this option to be unattractive. Eleven bores were sunk but were dry or encountered saline water. Gall's Well, located six kilometres away was a source of brackish water containing 2735 parts per million of total dissolved salts and was suitable only for ore milling purposes. To illustrate the problems, housewives in 1950 would fill up their wash

troughs with dam water, put Epsom salts in the water to settle the mud overnight and would end up by scooping the clean water off the top in the morning to do their washing. Brackish water was used for washing in the cubicle and tent camp. Yet another problem illustrating the ‘pioneer’ environment at the mine was that bush snakes invaded the houses searching for water and every housewife had a ‘snake charmer’ to repulse them. This was a piece of fencing wire about 2.8m long, doubled over, with the two strand ends twisted together for stiffness. The 1.4m long weapon was wielded to good effect by the housewives when confronted by the snakes.

To overcome the problems, the nearby Teasdale’s dam was enlarged in 1952 to hold 12-million gallons of run-off water, if it rained. The cost of pumping water from the dam was 4 shillings and 3 pence per thousand gallons in 1953. Furthermore, in July 1952, fresh water for drinking and cooking was obtained from the South Australian Railways and transported 40km by ex-army road tanker from Olary (35,000 gallons per month) at a cost of £3.10s per 1,000 gallons. The water was stored in a 100,000 gallon steel tank which had been salvaged from the war time Wallaroo, Power Alcohol Distillery complex. The projected consumption rate of fresh water by March 1954 was 150,000 gallons per day.²¹ As a consequence of this projection, arrangements were made with the New South Wales Government and the Broken Hill Water Board for the South Australian Government, Engineering and Water Supply Department, to install a six-inch pipeline from the Broken Hill water supply system located 85km away from Radium Hill at the Umberumberka Reservoir.

Figure 4: *The two million gallon water tank (in background) and swimming pool*



Source: Courtesy Radium Hill Historical Association.

Water commenced flowing in the new pipeline to a newly constructed 2,000,000 gallon capacity concrete tank at Radium Hill on the night of 4th March 1954. The charges for water from the reservoir were fixed at 23 shillings per thousand gallons excluding the pipeline maintenance costs.²²

Back in 1950, the few houses that were built only had wood stoves and kerosene fridges and lamps. From 1951, small diesel engines generated electricity for lighting, hoisting winches and pumps. The acquisition of surplus diesel army tank engines, G. M. Model 6062A coupled to Magnicon 75 kW alternators in 1952, increased the supply of electricity for mining and domestic purposes. The average householder alone used 1,560 kWh in 1952. The start up of the pilot mill, more employees, more houses, two man cubicles and tents meant more electricity was required, so two 400 HP National R4AB diesels coupled to Brush 275kW alternators were obtained from England to provide this extra power.

It was estimated that the main production mill, mine, town and support services could potentially require up to 15 megawatts of power. It took the Electricity Trust of South Australia only 15-months after the scheme was first mooted to design equipment and install 649 Stobie poles, each 75 foot long, to span the 210km between North West bend near Morgan and Radium Hill. These poles were designed by James Stobie and each pole weighed 12,895 pounds, or 5.8 tonnes.²³ That line ran straight for a distance of 200km.

The transmission wires also acted as a landline to communicate between site locations during the construction phase. Power first hummed through the wires to Radium Hill at 10.42am on 8th October 1953.²⁴ During the construction phase, the original survey party was the first of many who lost their way in the bush. Other difficulties experienced were lack of water, hassles with transport and the pits of bogging bulldust churned up by the trucks.

In January 1953, a young university graduate, Ron Stewien surveyed the turn out from Cutana siding on the main Broken Hill railway line for a spur line out to Radium Hill. It was to transport the uranium concentrates to Port Pirie, carry ballast for the line and goods and passengers to or from Radium Hill. The first 'be-flagged' train named 'The Atomic Comet' travelling on a new non-ballasted track, steamed into the Radium Hill Railway station on October 2nd 1953, at 10.30 am (Figure 5). A passenger service was now provided which enabled the townspeople to travel to or from Adelaide twice a week. A single ticket cost 45s 3d,²⁵ nearly a fifth of a week's basic wage.

