General Purpose Standing Committee No. 5

The former uranium smelter site at Hunter's Hill

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Terms of reference

That General Purpose Standing Committee No. 5 inquire into and report on the Radium Hill uranium smelter[1] site in Nelson Parade, Hunter's Hill, and in particular:

(a) any rehabilitation or remediation of the site previously undertaken,

(b) the extent of contamination and radioactivity levels,

(c) the impact of any contamination on public health and the environment,

(d) the appropriateness of the Government's planned remediation strategy, and

(e) disposal of waste from the site.[2]

The terms of reference for the inquiry were referred to the Committee by the Legislative Council on 14 May 2008.

1 The term 'smelter' which has been commonly used to describe the uranium processing facility formerly at Nelson Parade is not strictly accurate. Smelting is a 'hot' process, whereas the extraction process used at Hunter's Hill was a wet chemical treatment. Throughout this report the more correct term 'refinery' is used.

2 Legislative Council Minutes No 52, 14 May 2008, Item 4, p 588

Committee membership

Mr Ian Cohen MLC	The Greens	*Chair*
The Hon Rick Colless MLC	The Nationals	*Deputy Chair*
The Hon Tony Catanzariti MLC	Australian Labor Party	
The Hon Robert Brown MLC	Shooters Party	
The Hon Charlie Lynn MLC	Liberal Party	
The Hon Lynda Voltz MLC	Australian Labor Party	
The Hon Helen Westwood MLC	Australian Labor Party	

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Chair's foreword

From 1911 to 1915, the area of land now covered by numbers 5, 7, 9 and 11 Nelson Parade, Hunter's Hill was occupied by a refinery that extracted radium from uranium ore. Radioactive waste from the extraction process was dumped on site and possibly into the Parramatta River adjacent to the refinery. The area was subsequently redeveloped for residential purposes but the issue of radioactive contamination, its extent and impact on local residents, has remained.

Newspaper articles as early as 1978 reported residents' concerns about the contamination and the lack of information about it. In early 2008, media reports suggesting that the death or illness of certain former residents might be attributable to the radioactive contamination again raised the concerns of local residents.

In 2008 NSW Health engaged the Australian Nuclear Science and Technology Organisation (ANSTO) to conduct a gamma radiation survey of the area. Based on its interpretation of the results, NSW Health declared that residents need not have any health concerns and that radiation levels were within Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) guidelines. However, it is reasonable to conclude that the evidence given to the inquiry by NSW Health that exposure levels at number 11 Nelson Parade fall within ARPANSA guidelines should not have been based on ANSTO's 2008 report, a report the NSW Government itself describes as 'not designed to be a comprehensive health risk assessment.'

As this inquiry has revealed, the need to remediate certain areas of land contaminated by the operation of the former uranium refinery before it is safe for residential occupation is currently not in dispute. However, the extent of the area requiring remediation is still unclear. The results of numerous radiological surveys from 1965 to 2008 present a piecemeal and occasionally inconsistent picture of the extent and location of the contamination, leading to considerable anxiety and confusion amongst local residents. The weight of evidence presented to the Committee clearly calls for extensive retesting of the entire area to engender public confidence and ensure that all areas of contamination are included in any remediation activities.

Currently, the NSW Government is assessing a remediation plan that involves excavating contaminated soil and trucking or barging it offsite. The Committee proposes the contaminated areas be remediated back to the background radiation level in the Hunter's Hill area, which is the natural radiation level present without any human contribution.

History has shown both in Australia and overseas that the knowledge of adverse impacts of ionising radiation on human health has grown over generations so that acceptable practices and levels of precaution in the past are no longer deemed adequate. With the ongoing expansion of the nuclear industry in its many manifestations it is increasingly clear that governments and industry have a responsibility to apply forensic attention to all aspects of the nuclear cycle. This issue clearly indicates the need to learn from our past experiences.

I would like to thank the many contributors to the inquiry, including my colleagues on the Committee, submission authors and witnesses at hearings. I would like to particularly thank the Committee secretariat for their assistance, including the Principal Council Officer, Mr Jonathan Clark for preparing the draft report and the Council Officer Assistant, Ms Christine Nguyen for ensuring the smooth administration of the inquiry process.

Hon Ian Cohen MLC
Committee Chair

Summary of recommendations

Recommendation 1 *Page 59*

That the Department of Environment and Climate Change ensure that the independent site auditor appointed to oversee the remediation of the foreshore areas of numbers 7, 9 and 11 Nelson Parade, is also appointed to oversee the remediation of the upper levels of numbers 7 and 9 Nelson Parade and any other areas beyond the site requiring remediation.

Recommendation 2 *Page 61*

That NSW Health prioritise the completion of a detailed timeline for the development and implementation of the proposed remediation plan, including projected dates for the submission of the environmental assessment, the completion of the Department of Planning's review of the proposals it contains, and the commencement and estimated completion of proposed remediation works, as approved by the Minister for Planning.

Recommendation 3 *Page 66*

That NSW Health and the Department of Environment and Climate Change ensure that, prior to the finalisation of the remediation plan and the commencement of remediation activities:

- all local residents are notified and consulted on the process of testing,
- all properties in Nelson Parade and the footpaths and street itself, are thoroughly surveyed for gamma radiation levels,
- properties on other nearby streets are surveyed for gamma radiation levels, and
- areas showing elevated gamma radiation levels are thoroughly characterised through analysis of soil samples taken down to a depth of several metres, analysis of ground water quality and measurement of radon gas levels.

Recommendation 4 *Page 66*

That NSW Health and the Department of Environment and Climate Change, in consultation with NSW Maritime, ensure that, prior to the finalisation of the remediation plan and the commencement of remediation activities, the marine environment adjacent to the site is thoroughly surveyed including analysis of sediment samples.

Recommendation 5 *Page 66*

That NSW Health and the Department of Environment and Climate Change ensure that thorough testing commence as soon as is practical, with regard to the availability of the necessary expertise and equipment.

Recommendation 6 *Page 66*

That NSW Health make the results of thorough testing available to all local residents, organise community feedback sessions to explain those results, and involve the independent site auditor in those feedback sessions.

Recommendation 7 *Page 68*

That NSW Health's remediation plan include all areas in Nelson Parade and any other site identified as contaminated by radioactive material in the vicinity of the uranium refinery site, including the marine environment adjacent to the site.

Recommendation 8 *Page 73*

That NSW Health and the Department of Environment and Climate Change, in consultation with NSW Maritime, further investigate the option of barging contaminated soil and other material from the site, and include in the remediation plan the reasons for choosing or rejecting this option, including reference to water levels, the depth required by loaded barges and the possibility of dredging the bay floor.

Recommendation 9 *Page 77*

That NSW Health's remediation plan include a clear description of an on-site method for classifying excavated soil and other material and the classification criteria to be used, and that contaminated soil and other material be subsequently disposed in a landfill licensed to accept it.

Recommendation 10 *Page 77*

That NSW Health's remediation plan include a strategy for dealing with contaminated soil and other material classified as hazardous waste according to the Department of Environment and Climate Change's *Waste Classification Guidelines, Part 3:Waste Containing Radioactive Material (2008)*, including a strategy for on-site containment should a disposal location for hazardous waste not be available.

Recommendation 11 *Page 77*

That NSW Health notify residents of progress in the development of the remediation plan and that once a plan has been assessed and accepted, NSW Health make it available to residents and organise community feedback sessions, involving the independent site auditor to clarify its details.

Recommendation 12 *Page 78*

That NSW Health's remediation plan include a commitment that the costs of remediation to all areas requiring it will be borne by the NSW Government.

Chapter 1 Introduction

This chapter gives an overview of the Inquiry process, including the methods the Committee used to encourage participation by members of the public, government agencies and relevant organisations. It also includes a brief outline of the report structure.

Inquiry terms of reference

1.1 The terms of reference for the inquiry were referred to the Committee by the Legislative Council on 14 May 2008. The terms of reference are reproduced on pg iv.

Conduct of the Inquiry

Submissions

1.2 A call for public submissions was advertised in the *Sydney Morning Herald* and the *Daily Telegraph* in May 2008, and local papers, the *Northern District Times, The Weekly Times* and the *North Side Courier,* in June 2008. A media release announcing the Inquiry and the call for submissions was sent to all media outlets in NSW. The Committee also wrote to a large number of relevant stakeholder organisations and individuals inviting them to participate in the Inquiry process. The submission closing date was 30 June 2008.

1.3 The Committee received a total of 23 submissions. Submissions were received from a range of stakeholders, including government agencies, national bodies in the field of radiation control, academics, and former and current residents of Nelson Parade. The Committee was also provided with reports from a number of radiological surveys previously conducted on the site.

1.4 A list of submissions is contained in Appendix 1. The submissions are available on the Committee's website: www.parliament.nsw.gov.au/lawandjustice.

Public hearings

1.5 The Committee held two public hearings at Parliament House on 3 and 4 July 2008. The Committee heard from a broad range of stakeholders, including NSW Health, the Department of Environment and Climate Change, the Department of Planning, NSW Maritime, the Australian Nuclear Science and Technology Organisation, the Australian Radiation Protection and Nuclear Safety Agency, Hunter's Hill Council, academics, a representative from a private organisation specialising in radiological issues, the legal representative of one of the current owners in Nelson Parade and former and current residents of Nelson Parade.

1.6 The Committee thanks all the individuals and organisations that made a submission or gave evidence during the Inquiry.

1.7 A list of witnesses is reproduced in Appendix 2. The transcripts of all hearings are available on the Committee's website.

Other contributors

1.8 The Committee wishes to particularly thank those people who assisted in checking the technical information.

Report structure

1.9 **Chapter 2** provides a description of the former uranium refinery site today and a brief outline of its pre-residential history, including the industrial activity that led to its contamination.

1.10 **Chapter 3** presents the basics of radiation, its effect on human health, and national radiation dose limits.

1.11 **Chapter 4** presents a summary of radiological surveys on the site and adjacent lots from 1965 to the present, with particular emphasis on the 2008 surveys conducted by the Australian Nuclear Science and Technology Organisation and Australian Radiation Services Pty Ltd. The chapter begins with an overview of technical terms and units of measurement used in these surveys.

1.12 **Chapter 5** presents the concerns of residents relating to contamination and its possible health effects. It includes a chronology of ownership of various lots on Nelson Parade, communication from NSW Health relating to contamination and remediation activities, and inquiry participants' views on this communication. Chapter 5 also addresses the concerns of residents that the death and serious illness of family members is linked to the contamination of the Nelson Parade site.

1.13 **Chapter 6** considers the NSW Government's proposed remediation plan for the site. This includes the possibility of retesting prior to remediation, the remediation assessment criteria and the classification and disposal of contaminated soil excavated from the site. The chapter begins with a summary of past remediation activities and plans, followed by an overview of the role played by government agencies in developing and implementing the current remediation plan.

Chapter 2 Background

This chapter provides a description of the former uranium refinery site today and a brief outline of its pre-residential history, including the industrial activity that led to its contamination.

Snapshot of the site today

2.1 Numbers 5, 7, 9 and 11 Nelson Parade, Hunter's Hill cover an area of land that, in the early 1900s, was occupied by a uranium refinery. Today, numbers 5 and 11 are privately owned, containing residences that are currently unoccupied. Numbers 7 and 9 are owned by NSW Health through the Health Administration Corporation and do not contain residences.[3] They are currently zoned for residential purposes but were declared unhealthy building land in 1993 under the then *Unhealthy Buildings Lands Act*[4]. They remain heavily vegetated and fenced off to restrict public access.[5] The foreshore area at the rear of numbers 7, 9 and 11 has been declared a remediation site under the *Contaminated Land Management Act 1997*. NSW Health is currently proposing to change the land use and allow occupancy of lots 7 and 9, which will first require extensive remediation of the site.[6]

2.2 Throughout this report 'the site' will refer to the parcel of land owned by NSW Health, which includes numbers 7 and 9, and the foreshore area at the rear of numbers 7, 9 and 11.[7] The site has a total area of 1972.5 m^2 distributed as follows: number 7 – 765.1 m^2; number 9 - 689 m^2; foreshore area at the rear of numbers 7 and 9 - 354.0 m^2; and the foreshore area at the rear of number 11 – 164.4 m^2.[8]

2.3 The area of Nelson Parade containing the site and adjacent lots is on the southern side of the Hunter's Hill peninsula, fronting the Parramatta River at Fern Bay. Topographically, the site and adjacent lots are split into two levels, with the upper levels separated from the lower foreshore areas by a 10-12 m sandstone cliff.[9] The upper levels are themselves steep and terraced, with the entire area sloping from north to south – that is, from Nelson Parade down to the Parramatta River. The foreshore area is reclaimed land retained behind a sandstone seawall.

3 Submission 22, NSW Government, p 6

4 Ms Elizabeth Corbyn, Director General, Department of Environment and Climate Change, Evidence, 3 July 2008, p 58

5 Submission 22, p 2

6 Submission 22, p 15

7 See Appendix 4 for map of site

8 Submission 18, Hunter's Hill Council, p 13

9 NSW Health, 'Remediation of 7-9 Nelson Parade, Hunter's Hill: Preliminary Environmental Assessment, November 2005, p 3

Pre-residential industrial activity in the area

The uranium refinery

2.4 From 1911 to 1915 the Radium Hill Company operated a uranium refinery on an area of land that is now number 5, 7, 9, and 11 Nelson Parade. The refinery extracted radium from uranium ore.[10]

2.5 The uranium ore came from Radium Hill in South Australia where Australia's first uranium mine had been established a few years earlier, following the discovery of potentially economic uranium-bearing ore by prospector Arthur John Smith.[11] The ore was shipped from South Australia and unloaded at the refinery's wharf that extended out from the foreshore area adjoining the site.[12] The Radium Hill Company spent more than £15,000 developing the refinery at Hunter's Hill, which had the capacity to process approximately 10 tonnes or ore per week. It was motivated by the price for radium, which in 1911 had reached a staggering £13,000 per gram.[13] The primary demand for radium was from scientific research and medical use. Some of the radium produced at Hunter's Hill was sold to nuclear physicist Earnest Rutherford,[14] and some to Marie Curie in France,[15] both of whom used it in their research into radioactivity and radioactive elements.

2.6 The outbreak of the First World War lead to a downturn in overseas demand, bankrupting the Radium Hill Company. The Hunter's Hill refinery closed in June 1915 having produced approximately 1.8 grams of radium.[16]

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10 Submission 22, p 4; Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 173-174

11 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 172; Submission 18, p 2

12 A photograph of the refinery showing the wharf extending out from the foreshore was submitted to the inquiry by Dr Gavin Mudd, Monash University, in his journal article: Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2). Members from the Nelson Parade Resident Group suggest this photo is actually of the tin smelter on nearby Kelly's Bush Reserve (Ms Phillipa Clark, Co-ordinator, Nelson Parade Residents Group, Evidence, 3 July 2008, p 10). The photo first appeared in the South Australian Department of Mines publication *Review of Mining Operations in South Australia,* No 17 (December 1912), p 12. with the title "Woolwich radium refinery, Sydney, 1912.

13 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 173-174

14 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 174

15 Mr Benjamin Nurse, Evidence, 4 July 2008, p 56

16 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 173-174

The carbolic acid plant

2.7 In the late 1800s to early 1900s, prior to the existence of the uranium refinery, a plant operated on the foreshore area of Nelson Parade producing carbolic acid from coal tar.[17]

The tin smelter on Kelly's Bush Reserve

2.8 From 1895 to 1966 a tin smelter operated on what is now Kelly's Bush Reserve, which borders Nelson Parade. The smelter processed tin ore that contained uranium-bearing and thorium-bearing monazite minerals.[18]

Contamination of the site

Contamination on land

2.9 Uranium ore from Radium Hill was difficult to process and an aggressive chemical treatment was used at the Hunter's Hill refinery to extract the radium.[19] A by-product of the process was radioactive tailings that had a sand-like texture.[20] These tailings were thrown onto several dumps on the site.[21] The dumping of these tailings on-site and subsequent use as fill behind retaining walls and over rock shelves is the primary source of radioactive contamination of the Nelson Parade site and adjacent lots.[22] Another by-product of the chemical extraction process was liquid waste, which when discharged on land would have contaminate the soil and rocks.[23]

The amount of ore processed

2.10 The amount of uranium ore processed during the lifetime of the refinery is important, since it gives an indication of the level of contamination remaining on the site. The Committee heard evidence that approximately 500 tonnes of uranium ore were processed at the Hunter's Hill site, based on the limited data available.[24] B W Scott, Consultant Physicist to the Health Commission, noted in 1977 that although 'records are not sufficiently precise to enable an

17 Submission 22, p 4

18 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 174

19 Dr Gavin Mudd, Lecturer, Department of Civil Engineering, Monash University, Evidence, 4 July 2008, p 11

20 Submission 22, p 4

21 Scott, B W, 'Investigation of Radioactive Contamination at Nelson Parade, Woolwich', prepared on behalf of NSW Health Commission, April 1977, p 3

22 Submission 22, p 2 and p 4

23 Correspondence from Dr Gavin Mudd, Lecturer, Department of Civil Engineering at Monash University to Committee Secretariat, 15 August 2008

24 Submission 22, p 4; Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 174; Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 4

accurate estimate to be made of the amount of uranium ore bought to Woolwich,' it would 'appear to be in the vicinity of 500 tons'.[25]

2.11 Dr Gavin Mudd, lecturer with the Department of Civil Engineering at Monash University, who also noted that records are incomplete, said this figure could be as high as 2,150 tonnes, based on accounts of production at the Radium Hill mine.[26] Dr Mudd suggested this larger figure may be more accurate based on the fact the Hunter's Hill refinery had the capacity to process around 10 tonnes of ore per week, or 520 tonnes per year, and operated for approximately five years.[27]

The amount of radium left on the site

2.12 In his 1977 report, Mr Scott noted that 'one batch [of uranium ore] contained 1.4% uranium oxide, U_3O_8', a percentage concentration he uses in subsequent calculations.[28] Dr Mudd estimated the uranium oxide concentration of the ore at 1.6% to 2%.[29] Mr Scott also quoted from a 31 December 1912 report from the Directors of the Radium Hill Company to the shareholders, in which they reported '95 tons [or ore] were treated for 350 mg of radium.' Based on this, Scott calculates 500 tonnes of the same quality ore processed in the same way at Hunter's Hill would yield 1.8 grams of radium.[30] Several other inquiry participants also quote this figure as the amount of radium produced at the Hunters Hill refinery.[31]

2.13 The extraction efficiency of the chemical process is estimated to have been 86%.[32] In other words, approximately 14% of the radium available in the ore was not extracted and remained on the site in the discarded tailings and liquid waste. Therefore, the amount of radium estimated to remain on the site depends on the amount of ore processed.

