

'Radium Hill: Bindi to Boom Town' - some comments

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The paper entitled 'Radium Hill: Bindi to Boom Town' by Kevin R. Kakoschke in Volume 5 (2007) of the *Journal of Australasian Mining History*¹ is an interesting and enjoyable oral history contribution. Although it reinforces many unique facets as well as some new points of note on the public record regarding the Radium Hill uranium project, it also makes a number of assertions which are critical in understanding the history of the project and its relative importance. This commentary challenges some of these assertions and provides evidence for a more realistic understanding of some key aspects of Radium Hill's contribution to mining in Australia, especially uranium mining.

The Kakoschke paper is primarily concerned with the Cold War era of the 1950's, and this is perfectly understandable given the author's early career at Radium Hill during this time. Hence the earlier period in the 1910's when the deposit was actually exploited primarily for radium, with uranium only a side interest, does not receive significant attention. Mudd has covered this early period of radium mining across Australia in significant detail,² with Radium Hill a major focus of the research.

It is claimed by Kakoschke³ that between 1910 and 1914 ore was sent to Germany. This is contrary to records and information published in the South Australian Department of Mines' (SADM) half-yearly journal, the *Mining Review*⁴, as well as other literature. During the period 1911 to 1914, the Radium Hill Company generally concentrated ore on site using a magnetic mill, and transported the ore concentrate to Hunter's Hill in the suburb of Woolwich, Sydney. Based on data compiled in Table 1 of Mudd,⁵ there was at least 2,150 tonnes of ore beneficiated at Radium Hill, the concentrate being metallurgically processed at Hunter's Hill to produce radium and some minor uranium oxide. Unfortunately, there remain unresolved radioactive waste issues at the Hunter's Hill site – despite the problems becoming public knowledge in the 1970's, and is currently the subject of a New South Wales Parliamentary Enquiry.⁶

It is also stated by the *Mining Review* that small amounts of radium-uranium ore were sold to Europe from Mt Painter, though no such details are noted for Radium Hill. Mt Painter exported at least 127 tonnes to England, while 'Europe' in general was of the

order of 41 tonnes only.⁷ In discussing the radium-mining era in Australia, it appears to be a common result to confuse operations at Radium Hill and Mt Painter.

These points concerning the destination of the radium-uranium ore from Radium Hill may appear to be minor, however, the determined but failed radium mining efforts were critical at providing Australia with a sound scientific basis for uranium geology and processing technology at the advent of the nuclear age in August 1945.⁸ In this regard, Kakoschke is certainly correct in highlighting the major public interest and glowing reputation given to radium's asserted potential for medicine (eg. the citation of newspaper reports of the day), but the paper does not accurately describe the actual mining and operations associated with Radium Hill during the early radium years.

Kakoschke asserts that a 'sense of urgency'⁹ was felt both by the British and Americans to secure uranium supplies for military purposes. Given the time of the formal request from the British to the Australian Government in May 1944, and the complete lack of evidence of any formal or even anecdotal American interest in potential Australian uranium (they had secured sufficient Belgian, Canadian and internal supplies for the remainder of the Manhattan Project), the May 1944 uranium request can only be interpreted as the British positioning themselves for their own post-war military program. An extensive analysis of this critical issue has been given by Mudd.¹⁰ In the ongoing global concern on nuclear proliferation issues, it is therefore important that Australia's historical roles be accurately recognised and understood.

As discussed by Kakoschke, the original uranium export contract for Radium Hill for British or American nuclear weapons was indeed unique,¹¹ and it is hard to envisage a new Australian mining venture that could ever re-create such overly generous financing terms. The positive view expressed, however, must be tempered with a sense of reality. In 1952 the Americans and British were intent on securing as much uranium from across the world as they could to expand their nuclear weapons programs (the Americans were especially aggressive in uranium procurement, while the British much less so). It is commonly believed that the uranium from Radium Hill went to the British and, somewhat ironically, was later used at Maralinga. As Cawte astutely notes, the Radium Hill agreement 'must rank as the easiest and most generous in the history of uranium negotiations'.¹²

Given surging exploration success in the USA (and Canada), within just a few years internal American uranium resources and production were more than adequate to meet foreseeable requirements and global procurement was completely curtailed. Thus,

despite Radium Hill, Mary Kathleen, Rum Jungle and the South Alligator uranium mines all having remaining uranium resources of varying significance,¹³ no project was able to secure further export contracts until the advent of the civic nuclear power industry that emerged after the late 1960’s.