With the construction of the railway spur line from Cutana siding, a shorter 20km road was constructed to follow the rail line embankment. This was a welcome relief for the town's folk wishing to go shopping in Broken Hill by private car or by using the local 1936 Diamond T, private bus service. After some rain on one occasion the normally dry and dusty Broken Hill road turned to mud and the local soccer team on the bus had to get out and push and hold the bus on to the crown of the road and walk with it nine kilometres to get to Cockburn. All agreed to rest there awhile at the Bordergate Hotel! They had to cancel their game in Broken Hill as they were in no fit state to play soccer that day.

Figure 5: *The first train into Radium Hill, 1953*



Source: Courtesy Radium Hill Historical Association.

In October 1951, an Australian made ex-WW11 army, DH 84 Dragon bi-plane air ambulance was the first Royal Flying Doctor Service plane to land in Radium Hill. The patient was Fred Hill, the mine foreman who after being treated by the flying doctor had to be flown to Broken Hill for more urgent medical attention. Guinea Airways commenced domestic flights to Adelaide on Tuesdays and Thursdays in 1954, and tickets cost £2.10s single, for the two-hour flight. Thus, were the twin tyrannies of distance and isolation e gradually whittled away.

Twenty-six year old Les Roberts who had 'houses placed on the same contour line and overlooking a valley containing recreation facilities, parks and shops etc.',

surveyed the proposed town layout.²⁶ Houses for the new town site were to comprise, three-bedroom (70 per cent of total), two-bedroom (20 per cent), and four-bedroom (10 per cent). Housing for the general manager and his four section heads were architecturally designed and more spacious than that provided for the general work force.

Figure 6: *R.F.D.S. Plane At Radium Hill 1951. BMP*



Source: Courtesy Radium Hill Historical Association.

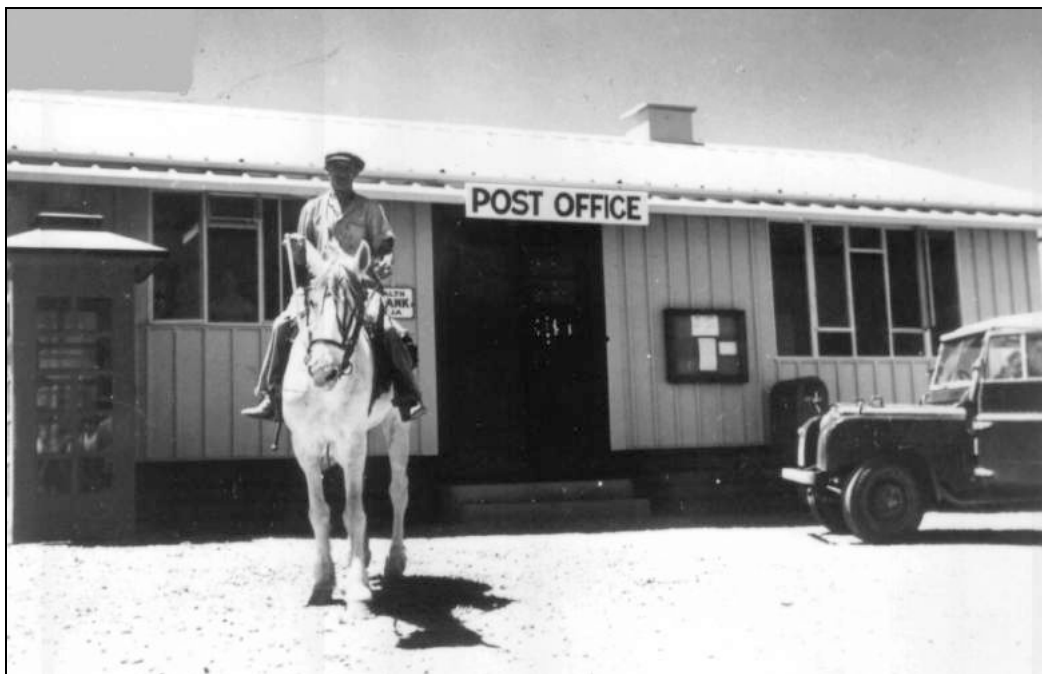
With the increase in production from 1953, local miners and tradesmen were scarce. During 1954 the labour turnover in the mining and mill sections was 165 percent compared to the Kalgoorlie figures of only 33 1/3 percent.²⁷ Adverts were put into the papers of Italy, Austria, Germany and Gt. Britain to lure workers with the promise of a new home, good pay, plenty of sunshine and a new way of life away from the war torn ravages of Europe. It was anticipated that the total population would reach 1,500 people but the maximum reached was only approximately 1,200.