2.14 Dr Mudd calculated the amount of radium potentially remaining on the site, based on a uranium oxide concentration in the ore of 1.5%, an extraction efficiency of 86% and the amount of radium extracted being 1.8 grams. If one assumes 500 tonnes of ore was processed, 1.8 grams from a possible 2.1 grams of radium was extracted, leaving 0.3 grams remaining on the site. If one assumes 2,150 tonnes of ore was processed, 1.8 grams of a possible 9 grams

25 Scott, B W, April 1977, p 4

26 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 176; Submission 20, Dr Gavin Mudd, p 1; Email from Dr Gavin Mudd, Lecturer, Department of Civil Engineering at Monash University to Committee Secretariat, 15 August 2008

27 Email from Dr Gavin Mudd, to the Committee Secretariat, 15 August 2008

28 Scott, B W, April 1977, p 4

29 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), pp 174; Submission 20, p 2

30 Scott, B W, April 1977, p 4

31 Submission 22, p 4; Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 174; Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 4

32 Submission 13, p 4; Submission 22, p 4; Scott, B W, April 1977, p 3

was extracted, leaving 7.2 grams of radium remaining on the site. The most likely figure, according to Dr Mudd, is somewhere in the middle.[33]

2.15 The land based radioactive contamination is confined mainly to the upper levels of the site. Whilst the foreshore area of reclaimed land does include minor radium contamination, the primary source of contamination in this area is from heavy metals and hydrocarbons.[34] These are possibly from the carbolic acid plant that operated on the site prior to the uranium refinery, but the origin of the contamination is unknown and contamination of the material may have occurred off-site before it was used as fill on the foreshore area.[35] Contaminants in the soil of the foreshore area include Polycyclic Aromatic Hydrocarbons, Total Petroleum Hydrocarbons, lead and arsenic and constitute a 'significant risk of harm' leading to it being declared a remediation site under the *Contaminated Land Management Act 1997*.[36]

Contamination on the harbour floor

2.16 The Committee also heard evidence that the area below the mean high water mark directly adjacent to the refinery site had been contaminated with up to 500 tonnes of radioactive material.[37] There was anecdotal evidence presented to the Committee that the uranium ore from South Australia was unloaded from ships in wooden barrels, with split barrels being dumped off the wharf into the harbour.[38] A 1965 Department of Health paper noted an area of contamination 'outlining the original wharf.'[39] The Committee heard that it is probable that liquid waste was also discharged into the harbour adjacent to the site.[40]

2.17 NSW Maritime gave evidence that they were not aware of any waste being dumped into the harbour during the time the refinery operated or since.[41]

Approval of the area for residential housing

2.18 Although it is thought that houses were built on the upper level of numbers 7 and 9 Nelson Parade as early as the 1920s, the bulk of residential development in the area occurred after the

33 Email from Dr Gavin Mudd, to the Committee Secretariat, 15 August 2008

34 Submission 22, p 2

35 GHD, '7-11 Nelson Parade: Results of Foreshore Contamination Assessment', prepared on behalf of NSW Department of Commerce, November 2004, p 16

36 Submission 22, pp 16-17

37 Submission 8, Mr Michael Richardson MP, p 13; Submission 12, Ms Lynne Saville, p 2

38 Submission 19, Mr Graham Camp, p 1

39 Bayliss, R J, "Interim Report on Contamination of Residential Premises at Hunter's Hill", NSW Department of Public Health, p 2

40 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 187; Email from Dr Gavin Mudd, to Committee Secretariat, 15 August 2008

41 Mr Bruce Green, Acting General Manager, Maritime Property Division, New South Wales Maritime, Evidence, 3 July 2008, p 72

mid-1960s.[42] Following the closure of the nearby tin smelting plant in 1965 the area was approved for residential housing despite minimal, if any, remediation aimed at addressing the combined radioactive waste from the uranium refinery and the tin smelter.[43]

Subsequent movement of contaminated material

2.19 Whilst most of the land based contamination occurred in the particular area the ore was being treated, on what is now numbers 7 and 9 Nelson Parade,[44] the Committee heard evidence that some contaminated material was moved to adjacent blocks on the low side of Nelson Parade, that is, other odd numbered lots.

2.20 The redevelopment of the area for residential purposes saw several retaining walls and terraces constructed which would have involved a certain amount of solid waste from the uranium refinery being used as fill.[45] The NSW Government noted that 'a small proportion of tailings are thought to have been spread to numbers 3, 5, 11 and 13 Nelson Parade.'[46]

2.21 No 11 Nelson Parade, in particular, has been extensively landscaped with material taken from numbers 7 and 9 and used as fill behind a retaining wall on number 11.[47] Material was also taken from the upper section of number 11 and used as fill behind the stonewall at the foreshore.[48]

2.22 Hunter's Hill council was not aware of permission being sought to move soil from the site[49] and members of the Nelson Parade Resident's Group are not aware of any stories of residents removing soil from the site.[50]

Committee comment

2.23 Notwithstanding the comment by the Nelson Parade Resident's Group that it was not aware of any soil being removed from the site and deposited elsewhere the Committee considers it possible this may have occurred. The area of Nelson Parade and its immediate surrounds slopes steeply down to the Parramatta River and a majority of blocks have retaining walls and terraces involving the use of large amounts of fill. Contaminated tailings have been removed from the site and used as fill in known locations, on numbers 3, 5, 11 and 13, and the Committee considers it possible tailings have been used as fill in unknown locations also.

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42 Submission 22, p 4

43 Submission 20, p 2

44 Submission 22, p 4

45 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 187

46 Submission 22, p 4

47 Mr Barry Smith, General Manager, Hunter's Hill Council, Evidence, 3 July 2008, p 34

48 Submission 19, p 1

49 Mr Barry Smith, Evidence, 3 July 2008, p 30

50 Ms Phillipa Clark, Co-ordinator, Nelson Parade Residents Group, Evidence, 3 July 2008, p 14

2.24 Consequently, the Committee has written to the Department of Environment and Climate change requesting that radiological testing be carried out along Nelson Parade and nearby streets to determine whether or not contamination has been spread beyond the lots immediately adjacent to the site. Chapter 6 deals more thoroughly with the issue of retesting prior to remediation.

The former uranium smelter site at Hunter's Hill

Chapter 3 Radiation, human health and relevant guidelines

This chapter presents the basics of radiation, its effect on human health, and national radiation dose limits.[51]

Radiation basics

3.1 The Committee was provided with and directed to a variety of information sources on radiation and its effects on human tissues.[52] The following is a summary derived from those sources.

Radionuclides

3.2 Radionuclides are elements whose atoms have an unstable nucleus due to an excess of nucleons (protons or neutrons). These atoms attempt to achieve stability by throwing off the excess nucleons, or by emitting energy in some other form. This process is called radioactive decay, and the particle or energy emitted is called radiation. With the emission of radiation, and consequent loss of energy and mass, a new isotope or element is formed. This 'daughter' product may still have an unstable nucleus, in which case it will also emit radiation. All radionuclides continue to radioactively decay through various daughter products on their way to becoming stable elements.

3.3 Uranium, the heaviest naturally occurring element, is a radionuclide. It's daughter products include thorium, radium, radon, polonium, radioactive isotopes of lead and finally stable lead. Wherever you find uranium you expect to find these other elements also, since some of the uranium will have decayed into thorium and radium, and so on. Note that radium-226, a radionuclide referred to throughout this report, is a radioactive isotope of radium.

3.4 The rate at which a radionuclide decays is expressed as its 'half-life' - the time it takes for half of a given amount of it to decay. Uranium-238, which emits radiation relatively infrequently, has a half-life of 4.47 billion years. By contrast, radium has a half-life of 1600 years and radon,

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51 The Committee would like to thank Professor Tilman Ruff from the Medical Association for the Prevention of War for his help in checking the technical information presented in this chapter.

52 Submission 22, NSW Government, Appendix 1; Tabled document, NSW Health, *Conversion of Radiological Units*, 3 July 2008; Tabled document, NSW Health, *SI Radiation Measurement Units: Conversion Factors*, 3 July 2008; Submission 20, Dr Gavin Mudd, p 2-3; Dr Gavin Mudd, Lecturer, Department of Civil Engineering, Monash University, Evidence, 4 July 2008, p 3-5; Professor Tilman Ruff, Medical Association for Prevention of War, Evidence, 4 July 2008, p 46-53; Tabled PowerPoint presentation, *Health Effects of Radiation* Exposure, Professor Tilman Ruff, PowerPoint presentation, 4 July 2008; Submission 13, Australian Radiation Protection and Nuclear Safety Agency; Mr Peter Burns, Physicist, Australian Radiation Protection and Nuclear Safety Agency, Evidence, 4 July 2008; Submission 12, Ms Lynne Saville; Australian Radiation Protection and Nuclear Safety Agency, Radiation and Health Factsheet, *Ionising Radiation and Health*, accessed 7 August 2008, < http://www.arpansa.gov.au/radiationprotection/factsheets/is_rad.cfm#1>

a highly radioactive gas, has a half-life of 3.8 days. The shorter the half-life the more radioactive the element – that is, the more radioactivity it emits per second.

Radiation

3.5 Radiation is emitted in two main forms; as particles and as electromagnetic radiation. Particulate radiation consists of fast moving sub-atomic particles, which include alpha particles, beta particles, neutrons, electrons and protons. Electromagnetic radiation consists of gamma and X-rays, and which are waves of electromagnetic energy similar to visible light but with more energy.

3.6 These forms of radiation are called 'ionising' radiation due their having sufficient energy to interact with surrounding matter by producing electrically charged particles called 'ions' in the material they hit. They can, for example, knock electrons off atoms in human tissue and cause biological damage. They penetrate matter to different degrees with neutrons being the most penetrating, followed by gamma rays, then beta particles, then alpha particles. Alpha particles cannot penetrate skin but pose a significant health risk when they are inhaled. They are heavier and slower than beta particles and gamma rays, and their energy is deposited over a shorter distance. This makes them more damaging because they cause multiple ionisations within a small area.

Units of measurement and 'absorbed' and 'equivalent' doses

3.7 The *becquerel* (Bq) is a measure of radioactivity. It expresses how many radioactive disintegrations producing a particle or wave are occurring in a source per second. One becquerel equals one radioactive decay per second. It does not indicate what type of radiation has been emitted or what its effect might be. The becquerel is a small unit and is usually expressed in multiples such as a kilobecquerel (kBq: one thousand Bq), megabecquerel (MBq: one million Bq) or gigabecquerel (GBq: one billion Bq).

3.8 The *gray* (Gy) is a measure of how much energy is absorbed by a substance from the radiation passing into or through it, or the *absorbed dose* of radiation energy. One gray equals one joule of energy absorbed by one kilogram of matter. One gray is a large amount of energy and the absorbed dose is usually expressed in smaller units such as a milligray (mGy: one thousandth of a gray) or microgray (μGy: one thousandth of a mGy) or nanogray (nGy: one thousandth of a μGy).

3.9 The *sievert* (Sv) is a measure of the biological effect the absorbed dose of radiation energy has on human tissue, or the *equivalent dose*. Not all forms of radiation cause the same amount of biological damage. For example, a given amount of energy contained in alpha particles causes more damage than the same amount of energy in gamma rays. Therefore, the energy absorbed by tissue (the absorbed dose expressed in Grays) is multiplied by a weighting factor to take account of the different forms or radiation. The weighting factor for gamma rays and electrons is 1, meaning that for gamma rays the equivalent dose (Sv) = absorbed dose (Gy). The recommended weighting factor for protons is 2, and for alpha particles it is 20, meaning that for alpha particles the equivalent dose (Sv) = 20 x absorbed dose (Gy). One sievert is large amount of energy and the doses associated with environmental exposures are often expressed in millisieverts or microsieverts.

Exposure pathways

3.10 Human tissue is exposed to radiation via four main pathways. The first is external radiation, such as gamma rays, hitting and penetrating our skin. The second is inhalation, for example of radon gas, and consequent exposure to the alpha particles it emits. The third is direct ingestion of dust and particles from radioactive soils or contaminated water, or the entry of radionuclides into the body through open wounds. The fourth is ingestion through accumulation in the food chain, through eating vegetables, fruits or herbs that have been grown in contaminated soil, or eating the products of animals that have eaten these.

3.11 Different radioactive elements may behave chemically like other common elements, and be distributed in the body accordingly. For example, radium shares certain chemical properties with calcium and is stored by the body in bones and teeth. This results in a significant exposure pathway should radium be ingested and can lead to bone cancers and cancers of the blood forming organs.

Background radiation

3.12 Everyone on earth is exposed to ionising radiation every day. This natural background radiation can be of cosmic or terrestrial origin.

3.13 Cosmic rays are high-energy particles from outer space that pass through earth's atmosphere. External terrestrial radiation comes from naturally occurring radionuclides such as uranium and thorium that are present in small quantities on most soils and rocks. These radionuclides decay to radon gas, which can then be inhaled. Internal terrestrial radiation comes from naturally occurring radionuclides inside the body. For example, most living things have small amounts of the radioactive isotope potassium-40.

3.14 The average natural background radiation level in Australia is approximately 1.5 mSv per year, comprised of 0.3 mSv from cosmic rays, 0.6 mSv from external radiation, 0.4 mSv from internal radiation and 0.2 mSv from radon gas. [53]

3.15 Medical scans such as x-rays, including CT scans, and nuclear medicine procedures also involve exposure to radiation. A 1990 study showed that Australians are exposed to approximately 0.8 mSv of radiation per year from medical scans.[54] This amount is increasing, particularly due to increased use of CT scanning.

3.16 It is important to note that background radiation levels vary from place to place throughout Australia. In Australia, the public exposure limit set by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) of 1 mSv per year[55] is *in addition* to whatever the background level in a particular location may be. Therefore, when assessing exposure levels

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53 Australian Radiation Protection and Nuclear Safety Agency, *Ionising Radiation and Health, Factsheet,* accessed 11 August 2008, <www.arpansa.gov.au/radiationprotection/FactSheets/is_rad.cfm#7>; Australian Radiation Protection and Nuclear Safety Agency, *What's Background Radiation? Factsheet,* accessed 11 August 2008, < http://www.arpansa.gov.au/pubs/baseline/bg_rad.pdf>

54 Australian Radiation Protection and Nuclear Safety Agency, *What's Background Radiation? Factsheet,* accessed 11 August 2008, < http://www.arpansa.gov.au/pubs/baseline/bg_rad.pdf>

55 See following section in this chapter for further discussion of guidelines in relation to dose limits

from man-made contamination in a particular location, background levels are taken from nearby uncontaminated areas to provide a point of comparison. The levels observed on the contaminated site above this local background level can then be attributed to the man-made contamination. See Chapter 4 for discussion of the background levels measured near the Nelson Parade site.

Radiation and human health

Cell damage and deterministic and stochastic effects

3.17 Ionising radiation has the capacity to damage or kill human cells, including damaging the DNA in our cells, which can cause cancers, other health effects and genetic damage.

3.18 Very high doses, above 1 Sv, received in a short period of time, kill large numbers of cells, impairing the function of vital organs and systems. Acute health effects such as nausea and vomiting, skin and deep tissue burns and impairment of the body's ability to fight infection can result within hours, days or weeks. These effects are called 'deterministic' effects, because they will almost certainly occur above certain thresholds, and will not occur below those thresholds. By limiting doses below these thresholds deterministic effects can be prevented.

3.19 At exposure levels below the threshold for deterministic effects cell damage can and still does occur. If damage occurs to the genes it is possible for cancers to develop. If genes in the reproductive organs are damaged, mutations can be passed on to children. Cancers and heritable mutations are called 'stochastic,' or probabilistic, effects. That is, the exposure to radiation increases the odds of the cancer or mutation occurring. Furthermore, exposure is cumulative – that is, the more episodes of exposure one is exposed to, the higher the risk of developing cancer and genetic mutations.

3.20 The increase in risk of developing a solid cancer from exposure to 1 mSv of radiation is estimated to be 1 in 10,000. The risk of developing leukaemia from the same dose of radiation is 1 in 100,000. Approximately half of cancer patients, excluding people with skin cancers, will die from their cancer. Therefore, the risk of developing a fatal cancer from exposure to 1 mSv of radiation is approximately 1 in 20,000.[56]

3.21 The risk to infants of damage due to radiation exposure is three or four times greater than for adults. The risk to females overall of developing cancer as a result of radiation exposure is approximately 40% greater than for males, and for females early in life the risk is twice that of males. Multiplying the risk factors for particular groups in the population can produce a 10-fold difference in susceptibility to damage from radiation exposure depending on age and gender.

3.22 Radiation risks are most significant during organogenesis and in the early foetal period, lessening slightly in the second trimester and again in the third trimester. Malformations have a threshold of 100 to 200 mGy and are typically associated with central nervous system problems.[57]

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56 Professor Tilman Ruff, Evidence, 4 July 2008, pp 48-49; Submission 13, p 5

57 Professor Tilman Ruff, Evidence, 4 July 2008, p 49

3.23 There is often a long latency period associated with the stochastic effects of exposure to radiation. For leukaemia it takes a minimum of five years before you would see an increase in incidence after exposure. For solid cancers you would not expect to see an increase until about 10 years after exposure.[58]

Linear No-Threshold hypothesis

3.24 The linear no-threshold hypothesis holds that the proportionality between dose and risk observed at high doses of radiation continues down through lower doses to zero. That is, there is no threshold below which radiation exposure is considered safe. As Mr Peter Burns, a Physicist with the Australian Radiation Protection and Nuclear Safety Agency explained, 'one radiation particle striking one cell can make that cell go cancerous.'[59]

3.25 The linear no-threshold hypothesis forms the basis of radiation protection guidelines around the world, including in Australia.[60] The National Research Council of the US National Academy of Sciences, which addressed the issue of risk of cancer from low doses of radiation, concluded that 'the smallest dose has the potential to cause a small increase in risk to humans.'[61]

3.26 Notwithstanding the widespread acceptance of the linear no-threshold hypothesis, there are methodological difficulties in proving it. Epidemiological research has been unable to establish unequivocally that there is a statistically significant increase in risk of cancer from radiation doses below a few tens of millisieverts.[62] This is due to statistical noise in the form of high incidence of cancer from many causes. The Friends of the Earth (Melbourne) provide the following illustration of this difficulty: it is estimated that out 100 people exposed to 100 mSv of radiation over their lifetime, one would develop cancer as a result of that exposure, whereas 42 people in the same group would be expected to develop cancer from causes other than radiation.[63]

3.27 Mr Burns explained that an epidemiological study seeking to establish a causal link between radiation doses around 10 mSv and cancer would require following millions of people for over 50 years and 'you probably still would not be able to see the effect because the risk is so small.'[64]

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58 Professor Tilman Ruff, Evidence, 4 July 2008, p 48

59 Mr Peter Burns, Physicist, Evidence, 4 July 2008, p 19

60 Submission 10, Friends of the Earth (Melbourne), p 1

61 BEIR VII-Phase 2, Health risks from exposure to low levels of ionizing radiation, Committee to assess health risks from exposure to low levels of ionizing radiation, National Research Council (National Academy of Sciences, Washington, D.C.), USA 2005, quoted in Submission 10, Friends of the Earth (Melbourne), p 3

62 Submission 13, p 11

63 Submission 10, p 2

64 Mr Peter Burns, Physicist, Evidence, 4 July 2008, p 19

3.28 The linear no-threshold hypothesis is adopted in recognition of the fact that no threshold for stochastic effects has been proven and in order to be cautious when establishing public health guidelines.[65]

Radiation regulations and guidelines

ICRP and ARPANSA dose limits

3.29 Australia's radiation protection guidelines have been adopted from recommendations made by the International Commission on Radiological Protection (ICRP).[66] The Australian body that implements those recommendations and issues radiation guidelines is the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

3.30 ARPANSA is a Commonwealth agency that was formed in 1998. Its functions include establishing national uniformity in radiation protection and nuclear safety. It does this through its Radiation Health Committee, which produces standards, codes of practice and recommendations.