The 1952 export contract for Radium Hill provided for capital financing by the British and Americans through their ‘Combined Development Agency’ (or CDA, the joint military procurement group), with operating costs also effectively paid for.¹⁴ The fixed price contract was set at 45 shillings per pound U₃O₈ plus 70 percent of production costs.¹⁵ It was expected that the final price would be nearly US\$14 per pound of uranium oxide (/lb U₃O₈), although the final average price was US\$21.27/lb U₃O₈.¹⁶ Based on the contract, the estimated costs in March 1952 for the seven-year project producing 178 t U₃O₈ per year are shown in Table 1.

Table 1: Original Capital and Operating Costs Under the 1952 Radium Hill Contract

	Operating Costs			Capital Costs
	Capacity	Total	Unit Cost	
Radium Hill	183,000 t ore/yr	£1,450,000	3.70	£3,771,000
Transport	-	£78,000	0.20	-
Port Pirie	19,500 t conc./yr	£494,000	1.26	£812,000
Management, Technical Services & Research	-	£114,000	0.29	£300,000
	Total	£2,136,000	£5.45/lb U ₃ O ₈	£4,883,000

Source: National Archives of Australia, *Radium Hill Uranium – Heads of Agreement with CDA [Combined Development Agency]*, Series A1209/23, 1957/4196, part 2, 1952, pp. 110-123.

By late 1953 the capital costs of the facilities at Radium Hill and Port Pirie were estimated at about £5 million and £1.5 million, respectively, with annual operating costs of about £2 million and £1 million, respectively.¹⁷ Furthermore, by the time the Port Pirie plant was opened in August 1955, capital costs had soared to £7.33 million.¹⁸ The financial costs and loans for Radium Hill were to prove a constant challenge, with a significant amount of archival correspondence dealing with financing difficulties¹⁹ (see also the many archival files referenced in Cawte).²⁰ The SADM’s *Mining Review* and Annual Reports never gave complete production statistics from either Radium Hill or Port Pirie – instead only reporting approximate output value.²¹ The total production at Radium Hill is widely reported as 852.1 t U₃O₈ (or 1.88 Mlbs U₃O₈).²²

The British and Americans, attempting to cut their losses and stop purchasing expensive Australian uranium, offered to terminate the Radium Hill contract as early as March 1958, because it was costing the Americans twice as much as the world market price at the time.²³ For example, according to Gowing, the average price paid by the CDA for uranium around this time (US\$/lb U₃O₈) was: Belgian Congo \$1.45-\$6.00, Portugal \$6.50-\$8.00, Canada \$3.50-\$12.50, South Africa \$7.70-\$9.94 and the USA \$12.50, compared to Radium Hill at \$21.27 (average) and Rum Jungle at \$17.60 (ceiling price). The uranium from Radium Hill is still probably the most expensive and difficult ever produced.²⁴ The Commonwealth had noted during this time that they would be embarrassed if actual uranium prices became public since South Australia was receiving more for that produced at Radium Hill than from Rum Jungle.²⁵

The realised value of the Radium Hill uranium export contract is commonly quoted as approximately £17 million,²⁶ although no profits or dividend data have ever been reported.²⁷ Curiously, O’Neil states that Radium Hill had some £16 million in revenue.²⁸ The SADM reported annual production value, giving a cumulative total £12.25 million²⁹ – the £4.75 million difference can only be presumed to be the original capital costs. The *Mining Review* gave a ‘total value’ of £17.5 million to the end of 1961,³⁰ with the production until the end of February 1962 (when Port Pirie ceased) presumably adding a further ~£0.3 million (no data given in the *Mining Review*), thereby giving a total value of about £17.8 million.

At Gowing’s average price of US\$21.27/lb U₃O₈,³¹ this gives production costs of US\$40 million – even allowing for currency exchange rates (i.e. £1 = Aus\$2, and that the US\$-Aus\$ exchange rate was 1.12 over 1960/61 to 1961/62,³²) it is nigh on impossible to conceive of how Radium Hill could have made a profit. For comparison, published production revenues and profits for all uranium projects of the 1950’s are shown in Table 2.