In 1955 the quoted cost of a three-bedroom Type P house was £2,600 and this was rented at 35s per week. There was also a hire charge of 2s per week for electric

stove, 3s for refrigerator, and 5s for garage where supplied.²⁸ However, a district allowance of 35s a week was paid to each male employee and 26s 3d for each female. This helped offset the accommodation charges. Thirty-one Hawksley type houses in kit form were obtained from England. A total of 160 houses were built for families and 220 two-man cubicles for single workers. No more tents thank goodness!

The pay for employees was high, especially for some of the contract miners who would actually bank in excess of £100 per fortnight compared to the envious Postmaster who in 1956 only took home £29. While wages were relatively high, to help lessen the turnover of workers, more attractive amenities were provided by the Project in conjunction with the Community Social Club. Bituminizing the streets lessened the comments of some housewives that they were getting ‘dusted lungs’ through sweeping up the dust in their houses each day. More than 7,000 trees were planted along the streets and recreational areas as a buffer against the dust storms and to help beautify the townscape. Profits from the ‘wet canteen’ were used to help pay for some of the additional amenities. On one hot day, 148 gallons of keg beer and 1,650 bottles were sold in the seven-and-a-half hours that the canteen was open for business.

Figure 7: *Old Hugger in front of the Post Office*



Source: Courtesy Radium Hill Historical Association.

Other worthwhile amenities also appeared. Churches, Australian Inland Mission Hospital, Banks, Post Office with telephone switchboard, and private businesses were

built on land that was leased to them for the princely sum of £1 per year. Numerous sporting and social activities were also developed and played a major role in building a very strong community spirit. Residents from the surrounding towns and pastoral district were invited to participate in these activities and social events. Radium Hill had become the largest town in the North-east of South Australia. As a result of these amenities, new housing and good wages, a strong sense of belonging and contentment developed. Perhaps this is reflected in the turnover of the workforce that declined from a peak of 200 per cent in 1955 to only 20 per cent by 1957.²⁹

The life of 'Old Hugger' the nearby sheep station boundary rider was also made easier with all the new services that had sprung up on his 'patch of dirt and bindi'. The 'can do' approach of the 'young Turks' had ensured the Project's success. From a harsh desert environment covered in bindi, saltbush and mulga they had created a boom-town in the bush, called Radium Hill.