3.31 Australia's current guidelines are based on recommendations made by the ICRP in 1990. They are contained in the Australian Radiation Protection and Nuclear Safety Regulations (1999), which state that:

- The effective dose limit for public exposure is 1 mSv annually[67]
- The effective dose limit for occupational exposure is 20 mSv annually, averaged over 5 consecutive calendar years[68]

3.32 These dose limits exclude background radiation and exposure due to medical scans.[69]

3.33 The effective dose limit for public exposure prior to 1990 was 5 mSv per year.[70]

3.34 According to ARPANSA and the Medical Association for the Prevention of War (NSW), radiation protection standards recognise that radiation exposure above background cannot be reduced to zero, but that they nevertheless provide a system of control to avoid unnecessary exposure and to keep dose levels low.[71]

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65 Submission 13, p 11

66 Submission 13, p 5

67 Australian Radiation Protection and Nuclear Safety Regulations 1999 (Cth), s 59 (3)

68 Australian Radiation Protection and Nuclear Safety Regulations 1999 (Cth), s 59 (1)

69 Submission 12, Appendix 1, p 3

70 Submission 13, p 7

71 Submission 13, p 11; Submission 12, Appendix 1, p 1

Uncertainty about the effect of low doses of radiation

3.35 ARPANSA further noted that the public dose limit had been formulated on the basis of the linear no-threshold hypothesis and 'is not a line between "safe" exposure and "unsafe" exposure.'[72]

3.36 Professor Tilman Ruff from the Medical Association for the Prevention of War cautioned that the science behind regulatory standards was hotly contested and that the more that was learnt about radiation, the stricter the regulations became:

> The more we learn the worse it looks. Radiation protection standards have gone down by a factor of more than 20 in the last 50 years.[73]

3.37 Professor Ruff presented the results of a nuclear industry study showing a relationship between incidence of childhood cancer and distance from a nuclear power station to illustrate his view that new discoveries about the link between cancer and low doses of radiation were still being made:

> The conventional science would tell us that that is not particularly plausible, because the measured doses involved are tiny—thousandths or hundredths of a millisievert. That is unexplained, but it is a very striking finding.[74]

72 Submission 13, p 6

73 Professor Tilman Ruff, Evidence, 4 July 2008, p 50

74 Professor Tilman Ruff, Evidence, 4 July 2008, p 50

The former uranium smelter site at Hunter's Hill

Chapter 4 History of testing on the site and surrounding area

In this chapter the Committee presents a summary of radiological surveys on the site and adjacent lots from 1965 to the present, with particular emphasis on the 2008 surveys conducted by the Australian Nuclear Science and Technology Organisation and Australian Radiation Services Pty Ltd. The chapter begins with an overview of technical terms and units of measurement used in these surveys.

Overview of terms and units of measurement

4.1 Until the 1960's the units of measurement relating to radiation included the Curie (Ci), the Rad (rad) and the Rem (rem). These have now been replaced with units from the *Systeme International* (SI), which are currently used around the world, other than in the United States. SI units include the becquerel, the gray and the sievert. The older units are converted to the SI units as follows[75]:

Table 4.1 Conversion of radiological units of measurement from old system to System Internationale

Old system		Systeme International
1 Curie (Ci)	=	37 gigabecquerel (GBq)
1 picocurie (pCi)	=	37 millibecquerel (mBq)
1 Rad (rad)	=	10 milligray (mGy)
1 millirad (mrad)	=	10 microgray (μGy)
1 Rem (rem)	=	10 millisievert (mSv)
1 millirem (mrem)	=	10 microsievert (μSv)

4.2 The older system also included a unit of measurement called the Roentgen (R), which was commonly used to express exposure rates. Most experts agree that the Roentgen, Rad and Rem can be considered numerically equivalent when referring to gamma radiation,[76] in the same way that grays and sieverts can be considered numerically equivalent in the new system when referring to gamma radiation.

4.3 Throughout this report, measurements reported in old units are followed by a conversion to current Systeme International units in brackets.

4.4 Various prefixes are used with the units of measurements, in particular to express very small quantities. These prefixes, using sieverts (Sv) as an example, are related as follows:

75 Tabled document, NSW Health, *Conversion of Radiological units*, p 1

76 Tabled document, NSW Health, *SI Radiation Measurement Units: Conversion Factors*, p 1

Table 4.2 Relationship between prefixes expressing very small quantities

Prefix	Relationship
1 sievert (Sv)	= 1000 millisievert (m Sv)
1 millisievert (mSv)	= 1000 microsievert (μSv)
1 microsievert (μSv)	= 1000 nanosievert (n Sv)
1 nanosievert (nSv)	= 1000 picosievert (p Sv)
1 picosievert (pSv)	

4.5 The *external dose rate* is a measure of the absorbed dose of radiation a person would receive in a particular location and is expressed in grays. It typically refers to gamma radiation, and where it does the absorbed dose in grays is numerically equivalent to the *equivalent dose* in Sieverts.

4.6 The a*ctivity level* of a sample (e.g., soil) is a measure of its radioactivity. That is, it measures the frequency with which radiation is being emitted from a given amount of matter. It is expressed in becquerels. Depending on where the sample is (on the surface, below the surface, under vegetation) and what materials may absorb the radiation before it reaches a human being, the activity level does not necessarily translate into the *absorbed dose*. However, high soil activity levels at the surface would be expected to correlate with high absorbed dose rates at that locations. In addition, the activity level does become an internal radiation hazard if soil is ingested or inhaled.

4.7 *Dose limits* refer to the effective dose limit, set by the International Commission on Radiological Protection (ICRP) and adopted by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), as discussed in Chapter 2. *Dose limits* refer to total dose from radiation in any form, particulate or electromagnetic. In 1966 the public exposure limit was 0.5 rem/yr (5 mSv/yr). This limit remained until 1990 when it was revised down to 1 mSv/yr. It is important to note that absorbed and effective doses are always expressed per unit of time, for example, per year or per hour. A per hour rate will only translate into per year rate if a person spends 24 hours per day, 365 days per year on the spot where the rate was measured. For example, assuming occupancy for every hour of a year, 0.06 mrem/hr (0.6 μSv/hr) equates to 0.5 rem/yr (5 mSv/yr), and 0.12 μSv/hr equates to 1 mSv/yr.

4.8 *Occupancy rates* attempt to take into account the fact that people spend varying amounts of time inside and outside of their homes. The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) recommend occupancy rate estimates of 80% of time spent outdoors and 20% of time spent indoors. In other words, dose rates measured indoors would be multiplied by 0.8 to give the absorbed dose and dose rates measured outdoors would be multiplied by 0.2.[77]

[77] United Nations Scientific Committee on the Effects of Atomic Radiation <http://www.unscear.org/unscear/en/publications/1982.html > (Accessed 12 August 2008)

The 1965/1966 Bayliss survey

4.9 A survey commissioned by the NSW Department of Health in 1965 and conducted by R J Bayliss, Scientific Officer with the Radiation Branch, appears, according to the NSW Government, to be the first detailed radiation survey undertaken at Nelson Parade.[78] An interim report was delivered in December 1965[79] and a final report in March 1966.[80] It covered what are now lots 5, 7, 9 and 11 Nelson Parade and included measurement of external dose rates, soil activity and radium uptake in vegetables and herbs. It did not include measurement of radon levels. The 1966 report refers to an earlier report,[81] other then the interim report, however the Committee was not provided with a copy of this earlier report.

Results

4.10 External gamma dose rates were measured on what are now numbers 5, 9 and 11 Nelson Parade and found to be in the order of 1mR/hr (10μSv/hr).[82,83] A sample of 'a coke-like substance' taken from what is now number 5 gave a reading of 40 mR/hr (400 μSv/hr) at the surface.[84] On what is now number 11 a reading of 9.1 mR/hr (91 μSv/hr) was taken at a depth of three feet. Bayliss cautioned that if uncovered by building or gardening activity this radiation could result in an individual receiving the then maximum permitted dose of 10 millirem per week (50 μSv/wk).[85]

4.11 Soil activity was measured in three samples taken from what is now number 11 yielding an average activity level of 44 nCi/g (1.6 kBq/g). The report noted that a person would need to swallow 0.5 grams of soil per day to reach the then daily permitted intake of insoluble radium-226, a possibility that, for an adult, the report considered 'quite remote.' However, the report noted that proportionally, a child of 20 kg would only have to ingest 0.15g per day, a possibly considered 'a good deal greater.'[86]

4.12 The other exposure pathway for soil, inhalation, was not considered '[d]ue to the large particle sizes of the soil.'[87]

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78 Submission 22, NSW Government, p 11

79 Bayliss, R J, 'Interim Report of Contamination of Residential Premises at Hunter's Hill,' NSW Department of Health, Radiation Branch, December 1965

80 Bayliss, R J, 'Radioactive Contamination in the Grounds of Dwellings at Hunter's Hill,' NSW Department of Health, Radiation Branch, March 1966

81 Bayliss, R J, March 1966, p 5

82 Bayliss, R J, 'March 1966, pp 1-4

83 According to information regarding units of measurement and prefixes presented to the Committee, 1mR refers to 1 milliroentgen, which is equivalent to 1 millirem, which is equivalent to 10 microsieverts.

84 Bayliss, R J, March 1966, p 4

85 Bayliss, R J, March 1966, p 3

86 Bayliss, R J, March 1966, p 3

87 Bayliss, R J, March 1966, p 3

4.13 The survey included a measure of radium-226 uptake in beans and parsley grown in contaminated soil taken from 'high-activity areas on these lots'[88] and reported that the hazard was 'negligible.'[89]

4.14 The 1965 interim report noted that the activity level of the material taken from the harbour floor adjacent to the site was within the 'permitted disposal concentration for insoluble natural uranium' of 0.7 nCi/cc (26 Bq/cc). It was proposed to inform the Maritime Services Board of the results but not to recommend core samples be taken from the harbour floor in this vicinity.[90]

Committee comment

4.15 The Committee notes that the gamma radiation levels on the surface reported in the R J Bayliss survey for the Radiation Branch in 1966 are approximately ten times greater than those measured in subsequent surveys, with some peak readings far exceeding this. The Committee notes that these anomalous results may possibly be a result of the survey targeting specific hot spots, or possibly the result of miscalculation, misinterpretation or typographical error.

4.16 The Committee notes however, that an individual exposed to 1 mR/hr (10 μSv/hr), as reportedly measured at the surface on what is now numbers 5, 9 and 11 Nelson Parade could receive the then weekly limit of 10 mrem/wk (100 μSv/hr)[91] from exposure for approximately 10 hours per week, or just under 1 hour and 30 minutes per day.

4.17 The Committee also notes that the 1966 report refers to 'the first report on this matter'[92] and 'an earlier report.'[93] Both references are to material not contained in the 1965 interim report. The Committee was not provided with this earlier material.

Conclusions in the report

4.18 Based on the results of the report, the NSW Department of Health concluded that the radiation dose was not unacceptable. According to the minutes of a NSW Radiological Advisory Council meeting in 1966, the Council agreed that there was no significant health hazard to residents.[94]

4.19 However, the report did recommend that the Radiation Branch, with co-operation from the four householders concerned, co-ordinate the removal of 'certain areas of high activity soil.'[95]

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88 Bayliss, R J, March 1966, p 3

89 Bayliss, R J, March 1966, p 3

90 Bayliss, R J, December 1965 p 1; Bayliss, R J, March 1966, p 5

91 Bayliss, R J, March 1966, p 3

92 Bayliss, R J, March 1966, p 3

93 Bayliss, R J, March 1966, p 5

94 Submission 22, p 11; Scott, B W, 'Investigation of Radioactive Contamination at Nelson Parade, Woolwich', prepared on behalf of NSW Health Commission, April 1977, p 4

95 Bayliss, R J, March 1966, p 6

The 1977 Scott survey

4.20 In 1977, B. W. Scott, Consultant Physicist to the NSW Health Commission, conducted an investigation of radioactive contamination of numbers 3 to 13 Nelson Parade and the foreshore area.[96] The aims of the report included to investigate the distribution of contamination over the lots and the cause of high radon concentrations in number 7, and to recommend appropriate remediation.[97]

Results

4.21 External gamma dose rates ranged from 0.01 to 0.05 mR/hr (0.1 to 0.5 μSv/hr) at floor level inside numbers 5, 7 and 9, to 0.1 mR/hr (1 μSv/hr) at the surface on the grounds of numbers 7 and 9.

4.22 The report concluded that there is ' no external radiation hazard by ICRP standards.' It also noted that '[t]hese were the exposure rates obtained during a survey in 1966,'[98] a reference to R J Bayliss' 1966 survey for the Radiation Branch.

4.23 The concentration of radon in the air was measured inside the houses on numbers 5, 7, 9 and 11. Radon was not detectable in numbers 5, 9 and 11. The average radon level in number 7 was 100 times the accepted limit at the time of 0.3 pCi/l (11 mBq/l).[99]

4.24 Radium-226 activity levels were measured in soil samples taken from numbers 7, 9 and 13 Nelson Parade. One sample showed an extreme activity level of 1,440,000 pCi/g (53.3 kBq). The next highest level was 6,600 pCi/g (244 Bq/g) in a sample taken from the site of the uranium refinery's chemical laboratory. The activity level of the remaining samples ranged from 23 to 662 pCi/g (0.8 to 24.5 Bq/g).[100]

Conclusions in the report

4.25 Scott concluded that 'the radium in the soil on these properties does not constitute a serious health hazard from external radiation' but that the level of radiation is acceptable 'only because the residents do not spend sufficient time in their gardens to receive the annual dose limit.'[101]

4.26 Scott recommended the 'complete removal' of the soil on numbers 7 and 9, and the removal of soil from 'certain areas' of numbers 3, 5 and 11. He noted that '[a]t this stage the survey is completed for only Nos. 7, 9 and 13.'[102]

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96 Scott, B W, April 1977, p 1

97 Scott, B W, April 1977, p 2

98 Scott, B W, April 1977, p 15

99 Scott, B W, April 1977, p 15

100 Scott, B W, April 1977, pp 17-18

101 Scott, B W, April 1977, p 25

102 Scott, B W, April 1977, p 26

4.27 With regard to the offshore area adjacent to the site, the letter recommended the silt layer be 'dredged to an as yet unspecified depth.'[103]

4.28 A letter from the Department of Public Works to the Division of Occupational Health and Radiation Control dated 15 March 1977 and included in the 1977 Scott report recommended the silt layer offshore adjacent to the site be 'dredged to an as yet unspecified depth.' It also estimated that the volume of material to be removed from the land was about 500 cubic metres, and the same amount from the underwater area, which would be placed in 44-gallon drums to await 'ultimate disposal'.[104]

Committee comment

4.29 The Committee notes that Scott's 1977 survey was not completed for numbers 3, 5 and 11 Nelson Parade and that Scott stated 'Part B of this report will deal with the other areas.'[105] The Committee was not provided with Part B of this report, if in fact it was completed.

The 1987 Sinclair Knight and Partners survey

4.30 In 1987 the engineering firm Sinclair Knight and Partners (SKP) conducted a study of the site for the NSW Public Works Department, acting on behalf of the NSW Department of Health. Their report presented the findings of an environmental assessment study of the proposal to dispose of contaminated material on-site.[106] The SKP survey included measurement of soil activity levels and radionuclide uptake in site vegetation, but not radon or external gamma radiation levels.

Results

4.31 SKP took 251 soil samples from numbers 5, 7, 9, 11 and 13 Nelson Parade that were then analysed by the Australian Nuclear Science and Technology Organisation (ANSTO). The average radium-226 activity level of the samples was approximately 4 bq/g with 70% of samples exceeding 2 bq/g.[107]

4.32 Number 5 contained no samples with levels greater than 20 Bq/g. Number 7 contained a localised area with maximum radium-226 activity of about 44 Bq/g. The maximum activity level in a sample from number 9 was 37 Bq/g and the maximum level from number 11 was 15 Bq/g. Number 13 had a small area of land near the border with number 11 that yielded an activity level of about 35 Bq/g.[108]

103 Scott, B W, April 1977, pp 23-24

104 Scott, B W, April 1977, pp 23-24

105 Scott, B W, April 1977, p 27

106 Sinclair Knight and Partners, 'Radium Waste Clean-Up, Nelson Parade Hunter's Hill: Review of Environmental Factors,' prepared on behalf of NSW Public Works Department and NSW Department of Health, 1987, p 2.1

107 Sinclair Knight and Partners, 1987, pp 4.3, 4.5

108 Australian Nuclear Science and Technology Organisation, 'Radioactive Contamination of Properties at Nelson Parade, Hunter's Hill, NSW,' report to Sinclair Knight and Partners, 1987, p 8

4.33 The maximum radioactivity measured in 'dry' vegetation taken from the site was 0.4 Bq/g. The expected average concentration in 'green' plant material was 0.07 Bq/g of radium-226 and 0.001 Bq/g of thorium-230. The report noted that these levels would allow vegetation taken from the site to be disposed of in a municipal tip, for which the National Health and Medical Research Council (NHMRC) sets a radioactivity limit of 0.25 Bq/g.[109]

4.34 The report noted that sediment taken from the shoreline adjacent to the site yielded activity levels that were 'generally low' with a majority of samples being less than 0.5 Bq/g. One sample of sediment was approximately 10 Bq/g.[110]

Conclusions in the report

4.35 The report estimated that up to 950 cubic metres of soil from the site would require 'special disposal.'[111]

1999 Egis Consulting Stage 1 survey

4.36 In 1999 Egis Consulting Australia were engaged by the NSW Department of Health to undertake investigations of radioactive contamination on numbers 7 and 9 Nelson Parade.[112] The aim of stage one of their survey was to measure external gamma radiation dose rates and compare these with results of soil activity analysis from the Sinclair Knight and Partners survey reported above.[113]

Results

4.37 The highest dose rate reported was in the southwest corner of number 9 where the rate was approximately 1.5 μSv/hr. Approximately 50% of the surface area of number 9, including the foreshore area, had a dose rate in excess of 0.5 μSv/hr, or 4.4 mSv/yr. Approximately 5% of the surface area of number 7, including the foreshore area, gave a dose rate in excess of 0.5 μSv/hr.[114] These measures were taken at one metre above the surface.[115]

Conclusions in the report

4.38 The report stated that the maximum dose rates observed on number 9 were 'equivalent to 13.1 mSv/yr, some 13 times the State and National limiting criterion for the general public.'[116]

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109 Sinclair Knight and Partners, 1987, p 4.6

110 Sinclair Knight and Partners, 1987, p 4.7

111 Sinclair Knight and Partners, 1987, p 4.7

112 Egis Consulting, 'Environmental Management Plan for Site Investigations, Nos 7 and 9 Nelson Parade, Hunter's Hill', prepared on behalf of NSW Department of Health, July 1999, p 1

113 Egis Consulting, November 1999, p1

114 Egis Consulting, November 1999, p 24

115 Egis Consulting, November 1999, p 24

116 Egis Consulting, November 1999, p 24

4.39 The report also noted that the gamma dose rates measured on number 9 correlated closely with the results of soil analysis in the 1987 SKP report.[117] However, gamma dose rates on certain areas on number 7 and number 11 did not correlate well. Egis infer that this was probably due to 'soil transfer activities' conducted by the Radiation Control Branch after 1987.[118]

4.40 The report recommended 'intrusive soil sampling' at various sites be conducted during stage two of the survey.

2000 Egis Consulting Stage 2 survey

4.41 In 2000 Egis conducted stage two of their survey of the site. The purpose of stage two was to compare the 'disposition and depth' of radioactive contamination on the site to that reported from the 1987 SKP survey, and to determine whether the contaminated soil would be classified as 'hazardous waste' under the *Protection of the Environment Operations Act 1997*. [119]

Results

4.42 Egis reported the average activity level in 19 soil samples analysed was 7.0 Bq/g. This was higher than the results of ANSTO's previous analysis reported in the 1987 SKP survey. However, Egis targeted areas identified as having elevated gamma dose rates.[120]

Conclusions in the report

4.43 Egis concluded that 'there is no significant likelihood that the mean specific activity of contaminated soils on the site would exceed 100 Bq/g' and would therefore not be classified as hazardous waste.[121] The soils would instead be classified as 'industrial waste' under the *NSW Radiation Control Regulation, 1993*.[122]

2004 GHD survey

4.44 In 2004 GHD was commissioned by the NSW Department of Commerce to assess the contamination status of soils in the foreshore area adjacent to numbers 7, 9 and 11 Nelson Parade.