In addition, the Australian Atomic Energy Commission, *Rum Jungle Project* report shows the actual ‘profits’ stated for the Rum Jungle CDA contract period (1954-1963) are contradictory. AAEC stated that Rum Jungle gave ‘a profit to the Commonwealth of £3.38 million’. However, total uranium and copper revenue was £20.9 million versus total capital and operating costs of £19.6 million. Based on the CDA contract, uranium revenue was £18.236 million versus capital and operating costs of £17.5 million.³³

Table 2: Production, Revenues and Profits for 1950’s Uranium Projects

	Rum Jungle ³⁴	Radium Hill	Mary Kathleen	Rockhole	Moline
Company / Owner	Commonwealth Government	South Australian Government	Rio Tinto	South Alligator Uranium	United Uranium
Period	1954-1963	1954-1962	1958-1964	1959-1962	1956-1965
Exports	1,474 t U ₃ O ₈	852 t U ₃ O ₈	4,092 t U ₃ O ₈	139.7 t U ₃ O ₈	716 t U ₃ O ₈
Purchaser	CDA	CDA	UKAEA	UKAEA	UKAEA/CDA
Revenue	£18.236 million [§]	~£17.8 million	£39.80 million	£1.15 million	£5.81 million
Profits	~£0.7 million [§]	no data	£11.77 million	£0.495 million	£1.76 million
Unit Price (estimated)	£6.31/lb U ₃ O ₈	~£9.50/lb U ₃ O ₈	£4.40/lb U ₃ O ₈	£3.73/lb U ₃ O ₈	£4.37/lb U ₃ O ₈

Sources: Compiled from G.M. Mudd, ‘Compilation of Uranium Production History and Uranium Deposit Data Across Australia’, SEA-US Inc., last updated January 2008, 46 pp.; J.R. Stewart, ‘An Assessment of the Search for Uranium in Australia’. *Proceedings, 8th Commonwealth Mining and Metallurgical Congress*, vol. 2, AusIMM, Melbourne, 1965, pp. 343-351; Bureau of Mineral Resources, various, *Australian Mineral Industry Annual Review*. Bureau of Mineral Resources, Geology & Geophysics, Canberra, years 1948 to 1987; M.L. Fitzgerald, F.L. Hartley, ‘Chapter 9 – Uranium’, in J.T. Woodcock (ed.), *Proceedings, 8th Commonwealth Mining & Metallurgical Congress*, vol. 3, AusIMM, Melbourne, pp. 211-227. [§]Assuming revenue and costs for uranium under the CDA contract only.

Lee Parkin, a prominent geologist in the SA Department of Mines and heavily involved at Radium Hill, stated in a 1989 interview that ‘... Radium Hill may well rank as one of the few government mining ventures that operated without incurring a substantial financial loss to the taxpayer’.³⁵ To the best of the author’s knowledge, there has still not been, even half a century later, a proper financial account released of the Radium Hill project (the SA Government still maintains extensive archival records of Radium Hill but approval for access is difficult to achieve).

Given all of the above information and lack of actual evidence for Radium Hill, it is hard to believe as Kakoschke claims, that the project was actually financially profitable³⁶ (no reference is cited for this claim). Although South Australia arguably benefited politically, the above review demonstrates that Radium Hill was certainly not profitable in any rational sense when considering how a mining company would assess profits at the time, let alone similar government owned and operated enterprises.

It is hoped that this commentary helps to clarify these particular key aspects of the Radium Hill Project. However, the project should not be over-estimated – the site has still not been demonstrated to have been effectively rehabilitated, with recent research demonstrating continuing dispersal of radioactive debris across the site.³⁷ The Radium Hill project was clearly important in many respects, and its legacy continues to reverberate today (especially with respect to uranium mining) – though there are more sides to the story than just positive memories and curious Australian mining ‘firsts’.