Historic Legacies of Radium Hill

- It was Australia's first uranium mine, 1906.
- In 1981 Radium Hill became the first Australian State Government gazetted low level radioactive waste dumpsite.³⁰
- The uranium ore was named 'Davidite' and the site 'Radium Hill', by Sir Douglas Mawson, possibly the only such town site to be named by him.³¹
- In 1955 the Radium Hill Project was the first mining organization in Australia to take to court the matter of manning light air-leg mounted rock drills, to have one man to a machine. It was successful in the case and set a precedent for the Australian mining industry.³²
- It was the first time in the world that the boiling concentrated sulphuric acid technique was used to further process Davidite uranium bearing ore.³³
- At Radium Hill the heavy media milling process was used for separating hard rock ore for the first time in Australia.³⁴
- It was the first uranium mine in Australia to enter into an export agreement for selling its product overseas.³⁵
- The South Australian and Federal Government together with the mining industry established the Australian Mineral Development Laboratories or AMDEL as it was known, to keep together the various science specialists associated with the exploration, mining and milling requirements of Radium Hill and subsequently the broader Australian mining community as a whole.³⁶
- The pool of experts so gathered at AMDEL and the Mines Department prompted Sir Eric Rudd, together with Basil Lewis and Norman Shierlaw, to help form the Australian Mineral Foundation in Adelaide, which acts as a focus for the Australian mining industry.³⁷
- A survey of former Radium Hill miners revealed that by 1987, 54 had died of lung cancer. It indicated a significant increase in the risk of contracting lung cancer when compared to the general population. The results of this survey by the Department of Community Medicine, Adelaide University and the South

Australian Health Commission has led in part to the implementation of regulations for safer working conditions in the uranium mines of today.³⁸

- Radium Hill was one of the few South Australian Government projects that made a profit.

Endnotes

¹ The following conversions are noted for measurements in this article:

1 (imperial) gallon = 4.5461 litres; 1 troy oz = 20 dwt = 31.10348g; 1 dwt = 1.555g;

1 (long) ton = 1.01605 tonnes; 1 pound = 0.454kg; 1 inch = 25.4mm; 1 foot = 0.3048m;

1 mile = 1.609 km.

² *The Register* [Adelaide], 11 May 1906, p. 5.

³ Interview with Dora Wilkin, Cutana Station, Olary, by the author in October 1991. For transcript see article by Kevin Kakoschke, in Radium Hill Reunion Committee, 'Newsletter', 17 February 1992, p. 1. In *The Register*, 14 November 1913, it states that Smith had two men working for him. These were probably the Olson brothers.

⁴ A copy of this award is displayed at Radium Hill Heritage Museum, Tikalina Station, via Olary. Arthur Smith's granddaughter, Mrs Shirley Symons, Adelaide, donated it to the Museum in 1996.

⁵ 'Radium at Olary', *The Register*, 14 November 1913.

⁶ The information was taken from extracts of newspaper articles published between 1906-1913 that were included in a short play by the author 'Radium Hill and Smith 'n' Mawson', performed at the 2006 Centenary of Radium Hill.

⁷ Herman Lawrence, 'Australian Radium', *Australian Medical Journal*, January to December 1913, p. 975.

⁸ *Ibid.*

⁹ Letter dated 1940, Sir Douglas Mawson to Maurice Mawby, Mill Superintendent, Zinc Corporation, Broken Hill, held by the Broken Hill Historical Society, Broken Hill with copy provided to author.

¹⁰ Radium Lively's elder brother Harry was a young miner who suffered the only serious accident during this time. A shovel he was using and pushing with his left foot, struck a live detonator that exploded and caused his left foot to sever at the heel. He walked with a pronounced limp for the rest of his life.

¹¹ Bernard O'Neil, *Above and Below: The South Australian Department of Mines and Energy 1944-1994*, South Australian Department of Mines and Energy, Adelaide, 1995, pp. 78-9.

¹² M. Harrington and K. Kakoschke, 'We Were Radium Hill', *Stories and memories of people who once lived in Radium Hill*, Malcolm Harrington for the Radium Hill Community Association, Easter 1991, Adelaide, pp. 8-51.

¹³ Government Records series [GRS] 6038/14/P 47, Docket 00678. 19 September 1949, State Records, Adelaide [SRA].

¹⁴ Bernard O'Neil, 'Above and Below', pp. 38-9.