Results

4.45 GHD reported that the soil in the foreshore area is heavily contaminated with arsenic, lead and Polycyclic Aromatic Hydrocarbon (PAH) and Total Petroleum Hydrocarbon (TPH)

117 Egis Consulting, November 1999, p 24

118 Egis Consulting, November 1999, p 31

119 Egis Consulting, February 2000, p i

120 Egis Consulting, February 2000, p 20

121 Egis Consulting, February 2000, p 24

122 Egis Consulting, February 2000, p 26

compounds at levels above Environmental Protection Authority thresholds for open space and parkland use. They also reported that groundwater beneath the foreshore area is contaminated, most notably by PAH and TPH.[123]

Conclusions in the report

4.46 GHD stated that it is likely the material from the foreshore adjacent to numbers 7 and 9 would be classified as industrial waste, 'and potentially hazardous waste.'[124]

4.47 They estimated the amount of contaminated soil in the foreshore area adjacent to numbers 7 and 9 would be approximately 450 cubic metres, or 1080 tonnes.[125]

2008 Martens survey of 21 Nelson Parade

4.48 In May 2008, Martens Consulting Engineers conducted a survey of number 21 Nelson Parade at the request of the owners who required assurance about contamination levels in order to carry out building works on their property. Martens measured the dose rate on the property and surrounding area and analysed five samples of soil taken from number 21.[126]

Results

4.49 The background radiation for the Hunter's Hill locality was reported to be 0.35 to 0.44 mSv/yr.

4.50 Dose rates on number 21 ranged from 0.35 to 0.52 mSv/yr.

4.51 The dose rate reported from soil samples taken from number 21 was in the range 0.52 to 0.61 mSv/yr.

4.52 These levels compared to the dose rate measured on the street and footpath adjacent to numbers 7 and 9 of 5.26 to 7.0 mSv/yr.

4.53 Martens also reported dose rates measured at other locations on Nelson Parade, the street, itself. The results are presented in the following table:

123 GHD, '7-11 Nelson Parade: Results of Foreshore Contamination Assessment', prepared on behalf of NSW Department of Commerce, November 2004, p 16

124 GHD, November 2004, p 17

125 GHD, November 2004, p 13

126 Martens Consulting Engineers, 'Radiation Risk Assessment: 21 Nelson Parade, Hunter's Hill,' 27 May 2008, p 1

Table 4.3 Dose rates measured on the footpath and street of Nelson Parade

Location	Dose rate (mSv/yr)
1 Nelson Parade	3.5 to 4.4
2 Nelson Parade	1.3 to 5.3
3-5 Nelson Parade	2.6 to 4.4
4-6 Nelson Parade	1.1 to 1.6
11-15 Nelson Parade	2.6 to 5.25
8 Nelson Parade	1.5
10-18 Nelson Parade	0.35
17-25 Nelson Parade	0.35

4.54 Overall, these results show higher dose rates closer to the site, decreasing with further distance from the site.[127]

Conclusions in the report

4.55 Martens concluded that measured radiation levels on number 21 and in soil from number 21 are within typical local and Australian background levels' but noted 'elevated levels' on the road adjacent to numbers 7 and 9 Nelson Parade.[128]

2008 Australian Nuclear Science and Technology Organisation survey

4.56 In 2008, NSW Health requested the ANSTO carry out a gamma radiation survey of various sites at Nelson Parade. ANSTO submitted its report on 6 March 2008. The NSW Government, in its submission to the inquiry, stated that the purpose of the survey was to 'determine whether it was believed there was a current public health issue with regard to radiological contamination.'[129] It was not intended to be a comprehensive health risk assessment and did not include measures of radon levels or soil activity.[130]

4.57 Professor Wayne Smith, the Director of Environmental Health at NSW Health, stated that the survey was undertaken to 'ensure there was no immediate risk to public health. For that reason, really the only exposure route was through gamma radiation.'[131]

4.58 Ms Catriona Maloney, General Manager of Safety and Radiation Services at ANSTO, noted that NSW Health wanted the results of the survey within several days, 'and that is why we said

127 Martens Consulting Engineers, May 2008, p 2

128 Martens Consulting Engineers, May 2008, p 5

129 Submission 22, p 14

130 Submission 22, p 14; Australian Nuclear Science and Technology Organisation, 'Radiological survey of specific properties between blocks 3 to 11 on Nelson Parade, Hunter's Hill, and the roadway from No's 11 to 19', prepared on behalf of NSW Health, March 2008, p 3

131 Professor Wayne Smith, Director, Environmental Health, NSW Health, Evidence, 3 July 2008, p 46

that doing an indicative survey with gamma was the way to go.' The survey was, she stated, a 'rough and ready indication.'[132]

4.59 The survey was also intended to provide a point of comparison for previous surveys.[133]

4.60 For confidentiality reasons, the Committee was only provided with the results of the survey in relation to number 11 Nelson Parade. NSW Health informed the Committee it had written to the owners of other properties surveyed seeking permission to release the results, but had not received a reply in time for inclusion in this report.[134]

Gamma radiation levels on number 11

4.61 Gamma radiation levels were measured at 32 locations on number 11 both inside and outside the building. The average level inside number 11, excluding measures taken on the balconies, verandas and in the garage, was approximately 0.3 μSv/hr, ranging from 0.19 – 0.46 μSv/hr. The highest levels inside were in the first and second bedrooms on the third level down, 0.46 and 0.35 μSv/hr respectively.

4.62 Rates between 0.3 and 0.6 μSv/hr were measured on the balconies, with the 0.6 μSv/hr measurement taken on the third level down balcony facing number 9 Nelson Parade.

4.63 The average level gamma radiation level measured outside on the grounds of number 11 was 0.7 μSv/hr. The highest level measured was 1.2 μSv/hr near the old fish pond, with 0.83 μSv/hr measured in the middle of the yard and 0.8 μSv/hr down on the foreshore level.[135]

Background radiation levels

4.64 The ANSTO reports notes that the above radiation measurements should be compared to natural background radiation levels in the area. Background radiation was measured at a site 1 km west of Nelson Parade and found to be in the range of 0.21 – 0.26 μSv/hr.[136]

ANSTO's Conclusions in the report

4.65 The report stated that no attempt was made to assess occupancy factors, that is, how long a person might typically spend in any of the locations where measures were taken, and 'therefore it is not possible to make any estimate of actual radiation doses that would result from being in the surveyed areas.'[137]

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132 Ms Catriona Maloney, General Manager, Safety and Radiation Services, Australian Nuclear Science and Technology Organisation, Evidence, 4 July 2008, p 26

133 Ms Catriona Maloney, Evidence, 4 July 2008, p 27; Mr Andrew Humpherson, General Manager, Government and Public Affairs, Australian Nuclear Science and Technology Organisation Evidence, 4 July 2008, p 25

134 Answers to questions taken on notice during evidence 3 July 2008, Dr Kerry Chant, Acting Chief Health Officer, NSW Health, Question 4

135 Submission 22, p 14; Australian Nuclear Science and Technology Organisation, March 2008, p 7

136 Submission 22, p 14; Australian Nuclear Science and Technology Organisation, March 2008, p 9

137 Submission 22, p 14; Australian Nuclear Science and Technology Organisation, March 2008, p 9

4.66 The aim of the survey was to 'provide NSW Health with the external radiation dose rate data…so that they can determine whether the potential exposure to members of the public from external gamma radiation is within applicable limits.'[138]

Government interpretation of the results

4.67 The NSW Government, in its submission, stated that the radiation levels presented in ANSTO's 2008 report would not be expected to result in a dose rate to residents above national limits:

> The results of these surveys indicate that given the current land use of the properties, any radiation the residents may be exposed to generally would not be expected to exceed Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and NSW Regulatory standards for general public exposure of 1 mSv per year above normal background levels.[139]

4.68 Dr Kerry Chant, Acting Chief Health Officer for NSW Health, expressed a similar view, stating, '[o]verall, the findings indicate that the exposure levels fall within the Australian Radiation Protection and Nuclear Safety Agency's recommendations for public exposure.'[140]

Criticism of the Government's interpretation of the results

4.69 Whilst the Government interpreted the results of ANSTO's survey as indicating levels were within national guidelines, the following inquiry participants did not believe the results supported this conclusion.

4.70 Dr Nicholas Brunton, legal representative for the current owners of number 11 Nelson Parade, was critical of NSW Health for arriving at such a conclusion based on a survey that did not include measurements of radon gas or soil activity levels, did not consider the exposure pathways of inhalation or ingestion of radioactive material, and did not consider occupancy factors. Dr Brunton stated that, based on the survey, 'it is not possible to make any estimate of actual radiation doses that would result from being in the area.'[141]

4.71 In response to the question from the Hon Rick Colless MLC, "The Government now says that the ANSTO test proves that No. 11 is below the ARPANSA guidelines. Would you agree with that?", Ms Maloney stated, "I do not believe there are appropriate guidelines against which one could make a statement. In other words, the hourly rate depends on the occupancy factor and I would also need to know what the radon was and the like. I do not believe we would have made such an assumption."[142]

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138 Submission 22, p 14; Australian Nuclear Science and Technology Organisation, March 2008, p 3

139 Submission 22, p 15

140 Dr Kerry Chant, Acting Chief Health Officer, NSW Health, Evidence, 3 July 2008, p 39

141 Dr Nicholas Brunton, Solicitor, Henry Davis York Lawyers, Evidence, 3 July 2008, p, 20

142 Ms Catriona Maloney, Evidence, 4 July 2008, p 27

4.72 In regard to the gamma radiation measurement of 0.46 μSv/hr taken in the first bedroom on the fourth level down in number 11, Ms Maloney stated that in her opinion it certainly warranted further investigation.[143]

4.73 Professor Tilman Ruff from the Medical Association for the Prevention of War also noted that the 2008 ANSTO survey only measured gamma radiation and that it was important to also consider radon levels when estimating dose rates.[144]

2008 Australian Radiation Services survey of 11 Nelson Parade

4.74 The owners of number 11 Nelson Parade were not satisfied with either the extent of ANSTO's survey or the Government's interpretation of the results. Consequently, they commissioned an independent organisation, Australian Radiation Services Pty Ltd (ARS), to conduct a survey of their own.[145]

4.75 The ARS report is dated May 2008. The aim of the survey was to provide a preliminary investigation of the current state of radioactive contamination at the rear of the premises.[146]

4.76 The assessment included measurement of external gamma radiation and soil activity levels. The report noted that the results are 'by no means an exhaustive characterisation of the radioactive contamination present.'[147]

Gamma radiation levels

4.77 Gamma radiation levels were taken at 27 locations on the land at the rear of the premises.[148] The average level was 0.52 μSv/hr, ranging from 0.21 to 1.61 μSv/hr. The highest levels were measured along the boundary between numbers 9 and 11 where levels ranged between 0.65 and 1.61 μSv/hr. The 1.61 μSv/hr level was measured directly adjacent to the eastern wall of the premises.[149]

Background radiation levels

4.78 ARS measured background radiation levels at a randomly chosen location within Kellys Bush, immediately to the east of Nelson Parade. The background level they reported was 0.12 μSv/hr.[150]

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143 Ms Catriona Maloney, Evidence, 4 July 2008, p 27

144 Professor Tilman Ruff, Medical Association for Prevention of War, Evidence, 4 July 2008, p 51

145 Submission 4, Dr Nicholas Brunton, p 2

146 Australian Radiation Services, '11 Nelson Parade, Hunter's Hill, New South Wales: Radiation Assessment (Preliminary Findings)', May 2008, p 4

147 Australian Radiation Services, 'May 2008, p 4

148 Australian Radiation Services, May 2008, p 6

149 Australian Radiation Services, May 2008, pp 7-8

150 Australian Radiation Services, May 2008, p 8

4.79 After learning that Kellys Bush had once been the site of a tin smelting plant and potentially radioactively contaminated itself, ARS returned in July 2008 to conduct further background radiation tests in the area. The levels observed were ranged from 0.07 to 0.1 μSv/hr.[151]

Soil activity levels

4.80 ARS analysed six soil samples taken from number 11 along the boundary with number 9, from the surface and up to a depth of 0.9m. For comparison, a soil sample was also taken from Kellys Bush.

4.81 The report stated that the results indicated 'significantly elevated concentrations of radionuclides in the soils.' The level of radium-226 in one sample was considered 'very high' at 9 (± 0.4) Bq/g, which was 400 times the radium-226 activity in the Kellys Bush comparison sample.[152]

ARS's Conclusions

4.82 ARS calculate the dose to an individual spending 24 hours per day, 365 days per year either inside or on the grounds on number 11 Nelson Parade would be 0.7 – 2.5 mSv from gamma radiation for the year, *above* background radiation. They arrive at this figure by using the levels they measured themselves, the levels reported inside number 11 in the 2008 ANSTO report, a United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) conversion factor from Grays to Sieverts of 0.7 and UNSCEAR occupancy rates of 0.8 indoor and 0.2 outdoor.[153]

4.83 With regard to radioactive contamination in the soil, the report notes the risk this represents if soil is inhaled, ingested or absorbed through wounds, but concludes that 'there is insufficient radionuclide concentration data to calculate the internal contribution to the total effective dose an individual would be likely to receive as a result of the radionuclides present.'[154]

4.84 The report concludes that even without additional data, such as measurements of radon levels, 'the evidence suggests the site is unfit for long-term human habitation without remediation.'[155]

Committee comment

4.85 The Committee notes that the radiological surveys completed after 1966 reported gamma dose rates across numbers 7, 9 and 11 Nelson, ranging from 0.52 to 1.5 μSv/hr. The Committee recognises the importance of the height above ground that measures are taken, given that the dose decreases exponentially with distance from the source. With this in mind, it is difficult to compare levels recorded at different heights. Furthermore, some reports did not indicate at

151 Australian Radiation Services, '11 Nelson Parade, Hunter's Hill, New South Wales: Background Radiation Assessment', July 2008, pp 7-8

152 Australian Radiation Services, May 2008, p 11

153 Australian Radiation Services, May 2008, pp 10-11

154 Australian Radiation Services, May 2008, p 11

155 Australian Radiation Services, May 2008, p 12

what height gamma radiation levels were measured. Finally, the results reported in R J Bayliss' 1966 survey for the Radiation Branch, as noted previously (see paragraph 4.15), are difficult to reconcile with the results of subsequent surveys.

4.86 Consequently, the Committee does not believe the results of surveys to date, taken collectively, form a coherent representation of the gamma dose rates on the site and adjacent lots. The Committee makes a recommendation in relation to retesting the site and surrounding areas in Chapter 6.

Equipment used in the 2008 ANSTO and ARS surveys to measure background radiation

4.87 ARS reported a background radiation level for the Nelson Parade area of up to 0.1 μSv/hr, whilst ANSTO reported a background level of up to 0.26 μSv/hr, over twice the ARS level.

4.88 The accepted background level is important since the dose limits recommended by ARPANSA are *in addition* to background. The Committee heard evidence that the different equipment used by ANSTO and ARS in their respective surveys may account for the different background levels they report.

4.89 ANSTO used a measuring instrument known as a Rotem Ram R-200 Survey Metre (R-200) to record a background level of 0.26 μSv/hr. ARS used an instrument known as an Exploranium GR-130 minispectrometer (GR-130) in conjunction with a Mini Instruments Model 6-80/MC-71 Environmental Radiation Meter (MC-71) in their May 2008 survey to record a background level of 0.12 μSv/hr. They returned in July 2008 and used an instrument known as a Health Physics Instrument Model 1010 Tissue Equivalent Monitor (HPI-1010) to record a background level of 0.1 μSv/hr.[156]

4.90 Dr Joseph Young, Principal Consultant Health Physicist at Australian Radiation Services, suggested the R-200 was 'not suitable for background measurements,' describing it as a 'protection level instrument for use [with] elevated radiation levels'[157] and one 'used in facilities where you are known to get radiation levels above 0.5 microsieverts per hour.'[158]

4.91 Mr Andrew Humpherson, the General Manager of Government and Public Affairs at ANSTO stated that ANSTO used the monitor to measure the dose rate above 0.1 μSv/hr. He defended the use of the R-200 stating, '[a]t the expected dose rates for the site of a few tenths of a microsievert per hour, the [R-200] is as sensitive as other monitors such as the [HPI-1010].'[159]

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156 Correspondence from Mr Andrew Humpherson, General Manager, Government and Public Affairs, Australian Nuclear Science and Technology Organisation, to Chair, 1 August 2008; Australian Radiation Services, May 2008, p 8; Australian Radiation Services, July 2008, p 4; Dr Joseph Young, Evidence, 4 July 2008, p 37

157 Dr Joseph Young, Evidence, 4 July 2008, p 37

158 Dr Joseph Young, Evidence, 4 July 2008, p 39

159 Correspondence from Mr Andrew Humpherson, to Chair, 1 August 2008

4.92 However, Dr Young suggested that 'if you use [the R-200] at the 0.1, 0.2 microsieverts per hour level, you are pushing it to its absolute limit.'[160] The July 2008 ARS report explains that the HPI-1010 requires the taking of measurements over an extended period of time – known as 'integrated measurement' - usually up to one hour, to allow for the fact that low level gamma radiation levels can fluctuate over time, whereas the R-200 is an instantaneous measurement device typically used to measure much higher gamma radiation levels than normally exist in background environments.[161]

4.93 Dr Young explained that during the July 2008 ARS survey, the R-200 and HP-1010 were used side by side to take measurements. While the two instruments gave good agreement at elevated levels on Nelson Parade, the R-200 'over-read by a factor of 2' at background levels.[162]

4.94 The July 2008 ARS report concluded, '[t]he only true means of determining accurate natural background radiation levels is to integrate the reading of a suitably responsive radiation monitor irradiated over an extended period of time, as demonstrated with the [HPI-1010] reported in this study.'[163]

Committee comment

4.95 The Committee accepts the evidence of Dr Joseph Young and the reasoning in the July 2008 ARS report that the HP-1010 is a more appropriate instrument for measuring background radiation than the R-200. The Committee is convinced by two elements of Dr Young's argument: firstly, that the HP-1010 is a more sensitive instrument at levels of radiation around 0.1 μSv/hr; and secondly, that the HP-1010 'integrates' a reading over an extended period of time – an important factor given that low level gamma radiation levels fluctuate over time. Whilst the R-200 was an appropriate instrument to use to provide NSW Health with the information regarding elevated gamma radiation levels on radioactively contaminated areas in Nelson Parade, the Committee does not consider its measurement of background radiation levels reliable.

4.96 The Committee notes the importance of establishing a reliable background radiation level given that the national dose limits recommended by ARPANSA are *in addition* to background radiation. Therefore, the higher the background radiation level, the higher a measured dose rate can be before it exceeds the recommended dose limit. Conversely, the lower the background radiation level, the lower a measured dose rate must be to fall within the recommended dose limit. This has particular repercussions for the establishment of the assessment criteria, or remedial action level, for the remediation of contaminated areas of Nelson Parade, discussed in Chapter 6.