Endnotes

- ¹ K.R. Kakoschke, 'Radium Hill: Bindi to Boom Town', *Journal of Australasian Mining History*, Vol. 5, 2007, pp. 135-49.
- ² G.M. Mudd, 'Early Uranium Efforts in Australia 1906 to 1945: The Legacy From Radium Hill to the Atomic Bomb and Today', *Historical Records of Australian Science*, 16 (2), December 2005, pp. 169-98.
- ³ Kakoschke, 'Radium Hill: Bindi to Boom Town', p. 136.
- ⁴ South Australian Department of Mines, various, *Mining Review*, South Australian Department of Mines, Adelaide, years 1906 to 1963.
- ⁵ Mudd, 'Early Uranium Efforts', p. 176.
- ⁶ See *Ibid.*, pp. 186-9; The current NSW Parliamentary Inquiry is by General Purpose Standing Committee No. 5 of the Legislative Council (upper house), and was called on 14 May 2008, specifically to investigate residual radioactive contamination still present at the site and current proposals to rehabilitate the site - see <http://www.parliament.nsw.gov.au/gpsc5/>
- ⁷ See *Ibid.*, Table 1, p. 176.
- ⁸ See *Ibid., passim*.
- ⁹ Kakoschke, 'Radium Hill: Bindi to Boom Town', p. 138.
- ¹⁰ See Mudd, 'Early Uranium Efforts', *passim*.
- ¹¹ Kakoschke, 'Radium Hill: Bindi to Boom Town', p. 141.
- ¹² A. Cawte, *Atomic Australia 1944-1990*, UNSW Press, Kensington, NSW, 1992, p. 47.
- ¹³ J.R. Stewart, 'An Assessment of the Search for Uranium in Australia'. *Proceedings, 8th Commonwealth Mining and Metallurgical Congress*, vol. 2, AusIMM, Melbourne, 1965, pp. 343-51.
- ¹⁴ National Archives of Australia, *Radium Hill Uranium – Heads of Agreement with CDA [Combined Development Agency]*, 1952, Series A1209/23, 1957/4196, part 2, 1952, pp. 110-23.
- ¹⁵ National Archives of Australia, *Radium Hill Uranium*, p. 112.
- ¹⁶ M. Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945-1952*, vol. I - *Policy Making*, Macmillan Press, London, 1974, pp. 385, 480.
- ¹⁷ S.B. Dickinson, 'Radium Hill, South Australia: Review of Progress'. SA Department of Mines, Adelaide, no. 82, 1953, pp. 13, 19.
- ¹⁸ B. O'Neil, *Above and Below: The South Australian Department of Mines and Energy 1944-1994*, Special Publication no. 10, Dept. of Mines & Energy, SA, Adelaide, 1995, p. 94.
- ¹⁹ See National Archives of Australia, *Radium Hill Uranium*,
- ²⁰ See Cawte, *Atomic Australia*, endnotes for Chps 4 and 5.
- ²¹ See G.M. Mudd, 'Compilation of Uranium Production History and Uranium Deposit Data Across Australia'. SEA-US Inc., last updated January 2008, 46 pp.
- ²² See *ibid., passim*, and many references therein.
- ²³ Cawte, *Atomic Australia*, p. 90.
- ²⁴ J.A. Lackey, 'Uranium Ore Processing in Australia', *Proceedings, 'Symposium on Uranium Technology in South Australia'*, Royal Australian Chemical Institute, Adelaide, 25 March 1983, 22 pp; R.C. Merritt, *The Extractive Metallurgy of Uranium*. Colorado School of Mines Research Institute, Prepared for the US Atomic Energy Commission, 1971; see also Cawte, *Atomic Australia*, p. 52.
- ²⁵ Gowing, *Independence and Deterrence*, p. 480.
- ²⁶ Australian Atomic Energy Commission, 1962, 10th Annual Report. Australian Atomic Energy Commission, p. 20; Stewart, 'An Assessment of the Search for Uranium', p. 345.
- ²⁷ Cawte, *Atomic Australia*, p. 93.
- ²⁸ O'Neil, *Above and Below*, p. 221.
- ²⁹ South Australian Department of Mines, various, *Mining Review*, years 1954 to 1962; South Australian Department of Mines, various, *Annual Report*, South Australian Department of Mines, Adelaide, years 1954 to 1962.
- ³⁰ South Australian Department of Mines, *Mining Review*, no. 115, December 1961, p. 5.
- ³¹ Gowing, *Independence and Deterrence*, pp. 385, 480.
- ³² ABARE, *Australian Commodity Statistics 2002*, Australian Bureau of Agricultural & Resource Economics, Canberra, 2002, Table 11, p. 11.
- ³³ Australian Atomic Energy Commission, *Rum Jungle Project*, Australian Atomic Energy Commission (AAEC), 1963, pp. 3, 16.
- ³⁴ *Ibid.*
- ³⁵ O'Neil, *Above and Below*, p. 221.
- ³⁶ Kakoschke, 'Radium Hill: Bindi to Boom Town', p. 148.
- ³⁷ B.G. Lottermoser & P.M. Ashley, 'Physical Dispersion of Radioactive Mine Waste at the Rehabilitated Radium Hill Uranium Mine Site, S.A.', *Australian Journal of Earth Sciences*, 53, 2006, pp. 485-99.