¹⁵ *Ibid.*, p. 39.

¹⁶ *Ibid.*

¹⁷ *Ibid.*

¹⁸ Mines Dept. GRS 6038/14/P49, Docket 00129, 2 August 1950. The newly constructed mill was commissioned three months earlier than this schedule and exceeded these production estimates thanks to the efforts of Premier, Tom Playford, Director of Mines Ben Dickinson, Chief Metallurgist, Norton Jackson and the 'young Turks' of the Radium Hill Project team. The nuclear reactor was not built.

¹⁹ Bernard O'Neil, *Above and Below*, p. 30.

²⁰ GRS 6038/17/ 53, Docket 00872, 25 May 1953, SRA.

²¹ GRS 6038/17/P 51, Docket 00359, 28 July 1952, SRA.

²² South Australian Government, Mines Department, file, R.H. no. 508/1953.

²³ J.C. Stobie, 'Stobie Pole Design Type 75.9.24', Electricity Trust of South Australia, Adelaide, Drawing no. WA9452 Drn. 8.11.48. A pole comprised two 225mm x 100mm H section steel members, centres 600mm apart at ground level, tapering to 150mm apart at the top of the pole, with a core of concrete and held together with steel bolts. Cross arms were bolted to the pole from which the transmission wires were strung. The poles were fixed 2.4 metres into the ground with concrete sleeves. The concrete sleeve actually vibrated when the power was being transmitted and the wires hummed.

- ²⁴ M.J. Herbert, 'I Heard it Arrive', in 'The Adelect', Electricity Trust of South Australia newsletter, Christmas 1953, p. 18.
- ²⁵ *South Australian Railways Weekly*, Notice 42/53 [1953], compiled, printed and circulated by the South Australian Railways to their employees weekly.
- ²⁶ GRS 6038/17/P 52, Docket 00023, 5 February 1952, SRA.
- ²⁷ GRS 6038/17/P 53, Docket 01592, 24 March 1955, SRA.
- ²⁸ GRS 6038/17/P 50, Docket 00909, 24 November 1955, SRA.
- ²⁹ GRS 6038/14/P 49, Docket 00974, 17 July 1957, SRA.
- ³⁰ *South Australian Government Gazette*, 2 April 1981, p. 1018.
- ³¹ D. Mawson, 'On Certain New Mineral Species Associated With Carnotite In The Radio-Active Ore Body Near Olary', *Transcript of the Royal Society, South Australia*, vol. 30, 1906, p. 188.
- ³² Justice Pellew, 'Uranium Mining (Radium Hill) –Award' 1955, South Australia - In the Industrial Court, SA Government Printer, Adelaide, p. 3, where stated, 'This award is based on the living wage of 11 pounds 11s, and is binding on the South Australian Government Public Service Commissioner and on the Australian Workers Union (Adelaide Branch)'.
- ³³ Interview with Norton Jackson by author, November 2006.
- ³⁴ *Ibid.*
- ³⁵ Bernard O'Neil, *Above and Below*, p. 88.
- ³⁶ Interview with Norton Jackson by author, November 2006.
- ³⁷ Bernard O'Neil, *Above and Below*, p. 272.
- ³⁸ Alistair Woodward, *Search*, Official Publication of the Australian and New Zealand Association for the Advancement of Science (ANZAAS), Publisher, Aileen Boyd-Squires, Blackwell Scientific, Carlton, Vic., vol. 22, no. 4, June 1991, pp. 131-33. The Radium Hill Underground Supervisors manual S.233 in 1958 stated that the radiation level at any working place does not exceed 100 micromicrocuries of total radon daughters per litre of air [300 in USA]. Alistair Woodward, in *Cancer Causes and Control*, vol. 2, 1991, p. 213, states that prior to the installation of a large underground ventilation fan in March 1955, the levels of radon daughters were three times higher than those measured post March 1955.