4.97 The Committee notes that exposure to 0.12 μSv/hr above background for 24 hours per day, 365 days per year would be required to exceed ARPANSA's annual dose limit of 1 mSv above background. Taking ARS's background reading for the area around Nelson Parade of 0.1

160 Dr Joseph Young, Evidence, 4 July 2008, p 37

161 Australian Radiation Services, July 2008, p 8

162 Dr Joseph Young, Evidence, 4 July 2008, p 37

163 Australian Radiation Services, July 2008, p 9

μSv/hr, this means that levels of 0.22 μSv/hr measured at Nelson Parade are at this threshold. The Committee notes the average gamma radiation levels reported inside the premises at number 11 Nelson Parade and on the grounds of number 11 in both the ANSTO and ARS 2008 reports exceed 0.22 μSv/hr.

4.98 The Committee further notes that exposure to 0.46 μSv/hr, measured in 2008 by ANSTO at number 11 Nelson Parade in the first bedroom on the third level down, for just over 7.5 hours per day, would result in a radiation dose above ARPANSA's 1 mSv per year above background dose limit. Exposure to 1.2 μSv/hr, measured by ANSTO in the back yard of number 11, for 2.5 hours per day would result in an dose above the annual dose limit. Exposure to 1.61 μSv/hr, measured by ARS adjacent to the premises on number 11 and near the boundary with number 9, for just over 1.8 hours per day would result a dose above the annual dose limit.

4.99 Taking into account the results of both the ANSTO and ARS survey and the reservations expressed by Ms Catriona Maloney, General Manager of Safety and Radiation Services at ANSTO, the Committee understands the concern expressed by the owners of number 11 Nelson Parade in relation to the contamination on their property and the potential health effects arising from that contamination.

The former uranium smelter site at Hunter's Hill

Chapter 5 Residents' concerns relating to contamination and possible health effects

This chapter presents the concerns of residents relating to contamination and its possible health effects. It includes a chronology of ownership of various lots on Nelson Parade, communication from NSW Health relating to contamination and remediation activities, and inquiry participants' views on this communication. The chapter begins by defining Section 55 and Section 149 certificates.

Section 55 and Section 149 certificates

5.1 References to 'Section 55' certificates and '149' certificates appeared throughout the inquiry.

5.2 The Department of Health or its predecessors issued Section 55 certificates under Section 55 of the Public Health Act. The function of a Section 55 certificate included to declare a piece of land 'unhealthy building land'[164] or to declare it 'free' or 'clear of contamination.'[165] Inquiry participants sometimes referred to a Section 55 certificate as a 'clear certificate.' Section 55 certificates are no longer issued. Currently, land can be declared a remediation site under the *Contaminated Land Management Act 1997*, as is the case with the foreshore areas of numbers 7, 9 and 11 Nelson Parade. That declaration can, subsequent to remediation, be fully or partially lifted.

5.3 A Section 149 certificate is issued under Section 149 of the *Environmental Planning and Assessment Act, 1979*. It is issued by local councils in relation to lots of land. It notes any planning restrictions that may apply to the land, including a response to the question 'Is the land affected by contamination?' A Section 149 certificate will be issued or produced when a piece of land changes hands and alerts the buyer to the fact that there may be a contamination issue relating to the land that they may choose to look further into.

History of ownership and occupancy of the site and adjacent lots

5.4 The following section presents evidence received by the Committee relating to individual properties along Nelson Parade, including numbers 3, 5, 7 and 9, and 13 and 15. Number 11, about which a majority of evidence was received, is addressed last.

Number 3

5.5 Following the report completed by B W Scott in 1977 for the Health Commission, a small area of contamination on number 3 was removed:

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164 Letter from H. M. Whaite, Officer-in-Charge, Radiation Branch, Department of Public Health, to Mr G. H. Conlan, 5 Nelson Parade, Hunter's Hill, 3 November 1965, Attachment A, Submission 11, Mrs Joan Conlan

165 Letter from Mr P J Smith, for the Director General, Department of Health, to Hunter's Hill Council, 24 August 1989, in Submission 4, Dr Nicholas Brunton, Annexure 15

> [P]rior to the erection of a dwelling, a small area of contamination on number 3, about 4 square metres at the top of the cliff, was excavated and placed in plastic bags behind the seawall adjacent to number 7…This is believed to have removed any known radiological contamination from number 3.[166]

Number 5

5.6 The superintendent of the Radium Hill Company uranium refinery that operated on the site between 1911 and 1916 lived in a house built on what is now number 5 Nelson Parade.[167]

5.7 In 1966, R J Bayliss' survey for the Radiation Branch recommended that cooperation be sought from the owners of what are now numbers 5, 7, 9 and 11 Nelson Parade to remove 'certain areas of high activity soil.'[168]

5.8 In 1973 the former superintendent's house on number 5 was demolished and a new house built 'with extensive soil relocation for foundations, terracing and the construction of a swimming pool.'[169]

5.9 Scott's 1977 report recommended the removal of soil from 'certain areas' of numbers 3, 5 and 11.[170]

5.10 Egis Consulting Australia, who conducted surveys on behalf of the Department of Health in 1999 and 2000, noted in their November 1999 report correspondence from the Department of Health indicating that three to four cubic metres of soil was removed from numbers 5 and 11 in 1982 and relocated to numbers 7 and 9.[171]

5.11 Egis made a search of state archives, which further indicated that in February 1993, Mr A. W. Fleischmann of the then Radiation Health Services Branch, 'removed a smaller amount of extra soil from near the pool on No. 5 Nelson Parade.'[172]

5.12 Unfortunately, Egis were unable to locate Mr Fleischmann's notes concerning soil relocation activities undertaken by the Department of Health. Egis stated that 'we could find no actual documentation at all specifying where contaminated soils were uplifted from, how much, and where they were relocated to.' In particular, Egis note there were no existing records documenting the relocation of soil from numbers 11 and 5 onto numbers 7 and 9 in

166 Submission 22, NSW Government, p 13

167 Submission 22, p 4

168 Bayliss, R J, 'Radioactive Contamination in the Grounds of Dwellings at Hunter's Hill,' NSW Department of Health, Radiation Branch, March 1966, p 6

169 Submission 22, p 4

170 Scott, B W, 'Investigation of Radioactive Contamination at Nelson Parade, Woolwich', prepared on behalf of NSW Health Commission, April 1977, p 26

171 Egis Consulting, 'Stage One Investigation of Radioactive Contamination, Numbers 7 and 9 Nelson Parade, Hunter's Hill', prepared on behalf of NSW Department of Health, November 1999, p 15

172 Egis Consulting, November 1999, p 15

1982/1983 or the relocation of soil from under the house on number 7 following its demolition or from around the pool on number 5.[173]

Numbers 7 and 9

5.13 It is thought that houses were erected on numbers 7 and 9 in the 1920s after the closure of the refinery.[174]

5.14 Mrs Joan Conlan, in her submission, stated that she and her husband Gerald bought the residence on what is now number 9 Nelson Parade in 1956, when the property was known as 'Radium.' The Conlans rented out the property until they took possession themselves in 1962. In 1963 they leased the area of reclaimed land on the foreshore from the NSW Maritime Services Board, unaware throughout the lease that this had been the site of the former uranium refinery.[175]

5.15 In 1957, Victor Kongats bought what is now number 7 Nelson Parade.[176]

5.16 In 1965, the then Department of Public Health wrote to the Conlans informing them of the 'extensive, but generally low-level contamination of the area.' The letter requested permission to take soil samples from the lot and expressed the desire, on the part of the Department of Public Health, to take remedial action to avoid declaring the land unhealthy and depressing property values:

> It is our desire to take such remedial action as will avoid a departmental declaration of some of these lots as unhealthy building land under Section 55 of the Public Health Act, a course that would obviously depress the value of all allotments in the area.[177]

5.17 As noted previously, Bayliss' 1966 report recommended that 'certain areas of high activity soil' be removed from what are now numbers 5, 7, 9 and 11[178]

5.18 In 1977, the Maritime Services Board of NSW wrote to the Conlans advising that their lease on the foreshore land at the rear of their property was to be terminated in order to allow the Health Commission 'free access to the foreshore land to enable it to carry out the decontamination operation of the affected Nelson Parade properties.'[179]

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173 Egis Consulting, November 1999, p 16

174 Submission 22, p 4

175 Submission 11, Mrs Joan Conlan, p 1

176 Ausearch result, 26 May 2008, Annexure 17, Submission 4, Dr Nicholas Brunton, p 2

177 Letter from H. M. Whaite, Officer-in-Charge, Radiation Branch, Department of Public Health, to Mr G. H. Conlan, 5 Nelson Parade, Hunter's Hill, 3 November 1965, Attachment A, Submission 11, Mrs Joan Conlan

178 Bayliss, R J, March 1966, p 6

179 Letter from Mr G J Aldiss, Solicitor for the Maritime Services Board of NSW, to Mr G H and Mrs J P Conlan, 9 Nelson Parade, Hunter's Hill, 30 March 1977, Attachment C, Submission 11, Mrs Joan Conlan

5.19 Following this, the Conlans wrote to the Minister for Health regarding contamination in the area and their wish to sell their property. The Minister responded with a letter stating that the 'radioactivity does not affect your house, and there are no plans by the Government to seek to demolish it.' The Minister went on to state that an area of land in the Conlan's backyard 'should be removed' and that there were discussions underway regarding 'financial assistance to cover the costs entailed.'[180]

5.20 Scott's 1977 report recommended the 'complete removal' of soil from numbers 7 and 9.[181]

5.21 Following Scott's 1977 report, the NSW Government agreed that the Department of Health purchase numbers 7 and 9 Nelson Parade.[182] Number 11 was also purchased by the Department of Health at the request of owners of number 11. Number 9 was purchased from the Conlans in October 1978 for $75,000.[183]

5.22 In 1982 the NSW Government ordered the houses on numbers 7 and 9 to be demolished.[184]

5.23 In May 1983 the Department of Health purchased number 7 from Victor Kongats.[185]

5.24 Ownership of the reclaimed foreshore land adjacent to numbers 7 and 9 was transferred to the Health Administration Corporation in April 1989, and the reclaimed foreshore land adjacent to number 11 in November 1990.[186] At this time, the area of land referred to in this report as 'the site' – lots 7 and 9 and the reclaimed foreshore area at the rear of lots 7, 9 and 11 – was owned by the Department of Health.

5.25 The houses on numbers 7 and 9 were finally demolished in 1992.[187] The Development Application from the Department of Public Works stated that the purpose of the demolition and subsequent remedial action was to 'return the area to a condition compatible with the standard of the surrounding environment.'[188] The Development Application States that the volume of contaminated soil had not been established but that 'should the tailings be greatly contaminated but in small amounts the EPA will arrange for their safe removal from site.' Alternatively, if a 'large volume of soil with medium to high contamination' was identified, an on-site encapsulation strategy was to be implemented.[189]

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180 Letter from the Minister for Health to Mr G Conlan, 9 Nelson Parade, Hunter's Hill, 23 August 1977, Attachment B, Submission 11, Mrs Joan Conlan

181 Scott, B W, 'Investigation of Radioactive Contamination at Nelson Parade, Woolwich', prepared on behalf of NSW Health Commission, April 1977, p 26

182 Submission 22, p 13

183 Submission 11, p 2

184 Submission 8, Mr Michael Richardson MP, p 6

185 Ausearch result, 26 May 2008, Annexure 17, Submission 4, Dr Nicholas Brunton, p 2

186 Mr Bruce Green, Acting General Manager, Maritime Property Division, New South Wales Maritime, Evidence, 3 July 2008, p 71

187 Egis Consulting, November 1999, p 15

188 Department of Public Works, Development Application, 'Lots 7 and 9 Nelson Parade, Hunters Hill', submitted to Hunter's Hill Council, 15 April 1992, p 3

189 Department of Public Works, Development Application, 15 April 1992, p 10

5.26 The Committee received a submission that some material following the demolition of the buildings was sealed in three 205-litre drums, which remain under the control of the NSW Government.[190]

5.27 Mr Craig Lamberton, Director of Specialised Regulation with the Department of Environment and Climate Change (DECC), stated that DECC was aware of records that indicated material from the demolition was removed from the site and placed elsewhere, 'but we do not know precisely where it went to.'[191] NSW Health stated that 'records are inconclusive as to whether any contaminated material from No. 7 was removed off-site' following the demolition of the buildings.[192]

5.28 Egis Consulting Australia stated in their 1999 report that 'following the demolition of the houses on Nos 7 and 9…the "hotspot" of radioactive contamination under the kitchen area of No. 7…was supposedly dug up, sealed in 200 L drums and relocated to the Lidcombe site of DOH Radiation Health Services Branch.'[193] As previously noted (see 5.12), they were unable to find documents to confirm this.

5.29 The NSW Government stated in its submission that at the same time as the demolition activities were occurring, contaminated material from numbers 5, 11 and 13 was placed on the now vacant numbers 7 and 9. Numbers 7 and 9 were then covered, landscaped, vegetated and fenced.[194] This was part of a general remediation strategy to 'consolidate and contain contamination on numbers 7 and 9.'[195]

5.30 In 1993, numbers 7 and 9 were declared unhealthy building land under the now repealed *Unhealthy Building Lands Act*. Ms Lisa Corbyn, Director General of DECC, stated that it was DECC's assessment that the lots 'do not represent a significant risk of harm in their current uses.' Ms Corbyn also stated that the then 'Radiation Health Branch assessed that no further remedial action was needed at [numbers 7 and 9] as all measurements that they had were below the relevant limits set by the National Health and Medical Research Council at the time.[196]

5.31 In 2004, NSW Health commissioned GHD to conduct an assessment of the contamination status of soil along the foreshore area at the rear of lots 7, 9 and 11. GHD concluded that the

190 Mudd, G M, 'The Legacy of Early Uranium Efforts in Australia 1906 to 1945: From Radium Hill to the Atomic Bomb and Today.' *Historical Records of Australian Science*, 2005, 16 (2), p 188

191 Mr Craig Lamberton, Director of Specialised Regulation, Department of Environment and Climate Change, Evidence, 3 July 2008, p 64

192 Answers to questions on notice taken during evidence 3 July 2008, Dr Kerry Chant, Acting Chief Health Officer, NSW Health, Question 2

193 Egis Consulting, November 1999, p 15

194 Submission 22, pp 13-14

195 Submission 22, p 1

196 Ms Lisa Corbyn, Director General, Department of Environment and Climate Change, Evidence, 3 July 2008, p 58

area posed a 'significant risk of harm.'[197] This foreshore area has now been declared a remediation site under the *Contaminated Land Management Act 1997*.[198]

Committee comment

5.32 The Committee notes the unfortunate circumstance that Department of Health documentation relating to remediation activities overseen by Mr A W Fleischmann of the then Radiation Health Services Branch of the Department of Health in 1982, 1992 and 1993 have been lost, and that in particular there is no record of the current location of possibly three 200 or 205 litre drums containing material from the demolition of the house on number 7 Nelson Parade in 1992.

5.33 The Committee notes the importance of the documents relating to the drums due to the potential health risk posed by the contaminated material they contain, given that: a) it reportedly came from a known hotspot under number 7, an area of contamination responsible for the radon gas hazard in the house on number 7 where radon levels measured by B W Scott in 1977 were 100 times the accepted limit at the time (see 4.23), and; b) there is a danger of radon gas build up when material generating radon is stored in sealed containers.

Numbers 13 and 15

5.34 In 1965 the Mansus bought numbers 13 and 15 Nelson Parade, living on number 15 while number 13 remained a vacant lot.[199]

5.35 In October 1977, Mr Mansu, the owner of the lots that now include numbers 13 and 15 Nelson Parade, received a letter from the then Health Commission stating that 'an area of contaminated soil exists on the lower section of your property…adjacent to the boundary of property number 11.' The Health Commission recommended that 'remedial action should be taken.' The letter went on to state that the Health Commission could not certify the land clear until remedial action had been taken:

> In the event of a solicitor requiring a search for building and land under Section 55 of the Public Health Act, it would not be possible for the Health Commission to provide an unqualified certificate of clearance on land until most, if not all, of the contamination had been suitably removed.[200]

5.36 In January 1978, Mr Mansu received another letter from the Health Commission stating that 'the New South Wales Government today resolved to arrange for decontamination of your property…at no cost to yourself…as soon as an arrangement can be reached with the Commonwealth Government on a suitable disposal site.' The letter goes on to state that the

197 GHD, '7-11 Nelson Parade: Results of Foreshore Contamination Assessment', prepared on behalf of NSW Department of Commerce, November 2004, p 14

198 Submission 22, p 2

199 Ms Kathie Frankland, Nelson Parade Residents Group, Evidence, 3 July 2008, p 12

200 Letter from H C Eagleton, Secretary, Health Commission of NSW to Mr H P Mansu, 13 Nelson Parade, Hunter's Hill, Appendix 2a, Submission 3, Nelson Parade Residents Group

decision had been made 'without any admission of liability by the Government of New South Wales.'[201]

5.37 Ms Kathie Frankland of the Nelson Parade Residents Group, who is Mr Mansu's daughter, stated that despite the Health Commission's undertaking, and the statement by the NSW Government in its submission to the inquiry that around 1992 to 1993 material was removed from number 13[202], the contamination was never removed.[203]

5.38 Ms Frankland stated that in 1994 her parents, owners of number 15, received notice that the notice on their house title declaring it unhealthy was to be removed, despite the fact that remediation had not occurred:

> Eventually in 1994 they got a letter from the EPA saying the levels are now below the recommended safety levels and so the notice under the unhealthy building lands Act will be removed off their title. So it has gone from it was a hotspot, they could not sell, to 20 years later, it is okay.[204]

5.39 Ms Frankland, who grew up at number 15 Nelson Parade, built the house currently at number 13 in 2001.[205]

Number 11

Ownership by Mr Graham Camp

5.40 In 1965, Mr Graham Camp purchased the vacant block at number 11 for £3,200.[206] A record of ownership of number 11 provided to the inquiry indicates that Mr Camp took ownership on 19 August 1965.[207] Mr Camp stated in his submission to the inquiry that at that time there were already homes on numbers 7 and 9. He described building retaining walls, that currently still stand, on the property and cutting the upper sections of the lot back to rock, depositing the waste soil behind the retaining wall at the foreshore.

5.41 Mr Camp stated that he first became aware of radioactivity on the site 'when a man with a Geiger counter' came to his property. Mr Camp was given a white badge that registered radiation exposure to wear on his clothing, but he did not have the badge tested once he sold the land.[208] At that time a residence had not been built on the property.

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201 Letter from Mr Roderick McEwin, Chairman, Health Commission of NSW to Mr H Manusu, 13 Nelson Parade, Hunter's Hill, Appendix 2b, Submission 3, Nelson Parade Residents Group

202 Submission 22, pp 13-14

203 Ms Kathie Frankland, Evidence, 3 July 2008, p 13

204 Ms Kathie Frankland, Evidence, 3 July 2008, p 12

205 Ms Kathie Frankland, Evidence, 3 July 2008, p 9

206 Submission 19, Mr Graham Camp, p 1

207 Ausearch result, 26 May 2008, Annexure 17, Submission 4, Dr Nicholas Brunton, p 1

208 Submission 19, p 1

Ownership by the Nurses

5.42 In 1973, Mr Benjamin Nurse purchased the vacant lot at number 11 Nelson Parade. Mr Nurse had the house built which still stands and was occupied by him and his family from 1974 to 1980.[209] Mr Nurse stated that at the time of purchase his solicitors obtained a 'clear certificate' from the Health Department[210] and that they had no warning there was any contamination on the site.[211]

5.43 Despite Scott's 1977 report giving a radon measurement of 'not detectable' inside number 11, neither Mr Nurse nor his daughter Julienne had any recollection of testing being done inside their premises. Ms Nurse stated that if such testing was conducted, 'it was conducted on the land and not shown to us.'[212]

5.44 However, internal correspondence from the Health Commission dated 9 March 1977 and with the heading 'Measurements of Radiation on Mr Nurse's land at 11 Nelson Parade Hunter's Hill' refers to 'measurements of radon daughters levels made, in September 1976, in the three levels of the home.'[213]

5.45 In a letter to Mr and Mrs Nurse from the Health Commission dated 20 January 1977, the Health Commission offered a comprehensive medical check-up:

> As part of the overall investigations being conducted in your immediate vicinity you may wish to have a relevant and comprehensive medical check-up.
>
> This we would be willing to carry out should you so wish.[214]

5.46 Mr Nurse gave an account to the Committee of how various medical testing procedures proposed for him and his family failed to eventuate on three separate occasions:

> We went down to Lucas Heights and had tests done there…The equipment failed; we were also told we were to be sent down to Melbourne Hospital that specialised in measuring radon effects of the lung. We were not sent down; we do not know why. We were also told that we were going to go out to Lidcombe Hospital, which was a Department of Health hospital; we were not sent out.[215]

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209 Mr Benjamin Nurse, Evidence, 4 July 2008, p 57; Submission 2, Ms Julienne Nurse, p 1

210 Submission 23, Mr Benjamin Nurse, p 1

211 Mr Benjamin Nurse, Evidence, 4 July 2008, p 58

212 Ms Julienne Nurse Evidence, 4 July 2008, p 57

213 Tabled document, correspondence from Alan Bell, Director of the Division of Occupational Health and Radiation Control, NSW Health Commission, to Dr D M Storey, Commissioner, Environmental and Special Health Services, 9 March 1977

214 Tabled document, correspondence from M A Crawford, Specialist-in-Charge, Medical Branch, NSW Health Commission, to Mr and Mrs B S Nurse, 11 Nelson Parade, Hunter's Hill, 20 January 1977

215 Mr Benjamin Nurse, Evidence, 4 July 2008, p 58

5.47 It was at this point, Mr Nurse stated, that his former wife became sufficiently concerned about the health risk posed by the radiation that she left with their two children. Mr Nurse stayed until the Health Department bought the property in 1980.[216]

5.48 Mr Nurse stated that in 1980 the Valuer General valued number 11 at $250,000. Mr Nurse considered this approximately one-third of its actual value, given that houses on the other side of the street we valued at approximately $800,000. Mr Nurse believed that the basis of the low valuation was that the site was considered an 'unhealthy site.'[217] Mr Nurse considered suing the Department of Health because it had previously issued the 'Clear Certificate' but that the advice he received at the time was that the Crown could not be sued.[218]

Ownership by the Department of Health

5.49 The Department of Health offered to buy number 11 at the Valuer Generals' valuation. Accepting that the property was 'unliveable' Mr Nurse accepted the offer, and the Department of Health took ownership of the property in February 1980.[219]

5.50 The Committee heard evidence that for at least three or four years after the Department of Health purchased number 11, the Health officers occupied it as offices[220] or lived in the premises for 'safety and security reasons.'[221]

5.51 In September 1987, the NSW Government stated in its submission, contamination was removed from number 11 that brought the level within accepted guidelines:

> [C]ontaminated soil was removed from the garden of number 11 Nelson Parade and deposited on number 9 to reduce the gamma dose rate to less than the criteria adopted by the NSW Radiological Council for garden areas; 100 microroentgen/hr at 1 metre from the surface.[222]

5.52 In 1989 the Department of Health decided to sell number 11 and sought a Section 149 certificate from Hunter's Hill Council. The Section 149 certificate stated that the land was contaminated.[223]

Ownership by the Kongats

5.53 Nevertheless, in June 1989 the property was sold to Victor and Lorraine Kongats, who had sold number 7 to the Department of Health in May 1983.[224] The Committee heard evidence

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216 Mr Benjamin Nurse, Evidence, 4 July 2008, p 58

217 Mr Benjamin Nurse, Evidence, 4 July 2008, pp 55 and 59

218 Mr Benjamin Nurse, Evidence, 4 July 2008, p 59

219 Submission 23, p 1

220 Mr Benjamin Nurse, Evidence, 4 July 2008, p 58

221 Submission 4, Dr Nicholas Brunton, p 3

222 Submission 22, p 13

223 Mr Barry Smith, General Manager, Hunter's Hill Council, Evidence, 3 July 2008, p 35

224 Ausearch result, 26 May 2008, Annexure 17, Submission 4, Dr Nicholas Brunton, p 2

that the Kongats were aware of the Section 149 certificate indicating contamination of the property at the time of purchase.[225]

5.54 Dr Kerry Chant, Acting Chief Health Office with NSW Health, told the Committee that the Kongats received correspondence at the time to the effect that remediation had been undertaken at number 11 at that it complied with the standards of the day. Ms Chant noted that a caveat on the contract of sale allowed the Health Department access across number 11 to do further remediation on number 13 and that the Kongats 'were clearly involved intimately in the concepts of remediation issues of the time.'[226]

5.55 Following their purchase of number 11, the Kongats lodged a development application with Hunter's Hill Council. With the council's own Section 149 certificate indicating the land was contaminated, they made it a condition of their consent to the application that the land had to be declared 'free and clear.'

5.56 On 24 August 1989 the Department of Health wrote to Hunter's Hill Council informing them that they, the Department of Health, had just issued a Section 55 certificate for number 11 Nelson Parade declaring the property to be clear of radioactive contamination:

> Following the removal of affected soil from the subject property known as 11 Nelson Parade, Hunters Hill, the Department has issued a clear Certificate under the provisions of Section 55 of the Public Health Act, which indicates that the property is considered clear of radioactive contamination.[227]

5.57 Dr Chant told the Committee that the use of the word 'clear' was used in the context of standards of the day and might not, with hindsight, be used today, given that there was clearly contamination on the property:

> I think again it is important to understand that statement in terms of the context of the officers of the day, what they defined, we would have probably with hindsight used a different word other than "clear" in the sense that there is clearly contamination on the site and residual contamination on a number of the properties but I think in terms of how clean was written, it was written in terms of compliance with [contemporaneous] standards.[228]

5.58 As a result of Department of Health issuing the above Section 55 certificate, Hunter's Hill Council amended the Section 149 certificate relating to number 11 to indicate that the property was clear of contamination.[229]

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225 Mr Barry Smith, Evidence, 3 July 2008, p 35; Dr Kerry Chant, Acting Chief Health Officer, NSW Health, Evidence, 3 July 2008, p 41

226 Dr Kerry Chant, Evidence, 3 July 2008, p 41

227 Letter from Mr P J Smith, for the Director General, Department of Health, to Hunter's Hill Council, 24 August 1989, in Submission 4, Dr Nicholas Brunton, Annexure 15

228 Dr Kerry Chant, Evidence, 3 July 2008, p 41

229 Mr Barry Smith, Evidence, 3 July 2008, p 35

Ownership by the Vassilious

5.59 In November 2001, the Kongats sold number 11 to the current owners, Peter and Michelle Vassiliou, with a Section 149 certificate indicating no contamination.[230] The Vassiliou's rented the property out.

5.60 In 2005, Hunter's Hill Council received advice from NSW Health in the form of a 'Notification of Contaminated Land' applying to numbers 7 and 9 Nelson Parade and the foreshore area including that at the rear of number 11. In August 2007 the foreshore areas of number 7, 9 and 11 were declared a remediation site under Section 21 of the *Contaminated Land Management Act 1997*.[231]

5.61 Dr Nicholas Brunton, legal representative for the current owners of number 11, the Vassilious, stated that the first his clients knew of contamination issues was when they received a brochure from consultants to NSW Health describing the proposed remediation of numbers 7 and 9 Nelson Parade. They instructed Dr Brunton to request files from Hunter's Hill Council to verify whether their property was contaminated or not. Dr Brunton stated that those files 'indicated that number 11 was likely to be seriously contaminated.'[232]

5.62 As a result, the Vassiliou's withdrew their property from the rental market and it has since remained vacant.[233] Dr Brunton stated that 'the property now cannot be sold, lived in or rented out.'[234]

5.63 As noted in Chapter 4, the 2008 Australian Radiation Services survey commissioned by the Vassilious concluded that 'the evidence suggests the site is unfit for long-term human habitation without remediation.'[235]

5.64 On behalf of the Vassiliou's, Dr Brunton urged the inquiry to recommend that NSW Health 'place them back into the position they would have been had the Department not allowed this situation to develop.' Dr Brunton suggested this action include acquisition of number 11 for its full market value, unaffected by contamination, plus associated disturbance costs, inclusion of number 11 in the proposed remediation plan, reimbursement of the Vassilious for costs and expenses associated with the contamination including those associated with a proposed renovation which cannot now proceed, and payment of an amount for stress hurt and anxiety.[236]

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230 Dr Nicholas Brunton, Solicitor, Henry Davis York Lawyers, Evidence, 3 July 2008, p 26

231 Tabled document, Hunter's Hill Council, *Chronology of Events and Actions: Former Uranium Smelter, Nelson Parade, Hunter's Hill,* July 2008, pp 5-6

232 Submission 4, p 1

233 Submission 4, p 1

234 Dr Nicholas Brunton, Evidence, 3 July 2008, p 21

235 Australian Radiation Services, '11 Nelson Parade, Hunter's Hill, New South Wales: Radiation Assessment (Preliminary Findings)', May 2008, p 11

236 Submission 4, p 8

Committee comment

5.65 The Committee notes the apparent contradiction between the Department of Health's issuing a 'clear certificate' for number 11 Nelson Parade in 1973, according to the evidence of Mr Benjamin Nurse, and the NSW Government's statement in its submission to the inquiry that the removal of contamination from number 11 in 1987 brought the contamination level within guidelines set by the NSW Radiological Council. The Committee considers that a 'clear certificate' if it was issued in 1973, should be an indication the property was already within the guidelines of the NSW Radiological Council at that time.

5.66 The Committee also notes the obvious distress caused to Mr Nurse and his family through receiving the offer of a comprehensive medical check-up in relation to radiological surveys being conducted in the area and then the failure of the Health Commission to deliver that check-up.

5.67 The Committee further notes that despite the NSW Government's assertion that the removal of contamination from number 11 in 1987 bought the contamination level within guidelines set by the NSW Radiological Council, in 1989 the Section 149 certificate for the property still indicated the land was contaminated.

5.68 The Committee did not receive evidence as to the criteria applied when properties were assessed for a Section 55 certificate.

5.69 The Committee sympathises with the current owners of number 11 Nelson Parade who bought the property without knowing any of the contamination issues. The Committee notes that a factor contributing to this situation was the proper action of Hunter's Hill Council in removing notification of contamination from the 149 Certificate on the property when the then Department of Health issued a Section 55 Certificate stating the property was clear of radioactive contamination in 1989.

5.70 The Committee believes that number 11 Nelson Parade should be included in any plan to remediate sites affected by the former uranium refinery and the costs of that remediation be borne by the NSW Government. See Chapter 6 for further discussion of the inclusion of lots other than 7 and 9 in the Government's remediation plan and the Committee's recommendation in relation to this issue.

Inquiry participants' views on communication from NSW Health

5.71 Some inquiry participants were unhappy with the communication from NSW Health and its predecessor's about contamination in Nelson Parade. Residents in particular described their anxiety, confusion and embarrassment resulting from a lack of information from NSW Health or its predecessors, or inability to understand information provided. Views ranged from an accusation of deliberate deception to the perception of a breakdown in corporate knowledge. In recent times NSW Health has made an effort to address the concerns of residents with newsletters and feedback sessions.

5.72 Ms Katie McGrath, who believes her parent's may have died from radiation related illness after living in Nelson Parade, stated in her submission her belief that information relating to the contamination has been covered up and deliberately withheld by NSW Health:

> [T]his is a cover up that is beyond despicable, that is immoral, evil and even murderous, since the Department of Health intentionally withheld the truth from us.[237]

5.73 The Nelson Parade Resident's Group stated in its submission that whilst testing has been done on contaminated sites 'residents have been given no records.'[238] Ms Phillipa Clark, Co-ordinator of Nelson Parade Residents Group, stated '[w]e know that there is contamination. As residents we think there is contamination on 5, 7, 9, 11 and 13 and on the foreshores, but we do not know the extent and the level.'[239]

5.74 Ms Clark told the Committee of confusion amongst residents resulting from this lack of information:

> There was confusion about which sites actually have contamination and there was confusion about the validity of the testing. Many reports talk about changing the standards, the kind of testing that was done, whether it was soil samples or other kinds of testing. There is reference that maybe the material is decaying and the contamination effects are becoming worse.[240]

5.75 Ms Clark also described how residents recently arrived in Nelson Parade were 'shocked and dismayed' when NSW Health put forward a proposal for remediation in November 2007 because they had no idea there was a contamination issue in the area. The owners of number 21 Nelson Parade, stated Ms Clark, 'only learnt through the media that their house was supposedly absolutely unsafe.'[241]

5.76 Ms Clark went on to describe the embarrassment felt by residents through being the brunt of jokes and the fact that families from other areas are reluctant to allow their children to visit friends in Nelson Parade due to the perception that it is not safe to play in the street.[242]

5.77 Ms Clark also stated she felt uncertain about the potential health effects of the radioactive contamination in Nelson Parade.[243]

5.78 Ms Kathie Frankland, who grew up on number 15 and now owns number 13 Nelson Parade, described her confusion, in relation to contamination identified on her property, about changing standards relating to contamination:

> [O]ne of the problems we have had has been the change in what is acceptable and what's not acceptable. We got the clearance from the Government saying the land was clear you could sell it, and then the council [said], actually you can not build on it until you get it tested. There are just all these different hurdles. Although we think it is

237 Submission 1, Ms Katie McGrath, p 1

238 Submission 3, Nelson Parade Resident's Group, p 5

239 Ms Phillipa Clark, Co-ordinator, Nelson Parade Residents Group, Evidence, 3 July 2008, p 10

240 Ms Phillipa Clark, Evidence, 3 July 2008, p 9

241 Ms Phillipa Clark, Evidence, 3 July 2008, pp 9-10

242 Ms Phillipa Clark, Evidence, 3 July 2008, p 10

243 Ms Phillipa Clark, Evidence, 3 July 2008, p 14

> safe…the guidelines… seems to change all the time…[I]f we could just get one standard and get it all tested and sorted out, it would make life a bit easier.

5.79 Mr Barry Smith, General Manager of Hunter's Hill Council, stated that residents 'have no certainty of what is on those sites, or any adjoining sites.' He described the Government's management of information relating to the contaminated sites as 'a litany of misinterpretation, misinformation, [which] shows a complete breakdown in corporate knowledge leading to where we are today.'[244] Hunter's Hill Council, in its submission, stated that it wrote to the Department of Environment and Climate Change and the Minister for Health requesting information on the site and adjacent lots, but had 'not received a satisfactory response to these requests.'[245]

5.80 Dr Nicholas Brunton, legal representative for the current owners of number 11 Nelson Parade, described the document discovery process he has engaged in on behalf of his clients as 'protracted' and 'difficult' and stated that 'the Department of Health has, quite frankly, been less than cooperative.'[246]

NSW Health's recent attempts to provide information

5.81 Recently, the State Property Authority, on behalf of NSW Health, has recently engaged Elton Consulting to assist in providing information to the local community about proposed remediation works. A newsletter was distributed to 850 properties in the area, which included an invitation to a community information and feedback session held on 11 December 2007. A second newsletter was distributed at that feedback session and a third was subsequently distributed to approximately 100 residents in the immediate vicinity of the site. In addition, members of the remediation project team attended a resident initiated neighbourhood meeting on 19 February 2008.[247]

5.82 Dr Chant stated that the results of the 2008 ANSTO survey have been provided to the individual property owners along with an offer to meet with owners to discuss those results. Dr Chant also stated that Dr Michael Staff, Director of Environmental Health in the Northern Sydney Central Coast Area Health Service, or Professor Wayne Smith, Director, Environmental Health at NSW Health, were willing to meet with current and former residents to discuss any health concerns they may have.[248]

Committee comment

5.83 The Committee acknowledges the anxiety and uncertainty expressed by former and current residents of Nelson Parade in relation to the contamination in their street, and the contribution to this made by the nature of the communication from NSW Health and its predecessors, and their failure to follow through on repeated promises of remediation made as early as 1965.

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244 Mr Barry Smith, Evidence, 3 July 2008, p 28

245 Submission 18, Hunter's Hill Council, p 2

246 Dr Nicholas Brunton, Evidence, 3 July 2008, p 20

247 Submission 22, p 21

248 Dr Kerry Chant, Evidence, 3 July 2008, pp 39-40

5.84 The Committee notes the comments by Dr Nicholas Brunton, that NSW Health have been 'less than cooperative' and Mr Barry Smith, who describes a 'a litany of misinterpretation [and] misinformation' and a 'complete breakdown in corporate knowledge.' The Committee further notes, as previously, the loss of Department of Health documentation relating to remediation activities and the location of drums of potentially highly radioactive material.

5.85 The Committee believes NSW Health and its predecessors have failed to clarify the community understanding of contamination issues in Nelson Parade, and that the loss of official records in relation to the missing drums of radioactive material has further aggravated this situation.

5.86 The Committee does, however, acknowledges the recent attempts by NSW Health to communicate more fully and clearly with the residents of Nelson Parade in the form of community feedback sessions and the distribution of newsletters. The Committee makes a recommendation in relation to retesting and the communication of results in Chapter 6.

Reports of potentially radiation related deaths and illness in the area

5.87 Mr Michael Richardson MP reported to the Committee that 'five deaths have been attributed to this site, with possibly more to come.[249]

5.88 Ms Katie and Mr Gregory McGrath, who lived with their parents at 21 Nelson Parade in the 1970s gave evidence to the inquiry in relation to the death of their parents. Iris McGrath died from leukaemia at the age of 35 and Fabian McGrath died from stomach-related cancers at the age of 39.[250] The McGraths believe their parent's death may be related to exposure to radioactive waste originating at the former uranium refinery. Their parents grew vegetables in the garden at number 21 and their father built a retaining wall.[251] During the time the McGraths lived in Nelson Parade they walked across the foreshore area at the rear of what is now numbers 7, 9 and 11 Nelson Parade.[252]

5.89 Mr Benjamin Nurse and his family lived at number 11 Nelson Parade from 1974 to 1980.[253] One of his daughters, Ms Julienne Nurse, recalled spending many hours on the foreshore at the rear of the property, fishing, playing and gardening. She recalled hours spent at the base of the property climbing over a mound of bags approximately three metres high. The bags were unlabelled and damaged with soil spilling out of them. Later she learnt 'that these bags contained the most hazardous waste.'[254] Julienne's sister, Danielle, who was also raised at 11 Nelson Parade in her younger years, subsequently developed thyroid cancer, or Hashimoto's thyroiditis. Mr Nurse and his daughter Julienne stated that they believe this is due to Danielle's exposure to radiation.[255]

249 Submission 8, p 4

250 Ms Kathleen McGrath, Evidence, 3 July 2008, p 2

251 Ms Kathleen McGrath, Evidence, 3 July 2008, p 3

252 Mr Gregory McGrath, Evidence, 3 July 2008, p 4

253 Mr Benjamin Nurse, Evidence, 4 July 2008, p 57

254 Submission 2, p 1

255 Submission 2, p 1; Submission 23, p 2; Mr Benjamin Nurse, Evidence, 4 July 2008, p 57

5.90 Mrs Corinne Young, who along with her family resided in nearby Margaret Street from 1987 to 1992, was diagnosed with Hashimoto's thyroiditis in 2004. In 2006 she was hospitalised with a terminal lung condition that she stated medical evidence links to radon gas. Her two oldest children were diagnosed with Hashimoto's disease in 2004 and her next child was diagnosed with the disease in 2008. Hence, all her children have Hashimoto's disease, which she stated is more than the 25 percent expected occurrence from a gene carrier.[256]

5.91 Mrs Olive Taylor, also a resident of Margaret Street from 1938 to 1940, has had three sons and a daughter. One son had Down syndrome and died at the age of two. Her other two sons developed non-Hodgkins lymphoma and her daughter has thyroid problems. Mrs Taylor is concerned these illnesses may be linked to her exposure to radioactive contamination whilst living in Margaret Street.

Difficulties identifying cancer clusters attributable to radiation

5.92 In Chapter 3 the Committee discussed the methodological difficulties in establishing the link between cancer and relatively low doses of radiation.[257] In addition to these methodological difficulties, other limitations may include incompleteness and changes over time in cancer registries, limitations in accuracy and completeness of cancer diagnoses and causes of death, lack of exposure measurement, and movement of people between various jurisdictions. Bias may arise in various ways, particularly with retrospectively collected data. In addition, statistical power may be limited by a relatively small number of people at risk, and multiple confounding factors often complicate the ability to identify effects, and make interpretation of available data difficult. It can be thus be very difficult to establish whether there is an increased incidence of cancer in a given area attributable to a particular cause. Additional to these difficulties is the fact that cancers due to radiation exposure are indistinguishable from other cancers.[258]

5.93 Professor Wayne Smith, Director of Environmental Health at NSW Health, stated that there was no evidence known to NSW Health that suggested an increase in deaths from cancer or potential radiation-related illnesses in Nelson Parade, as compared to the rest of Hunter's Hill. Professor Smith explained that available records were insufficient to support a conclusion on the matter:

> We have looked at cancer, broader-term cancer rates, but they come down to a much larger area than just one street. We would have to count all of the cases that ever happened in that street and the duration of exposure for people who lived in that street and come to a conclusion about whether this is beyond expected or not. We have no way of counting that because the cancer register actually is not very valid

256 Submission 15, Ms Corinne Young, p 1

257 See paragraphs 3.26-3.27

258 Professor Tilman Ruff, Medical Association for Prevention of War, Evidence, 4 July 2008, p 48; Wareham, Sue, 2007, 'The Nuclear Industry: A History of Misleading Claims', Energy Science Coalition Briefing Paper, p 4, accessed 8 August 2008 < http://www.energyscience.org.au/BP20%20Misleading.pdf>

> prior to the mid eighties; it does not actually list all of the cancers, the people who had them and where they came from.[259]

5.94 The Committee heard that maps produced by the cancer council show no concentration of cancer deaths in Hunter's Hill.[260]

5.95 Mr Barry Smith, General Manager of Hunter's Hill Council noted that local residents had understandably voiced concerns about cancer rates in Hunter's Hill. He noted also that the most recent census information indicated that cancer rates tended to be higher in the higher socioeconomic suburbs of Sydney.[261]

5.96 Clr Susan Hoopman, Mayor of Hunter's Hill, stated that the recent census did not give cause for concern about cancer rates in Hunter's Hill.[262]

Committee comment

5.97 The Committee sympathises with those inquiry participants who attribute the death or serious illness of family members the radioactive contamination of the Nelson Parade site. Given the methodological difficulties in establishing the link between illness and relatively low doses of radiation, the Committee is unable to form a view as to the contribution the radioactive contamination on the site may have made to these deaths and illnesses.

5.98 The Committee notes the anxiety experienced by residents in relation to health concerns, emphasises the need for clear and regular communication from NSW Health regarding contamination levels and remediation activities on the site.

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259 Professor Wayne Smith, Director, Environmental Health, NSW Health, Evidence, 3 July 2008, pp 55-56

260 Submission 12, Ms Lynne Saville, p 3

261 Mr Barry Smith, Evidence, 3 July 2008, p 38

262 Clr Susan Hoopman, Mayor, Hunter's Hill Council, Evidence, 3 July 2008, p 38

The former uranium smelter site at Hunter's Hill

Chapter 6 Remediation plans

This chapter considers the NSW Government's proposed remediation plan for the site. This includes the possibility of retesting prior to remediation, the remediation assessment criteria and the classification and disposal of contaminated soil and other material excavated from the site. The chapter begins with a summary of past remediation activities and plans, followed by an overview of the role played by government agencies in developing and implementing the current remediation plan.

Summary of past remediation and remediation plans

6.1 As noted in Chapter 5, as early as 1965, the Department of Health expressed the desire to take remedial action in relation to the radioactive contamination at Nelson Parade.[263] The 1966 report for the Radiation Branch completed by R J Bayliss recommended the removal of 'certain areas' of soil from numbers 5, 7, 9 and 11 Nelson Parade.[264] The 1977 report for the Health Commission completed by B W Scott recommended the 'complete removal' of soil from numbers 7 and 9 and the removal of soil from 'certain areas' of numbers 3, 5 and 11 Nelson Parade.[265]

6.2 The Committee did not receive any evidence of remediation activity prior to 1977, when a small amount of contaminated soil on number 3 was removed.[266] There is some evidence soil was removed from numbers 5 and 11 in 1982 and placed on numbers 7 and 9, but no official records to confirm this.[267] According to evidence presented to the Committee, the next remediation activity occurred in 1987 when contaminated soil was removed from number 11 and placed on number 9.[268] Between 1992 and 1993 the buildings on numbers 7 and 9 were demolished and contaminated material from numbers 5, 11 and allegedly 13 was placed on numbers 7 and 9. Numbers 7 and 9 were then capped, vegetated and fenced, as they remain today. This completed the general strategy to consolidate contamination in the area onto numbers 7 and 9.[269]

263 Letter from H. M. Whaite, Officer-in-Charge, Radiation Branch, Department of Public Health, to Mr G. H. Conlan, 5 Nelson Parade, Hunter's Hill, 3 November 1965, Attachment A, Submission 11, Mrs Joan Conlan

264 Bayliss, R J, 'Radioactive Contamination in the Grounds of Dwellings at Hunter's Hill,' NSW Department of Health, Radiation Branch, March 1966, p 6

265 Scott, B W, 'Investigation of Radioactive Contamination at Nelson Parade, Woolwich', prepared on behalf of NSW Health Commission, April 1977, p 27

266 Submission 22, NSW Government, p 13

267 Egis Consulting, 'Stage One Investigation of Radioactive Contamination, Numbers 7 and 9 Nelson Parade, Hunter's Hill', prepared on behalf of NSW Department of Health, November 1999, p 15

268 Submission 22, p 13

269 Submission 22, p 1 and pp 13-14

1987 Sinclair Knight and Partners plan

6.3 In 1987, Sinclair Knight and Partners (SKP), commissioned by the Public Works Department on behalf of the Department of Health, conducted an environmental assessment of a strategy to dispose of the contamination on-site that was approved in principle by NSW State Cabinet on 22 June 1982. The objective of the strategy was to decontaminate numbers 5, 7, 9, 11 and 13 Nelson Parade.[270]

6.4 SKP noted decontamination strategies that had been considered and discarded by the NSW Government previously. These were, disposal at sea - not favoured due to 'specific practical and political difficulties' – and off-site land disposal - not favoured due to difficulty finding a suitable and cost-effective site.[271]

6.5 The on-site disposal strategy proposed by SKP involved the construction of four sealed concrete cylinders, or 'silos', at the foreshore area below numbers 7 and 9 and the transfer of all contaminated material into the silos. It was proposed that this be followed by revegetation and landscaping and the provision of 'site access controls and identification markers as necessary.'[272]

6.6 The Committee did not receive evidence as to why this remediation strategy was not implemented.

2000 Egis Consulting plan

6.7 In June 2000, Egis Consulting Australia developed a 'Remediation Action Plan' on behalf of the Department of Health. The objective of the plan was to remediate lots 7 and 9 'to a standard compatible with unrestricted residential land use.'[273]

6.8 In a previous report dated February 2000, Egis stated that 'uncertainty exists as to the total permissible annual dose rate that would constitute a remedial action level.'[274] Their Remedial Action Plan noted that the assessment criterion had not been finalised but that they considered it to lie between 3.25 and 6.14 mSv per year. Depending on the criterion chosen, an area between 220 and 1100 square metres would require remediation, involving 160 to 770 cubic metres of soil.[275]

6.9 Egis considered three remedial options. These were in-situ capping and containment, excavation and on-site containment and excavation and disposal to landfill. In-situ capping

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270 Sinclair Knight and Partners, 'Radium Waste Clean-Up, Nelson Parade Hunter's Hill: Review of Environmental Factors,' prepared on behalf of NSW Public Works Department and NSW Department of Health, September 1987, p 2.1

271 Sinclair Knight and Partners, September 1987, p 3.6

272 Sinclair Knight and Partners, September 1987, p 6.1

273 Egis Consulting, 'Remedial Action Plan, Lots 7 and 9 Nelson Parade, Hunter's Hill, NSW', prepared on behalf of NSW Department of Health, June 2000, p *7*

274 Egis Consulting, 'Stage Two Investigation of Radioactive Contamination, Numbers 7 and 9 Nelson Parade, Hunter's Hill', prepared on behalf of NSW Department of Health, February 2000, p 28

275 Egis Consulting, June 2000, p *i*

and on-site containment were not favoured due to the difficulty of guaranteeing the capping or containment material for the thousands of years the contamination would remain radioactive, and the danger of radon gas build up. Therefore, Egis recommended excavation and disposal to landfill.[276]

6.10 Based on soil samples 'representative of the highest levels of radioactivity' Egis anticipated that the excavated soil would be classified as industrial waste according to NSW EPA Guidelines for Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999) and could therefore be disposed of at any one of five landfills they identified operating in the Sydney area at the time.[277]

6.11 The Egis proposal was not proceeded with at that time due to two factors, which needed to be addressed prior to remediation activities commencing. Firstly, a single assessment criterion to determine which areas were to be excavated needed to be adopted, and secondly, the chemical contamination status of the foreshore land needed to be confirmed.[278] GHD, a private engineering and architecture company subsequently undertook these projects, beginning with a review of appropriate assessment criteria.[279]

6.12 GHD is developing the currently proposed remediation plan.

The role of government agencies in the proposed remediation plan

Summary of the roles of government agencies

6.13 NSW Health, through the Health Administration Corporation, and NSW Maritime are the landowners of the contaminated site and potentially contaminated foreshore areas adjoining the site. As such, they are, under the hierarchy of responsibility in the *Contaminated Land Management Act 1997*, responsible for remediation of these areas. [280]

6.14 NSW Health, through its Public Health Division, also provides input into the development consent process and advice on public health issues and health standards.[281] Dr Kerry Chant, Acting Chief Health Officer with NSW Health, outlined the Department's public health protection role:

> …the Health Department has a health protection role to ensure that public health is not compromised from environmental risks such as chemical and radiological contamination.[282]

276 Egis Consulting, June 2000, p 16

277 Egis Consulting, June 2000, pp 17-18

278 GHD, 'Lot 7 and 9 Nelson Parade + Adjoining Foreshore Land, Hunter's Hill: Remedial Action Plan and Technical Specification', prepared on behalf of NSW Health, May 2006, p 13

279 GHD, November 2002

280 Submission 22, pp 9-10

281 Submission 22, p 6

282 Dr Kerry Chant, Evidence, 3 July 2008, p 39

6.15 NSW Health has engaged the State Property Authority to project manage the remediation. The State Property Authority has in turn subcontracted the development of a remediation plan and project management of the remediation process to GHD.

6.16 Under the *Environmental Planning and Assessment Act 1979*, the Minister for Planning, with advice from the Department of Planning, is the approval authority for the remediation of the site at Nelson Parade. [283]

6.17 DECC has a regulatory role in the remediation process by virtue of administering the *Contaminated Land Management Act 1997,* the *Radiation Control Act 1990*, and the *Protection of the Environment Operations Act 1997,* all of which are relevant to the clean up of the Nelson Parade site. [284]

6.18 Ms Lisa Corben, the Director General of DECC, explained that DECC was working with the proponents of the remediation, NSW Health, and the consent authority, the Department of Planning, to develop a strategy to clean up the contaminated areas in Nelson Parade. [285]

Independent site auditor

6.19 Under the *Contaminated Land Management Act 1997,* DECC is empowered to accredit and establish guidelines for an independent site auditor for the remediation process. The functions of the independent site auditor include reviewing the work of consultants, the nature and extent of contamination and 'what investigation and remediation remains necessary prior to land being made available for a specific usage, and the suitability and appropriateness of a plan or remediation.' [286]

6.20 Ms Lisa Corbyn, the Director General of the Department of Environment and Climate Change (DECC), explained that the appointment of an independent site auditor ensured there would be transparent regulation of the process. Ms Corbyn stated that the independent site auditor would confirm that the required clean up standards had been met and submit site audit statements to DECC and the Department of Planning upon completion of the remediation works.[287]

Committee comment

6.21 The Committee notes that whilst the foreshore areas at the rear of numbers 7, 9 and 11 Nelson Parade have been declared a remediation site under the *Contaminated Land Management Act 1997*, the upper areas of numbers 7 and 9 have not. Consequently, an independent site auditor could technically be accredited only to oversee the remediation work done on the foreshore area, where chemical contamination predominates, and not the upper areas of 7 and 9, where radiological contamination predominates.

283 Submission 22, p 6

284 Ms Lisa Corbyn, Evidence, 3 July 2008, p 57

285 Ms Lisa Corbyn, Evidence, 3 July 2008, p 57

286 Submission 22, p 10

287 Ms Lisa Corbyn, Evidence, 3 July 2008, p 58

Recommendation 1

That the Department of Environment and Climate Change ensure that the independent site auditor appointed to oversee the remediation of the foreshore areas of numbers 7, 9 and 11 Nelson Parade, is also appointed to oversee the remediation of the upper levels of numbers 7 and 9 Nelson Parade and any other areas beyond the site requiring remediation.

Remediation plan development processes

6.22 The NSW Government provided the Committee with the following outline of the process for the development of the remediation plan.[288]

6.23 GHD, on behalf of NSW Health, must submit an Environmental Assessment to the Minister for Planning satisfying the Department of Planning Director General's Requirements for the remediation project.

6.24 Once submitted, this Environmental Assessment is made publicly available and the public and relevant agencies are invited to make submissions on the proposals it contains. Following an appropriate exhibition period, GHD, on behalf of NSW Health, will be required to formally respond to issues raised in the submissions.

6.25 The Minister for Planning may at any time constitute an independent panel of experts to strengthen the rigour of the technical assessment of the proposal.

6.26 At the end of this process, the Department of Planning completes an independent review of the proposal and reports to the Minister for Planning. The Minister for Planning then determines whether the project can proceed as planned, and if so, imposes a 'range of conditions to ensure that the proposal is carried out without causing harm to human health or the environment, and successfully remediates the land for its intended future use.'[289]

Proposed remediation plan

6.27 In 2006, GHD submitted a 'Remediation Action Plan' to NSW Health relating to lots 7 and 9 and the adjoining foreshore land at the rear of lots 7, 9 and 11. The aims of the plan included setting remediation goals to ensure the site was suitable for residential use, evaluating a range of remediation options to address existing contamination, documenting the preferred remediation techniques and procedures, and establishing necessary safeguards.[290] GHD subsequently completed a Preliminary Environmental Assessment, which included details of the remediation plan, in November 2007.

288 Submission 22, p 11

289 Submission 22, p 11

290 GHD, May 2006, p 5

6.28 GHD consider the same three remedial options as Egis Consulting Australia in 2000 and reject in-situ capping and excavation on-site containment for the same reasons, adding that gaining approval for on-site containment of radioactive material in a residential setting would be 'difficult, if not impossible' and that the cost would be likely to exceed excavation and off-site disposal. GHD's proposal, therefore is to excavate the contaminated soil and dispose of it off-site.[291]

6.29 GHD characterised contamination on the site as follows:

- The upper levels of the site remain impacted by radioactivity but appear free of chemical contamination above residential land use criteria
- The lower levels contain Total Petroleum Hydrocarbons (TPH) and Polycyclic Aromatic Hydrocarbons (PAH) compounds, as well as arsenic and lead at concentrations above residential land use criteria
- Groundwater in the foreshore area contains hydrocarbon contaminants, most notably PAH. However, the contaminants are suspended rather than dissolved and so should therefore be addressed by remediation of the soil.[292]

6.30 Based on their assessment criteria, GHD estimate the volume of soil requiring excavation to be 700 cubic metres from the upper levels and 550 cubic metres from the foreshore area.[293] (See paragraphs 6.72 to 6.89 below for discussion of assessment criteria).

6.31 Excavated soil is to be transported via a 'conveyer type system' to a loading zone on Nelson Parade (see paragraphs 6.90 to 6.98 below for discussion of trucking versus barging options). The soil will be loaded directly into haulage vehicles and not stockpiled. The vehicles will be covered to reduce dust generation and wheel washing facilities and/or 'rumble grids' will be installed at 'access gates' to minimise the migration of soil off-site.[294]

Committee comment

6.32 The Committee notes that the proposed remediation plan addresses the site owned by NSW Health, that is, lots 7 and 9 and the foreshore area at the rear of lots 7, 9 and 11. Sections 6.64 to 6.70 of this report address the issue of remediation beyond the site and the Committee recommends the inclusion of all identified areas of contamination in NSW Health's remediation plan.

Assessment process for the remediation plan

6.33 GHD's proposed remediation plan, developed on behalf of NSW Health, is currently in the early stages of the assessment process.

6.34 GHD submitted a 'Preliminary Environmental Assessment' in November 2007.

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291 GHD, May 2006, p 22

292 GHD, May 2006, p 17

293 GHD, May 2006, p 17

294 Submission 22, p 19

6.35 The Department of Planning issued the Director General's Requirements on 12 February 2008.

Committee comment

6.36 The Committee notes the long and intermittent history of remediation plans for contaminated sites in Nelson Parade. According to evidence presented to the inquiry, the then Department of Public Health expressed the desire to remediate contaminated areas as early as 1965 (see 5.16). In 1966, R J Bayliss' report for the then Radiation Branch recommended the removal of soil from 'certain areas.' In 1977, B W Scott's report for the then Health Commission recommended the 'complete removal' of soil from numbers 7 and 9 Nelson Parade and from certain other identified areas. According to evidence presented to the inquiry, it was not until 1987 that the first detailed remediation plan was commissioned and completed by Sinclair Knight and Partners. A second detailed remediation plan was commissioned and completed by Egis Consulting Australia in 2000. Neither of these remediation plans was implemented.

6.37 The Committee further notes that despite Health commissioning the architectural and engineering firm GHD to commence work in 2002, the currently proposed remediation plan is still in the early stages of the assessment process. The Committee notes in addition that despite NSW Health stating in a newsletter distributed to residents in the Nelson Parade area that it anticipated the environmental assessment report would be finalised in May 2008,[295] at the time of the inquiry only a preliminary environmental assessment had been submitted.

6.38 The Committee appreciates the frustration of residents with the false starts and extended timeframes that have characterised the development of remediation plans for the site and believes that the community has a right to be presented with a clear timeline for the development and implementation of the currently proposed remediation plan.

Recommendation 2

That NSW Health prioritise the completion of a detailed timeline for the development and implementation of the proposed remediation plan, including projected dates for the submission of the environmental assessment, the completion of the Department of Planning's review of the proposals it contains, and the commencement and estimated completion of proposed remediation works, as approved by the Minister for Planning.

295 NSW Health, 'Proposed Remediation of NSW Health Land, Nelson Parade, Hunter's Hill', Newsletter 3, May 2008, p 2

Issues arising from the proposed remediation plan

Retesting the site and adjacent lots prior to remediation

6.39 The NSW Government had not proposed further testing of the site and adjacent lots prior to remediation. However, a number of inquiry participants recommended that the site be thoroughly tested prior to any remediation.

6.40 The NSW Government, in its submission, stated that excavation areas on the site will be identified based on 'pre-existing analysis and data,' adding that '[a]dditional excavation may be necessary to identify any residual contaminated soil which fails to meet the project validation criteria.'[296]

6.41 Professor Wayne Smith, Director of Environmental Health with NSW Health, argued that there was no evidence of raised radiation levels beyond the site of the former uranium refinery to suggest further testing was needed:

> We have no evidence that there is anything raised beyond that site. The levels of radiation moving away from 7, 9 and 11 are decreased rapidly to background, and we have no reason to suspect that they will pop up again in any other location close to that…From a public health perspective I see no reason to [retest].

6.42 However, Dr Gavin Mudd, Lecturer with the Department of Civil Engineering at Monash University, noted that the contamination at depth on the site was not known and that there was 'no good data on some of the key pathways for radiation, that is, radon gas and dust on uptake and so on.' Dr Mudd argued that a survey of the whole area covering all radiation exposure pathways was needed to form the basis of a legitimate solution and engender public confidence in the process.[297]

6.43 Professor Tilman Ruff from the Medical Association for the Prevention of War stated that 'what has been particularly missing is a comprehensive overview that…maps the extent of this contamination'[298] and that a full survey of the site was necessary as a 'prelude to full remediation of the site.'[299]

6.44 Ms Catriona Maloney, General Manager of Safety and Radiation Services with the Australian Nuclear Science and Technology Organisation, noted that the size of 'hot spots', and therefore the volume of soil to be removed, was not known:

> [W]e do not have good characterisation of the actual size of the hot spots; whether you are going to go in and do bulk removal or just go in and take out a few square

296 Submission 22, p 19

297 Dr Gavin Mudd, Lecturer, Department of Civil Engineering, Monash University, Evidence, 4 July 2008, p 2

298 Professor Tilman Ruff, Medical Association for Prevention of War, Evidence, 4 July 2008, p 51

299 Professor Tilman Ruff, Evidence, 4 July 2008, p 52

> metres at a time. That gets back to doing a much more detailed characterisation of the site to see what needs to be done.[300]

6.45 Dr Joseph Young, Principal Consultant Health Physicist with Australian Radiation Services, also urged a thorough re-investigation of the site as a precursor to remediation:

> I would organise a thorough investigation using the correct radiation monitoring equipment of the external gamma radiation across the entire site. I would then arrange to have detailed sampling of the site because it has been many years since the original survey was done. Once you have got the activity concentration from the soil, and the external background gamma radiation at the site, you can then start to make some decisions based on this information. Because you need that data before you can actually draw some conclusions of what you are going to do.[301]

6.46 Hunter's Hill Council stated that 'there are very, very serious and legitimate concerns that the real extent of contamination and radiation levels has never been properly, or appropriately, assessed or addressed.'[302] Council stated that it could not support a remediation strategy without re-testing of the sites to provide reliable and up to date data:

> Based on the unreliability and paucity of historical information available and the recent independent tests undertaken by Australian Radiation Services Pty Ltd, Council cannot support the proposed remediation strategy.
>
> Any proposed remediation strategy must be based on sound, proper and current data. This can be achieved by agreeing with the request made by Council for the re-testing of the sites and preparation of a current risk assessment.[303]

6.47 Ms Phillipa Clark, Coordinator of the Nelson Parade Residents Group, suggested that the entire foreshore side of Nelson Parade, from number 1 to number 21, should be retested.[304]

6.48 Councillor Susan Hoopman, Mayor of Hunter's Hill, suggested that both sides of the street should be tested to remove the stigma now surrounding the area:

> I would go further than what they ask and say that the whole street, the lower side and other side, should be tested because of the stigma that is now around that area. That is the only way that can be removed. We are talking about more than real estate values. We are talking about life. We need to have it done and the sooner the better, as far as I can see.[305]

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300 Ms Catriona Maloney, General Manager, Safety and Radiation Services, Australian Nuclear Science and Technology Organisation, Evidence, 4 July 2008, p 29

301 Dr Joseph Young, Principal Consultant Health Physicist, Australian Radiation Services Pty Ltd, Evidence, 4 July 2008, p 39

302 Submission 18, Hunter's Hill Council, p 10

303 Submission 18, p 14

304 Ms Phillipa Clark, Co-ordinator, Nelson Parade Residents Group, Evidence, 3 July 2008, p 14 and 16.

305 Clr Susan Hoopman, Mayor, Hunter's Hill Council, Evidence, 3 July 2008, p 30

Testing the marine environment

6.49 In relation to the marine areas adjacent to the lot, Mr Michael Richardson MP stated in his submission to the inquiry that in 1977 an extensive survey of the nearby Parramatta River bed was recommended, but that whether or not the testing took place and what the results were was not known.[306]

6.50 Mr Bruce Green, Acting General Manager of the Maritime Property Division, New South Wales Maritime, stated that other than an indication from an early study of 'low level' contamination, the contamination levels offshore were not known.[307] The NSW Government, in its submission, stated that 'NSW Maritime will undertake sediment testing if the need is indicated by the current foreshore investigations.'[308]

Method of testing

6.51 In terms of the aims and methods of re-testing, if conducted, several inquiry participants called for a full 'characterisation' of the site involving soil sampling at depth, testing of water quality, radionuclide uptake, and radon gas and gamma radiation measurement.[309]

6.52 Dr Mudd emphasised the need for soil samples to be taken not just from the surface, but from 'several metres deep' and to take a similar approach to testing water column to ensure a vertical profile down the water column is obtained.[310]

6.53 Professor Ruff echoed this need to characterise the site 'spatially' sampling vertically. Professor Ruff added that testing should extend to the marine environment 'given the likelihood of significant volumes in the sediments close to shore.'[311]

Committee comment

6.54 The Committee notes the number of radiological surveys conducted in the past and the Government's intention to rely on the results of those surveys to identify areas requiring remediation and levels of contamination expected. However, the Committee notes the inconsistent results of those surveys, particularly in relation to gamma dose rates, the concern and confusion expressed by a number of inquiry participants in relation to those survey results, the range of different testing procedures, the different performance of different measuring instruments, and the difficulty in confirming, through the production of official documents, reported remediation activities and movement of soil in the past.

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306 Submission 8, Mr Michael Richardson MP, p 14

307 Mr Bruce Green, Acting General Manager, Maritime Property Division, New South Wales Maritime, Evidence, 3 July 2008, p 72

308 Submission 22, p 3

309 Dr Gavin Mudd, Evidence, 4 July 2008, p 7 and 9; Ms Catriona Maloney, Evidence, 4 July 2008, p 29 and 31; Dr Joseph Young, Evidence, 4 July 2008, p 39; Professor Tilman Ruff, Evidence, 4 July 2008, p 51

310 Dr Gavin Mudd, Evidence, 4 July 2008, p 7

311 Professor Tilman Ruff, Evidence, 4 July 2008, p 51

6.55 Consequently, the Committee is not satisfied, nor does it believe residents or other interested parties are satisfied, that all areas of contamination in the area have been identified or that where contamination has been identified, it has been fully characterised.

6.56 The Committee also notes, as previously, the possibility that tailings have been removed from the site over the years and used as fill in unknown locations.

6.57 The Committee further notes that the tin smelting plant formerly on Kelly's Bush Reserve was another potential source of radioactive and chemical contamination for properties on nearby streets.

6.58 The Committee agrees with the inquiry participants who urge a full characterisation of the site and other areas that may contain contamination as a necessary step prior to the commencement of remediation activities. Not only would this engender confidence that all the contamination had been located, but would, in combination with an agreed remediation criterion, provide vital information in estimating the volume of soil and other material requiring excavation and its likely level of contamination, in turn necessary information for the development of a detailed plan for the removal and disposal of contaminated soil and other material.

6.59 The Committee also notes the elevated levels on the footpaths and actual street in Nelson Parade reported in Martens Consulting Engineers 2008 survey of 21 Nelson Parade, and believes these areas should be also be tested prior to the commencement of remediation activities. This would not only identify areas potentially requiring remediation, but would also provide a 'before' measure of contamination on the street and footpaths for comparison to post-remediation levels should the option of trucking contaminated material away from the site via Nelson Parade be utilised.

6.60 The Committee notes the minimal information regarding offshore contamination adjacent to the site and believes a full characterisation of the site should include these offshore areas.

6.61 The Committee notes, as previously, the long history of contamination issues in Nelson Parade and believes testing can and should commence as soon as is practical.

6.62 The Committee recognises the rights of residents to be made fully aware of the results of retesting.

6.63 The Committee believes the involvement of the independent site auditor in community feedback sessions will contribute to the transparency of the feedback process and encourage community confidence in the testing and remediation process.

Recommendation 3

That NSW Health and the Department of Environment and Climate Change ensure that, prior to the finalisation of the remediation plan and the commencement of remediation activities:

- all local residents are notified and consulted on the process of testing,
- all properties in Nelson Parade and the footpaths and street itself, are thoroughly surveyed for gamma radiation levels,
- properties on other nearby streets are surveyed for gamma radiation levels, and
- areas showing elevated gamma radiation levels are thoroughly characterised through analysis of soil samples taken down to a depth of several metres, analysis of ground water quality and measurement of radon gas levels.

Recommendation 4

That NSW Health and the Department of Environment and Climate Change, in consultation with NSW Maritime, ensure that, prior to the finalisation of the remediation plan and the commencement of remediation activities, the marine environment adjacent to the site is thoroughly surveyed including analysis of sediment samples.

Recommendation 5

That NSW Health and the Department of Environment and Climate Change ensure that thorough testing commence as soon as is practical, with regard to the availability of the necessary expertise and equipment.

Recommendation 6

That NSW Health make the results of thorough testing available to all local residents, organise community feedback sessions to explain those results, and involve the independent site auditor in those feedback sessions.

Remediation of areas beyond 'the site'

6.64 GHD's remediation plan relates specifically to numbers 7 and 9 and the foreshore area at the rear of numbers 7, 9 and 11 Nelson Parade, that is, 'the site' owned by NSW Health. [312]

6.65 NSW Maritime have also engaged GHD to survey the two parcels of land it owns on the foreshore area adjacent to the site at the rear of numbers 5 and 13 Nelson Parade. The NSW Government stated in its submission that 'should the investigation reveal levels of contamination that warrant remediation, NSW Maritime will liaise with NSW Health and DECC to develop an appropriate remediation strategy.'[313]

6.66 From a regulatory perspective, NSW Health are obliged only to address the contamination existing on land it owns. The *Contaminated Land Management Act 1997* provides a hierarchy of responsibility relating to contamination which names the polluter as the entity primarily responsible, followed by the owner of the land. In the case of the site at Nelson Parade, the polluter, the Radium Hill Company, is no longer in existence. Therefore, responsibility for clean up falls to the owner of the land. In the case of the site, that is NSW Health, but in the case of adjacent lots, the responsibility lies with the individuals who own those lots.[314]

6.67 However, Dr Kerry Chant, Acting Chief Health Officer with NSW Health, gave an undertaking that remediation activities would include removing 'readily accessible material' near the site:

> Our position is…that readily accessible contamination should be removed at the time. It makes commonsense that if you are remediating and removing product off 7 and 9, that is an opportunity to access readily available material…[O]ur aim is to reduce exposure to the lowest possible level so we clearly support that concept of removing readily accessible material.[315]

6.68 Mr Craig Lamberton, Director of Specialised Regulation with DECC, stated that DECC had discussed with NSW Health the practicality of removing contamination from adjacent lots at the same time as removing contamination from the site itself. Mr Lamberton stated that 'it might be good sense, and that is what we have suggested.'[316]

Committee comment

6.69 The Committee agrees with representatives from NSW Health and DECC that it would be practical and efficient to remove contamination from nearby locations whilst the infrastructure

312 Submission 22, p 17

313 Submission 22, p 3

314 Submission 22, pp 9-10

315 Dr Kerry Chant, Evidence, 3 July 2008, p 49

316 Mr Craig Lamberton, Director of Specialised Regulation, Department of Environment and Climate Change, Evidence, 3 July 2008, p 59

and equipment is in place to remove contamination from the site at numbers 7 and 9 Nelson Parade.

6.70 The Committee further notes that this undertaking would be consistent with the intention of NSW Health's predecessors to remove radioactive contamination from affected lots in Nelson Parade, expressed as early as 1965, when all affected lots were privately owned, and expressed periodically since that time.

Remediation of marine areas

6.71 The Committee did not receive any evidence relating to the remediation of the offshore marine areas adjacent to the site.

Recommendation 7

That NSW Health's remediation plan include all areas in Nelson Parade and any other site identified as contaminated by radioactive material in the vicinity of the uranium refinery site, including the marine environment adjacent to the site.

Assessment criteria

6.72 'Assessment criteria,' 'clean-up criteria' and 'remedial action level' all refer to the threshold measure of radiation above which remediation is required. The assessment criteria is a critical component of the Government's remediation plan since it will be a determining factor in what soil is removed and what soil remains, and therefore the volume of soil and other material that must be excavated and disposed of. At the same time, it will be the determining factor in the level of exposure remaining once remediation activities are complete.

6.73 The Committee received evidence that guidelines relating to acceptable levels of radiation were not consistent across Australia and that the guidelines that existed were not necessarily consistent with international guidelines.[317] Previously proposed remediation plans had not clearly identified assessment criteria. As noted above, one of two reasons Egis' 2000 proposal was not proceeded with was the lack of a single assessment criterion (see paragraph 6.11).

Assessment criteria in the proposed remediation plan

6.74 In November 2002 GHD completed a review, on behalf of NSW Health, of appropriate radiation clean-up criteria from Australian states and territories and internationally.

6.75 GHD reported that Victoria, Tasmania, the Northern Territory and the Australian Capital Territory had not adopted specific clean-up criteria for radioactive soil, but that in Victoria, Section 7 of the *Health (Radiation Safety) Regulations 1994* states that a substance is radioactive if

317 Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 7; Egis Consulting, February 2000, p 13; GHD, 'Nelson Parade, Hunter's Hill: Desktop Review of Appropriate Radiation Clean-Up Criteria', prepared on behalf of NSW Department of Health, November 2002 p 4; Egis Consulting, November 1999, p 22

an individual is likely to receive an effective dose exceeding 10 mSv per year. Queensland are guided by a policy entitled *Policy on Land Affected by Radioactive Materials due to Past Practices,* 1998, which proposes 7.5 mSv per year as the level beyond which remediation is required. The Western Australian Government's position was reported as requiring a site be returned to its original natural condition.[318]

6.76 In NSW, the GHD stated that radiation criteria are contained in the Environmental Protection Authority's (EPA) *Radiation Information Series, No. 12, Clean-Up And Disposal of Radioactive Residues From Commercial Operations Involving Mineral Sands.* The recommendations in this document are derived from the National Health and Medical Research Council's (NHMRC) 1984 standards entitled *Guidelines for Remedial Action in Areas where Residues from Mineral Sand Mining and Processing have been Deposited.*[319] The NHMRC guidelines recommend the following 'action level criteria':

- For dwellings, schools (including playground) businesses, factories, etc, where occupancies by the same individuals occur regularly on a day by day basis, the remedial action level should be 0.7 μGy/h for all points at 1 metre above the area of concern on the property.
- For other areas, where occupancies are for a few hours per week by the same individuals or by differing individuals and for garden areas, the remedial action level should be 1 μGy/h for all points at 1 metre above the lowest surface of the area.
- For roads, paths, and other areas with intermittent occupancy, the remedial action level should be 2.5 μGy/h for all points at 1 metre above the surface of the areas.
- All values quoted above should include a value for normal natural background of 0.1 μGy/h

6.77 GHD's review of international criteria focussed on the 1 mSv per year dose limit for members of the public recommended by the International Committee on Radiological Protection (ICRP) and adopted by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA),[320] discussed in Chapter 3.

6.78 GHD dismiss the ICRP recommended 1 mSv per year limit as 'inappropriate to be used as the clean-up criteria, as it is lower than background levels at the site.'[321] The background level they accept for the site is 0.35 μGy/hr (approximately 2 mSv/yr).[322] They argue that 'in practical terms, it is impossible to adopt a clean-up criteria which is below background levels.'[323]

318 GHD, November 2002, pp 5-7

319 GHD, November 2002, p 4

320 GHD, November 2002, pp 9-10

321 GHD, November 2002, p 12

322 GHD, November 2002, p 13

323 GHD, November 2002, p 12

6.79 GHD propose the site be cleaned up to the background radiation level they accept of 0.35 μGy/hr.[324] This is the assessment criterion put forward in the Government's current proposed remediation plan.

Other views on assessment criteria

6.80 Ms Lisa Corbyn, Director General of DECC, stated that DECC considered the radioactivity of the soil at Nelson Parade to be 'relatively low' and that 'that the public dose limits in the regulations are a suitable yardstick to assess the need and adequacy of the proposed remediation of contaminated soil at Nelson Parade in relation to radioactive material.'[325]

6.81 Professor Wayne Smith, Director of Environmental Health with NSW Health stated that 'from a public health perspective…we would want to be seeing at the end of the day, after remediation has occurred, that all levels are falling well below the ARPANSA guideline level.'[326]

6.82 ARPANSA noted that '[d]etermining what is an acceptable risk for regulatory purposes is a complex values judgement.'[327] ARPANSA suggest that guidance can be found in the ICRP recommendations regarding remediation that emphasise 'optimisation' over adherence to a predetermined reference level:

> The objective is to implement optimised protection strategies which will reduce individual doses to below the reference level. However, exposures below the reference level should not be ignored; these exposure circumstances should also be assessed to ascertain whether protection is optimised…An endpoint for the optimisation process must not be fixed a priori…[328]

6.83 Professor Tilman Ruff from the Medical Association for the Prevention of War made a similar point in his discussion of the link between radiation exposure and cancer:

> [C]hildhood cancer studies suggest that low doses of radiation may be more injurious than is currently reflected in the regulatory guidelines, and that they might still move. So that there is an advantage in aiming for as low as achievable rather than to just get in below the cut off of one millisievert or any other defined level.[329]

6.84 In their submission, ARPANSA go on to further quote the ICRP and the recommendation, in relation to exposure situations arising from human activities, to reduce levels back to 'normal':

> In most existing exposure situations, there is a desire from the exposed individual, as well as from the authorities, to reduce exposure to levels that are close to or similar to

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324 GHD, November 2002, p 13

325 Ms Lisa Corbyn, Evidence, 3 July 2008, p 57

326 Professor Wayne Smith, Director, Environmental Health, NSW Health, Evidence, 3 July 2008, p 53

327 Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 6

328 ICRP 103, Section 6.3, quoted in Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 8

329 Professor Tilman Ruff, Evidence, 4 July 2008, p 53

> situations considered as 'normal.' This applies particularly in situations of exposure from material resulting from human actions.[330]

Assessment criteria for chemical contamination

6.85 In relation to the chemical contamination identified in the foreshore areas, the NSW Government stated in its submission that the relevant assessment and clean up values are contained in the *Guidelines for the NSW Site Auditor Scheme* and/or the *National Environmental Protection Measure on the Assessment of Site Contamination*.[331]

Committee comment

6.86 The Committee notes that GHD's reasoning regarding the internationally accepted dose limit of 1 mSv/yr contains a significant misunderstanding. The ICRP dose limit, discussed in Chapter 3, is *in addition* to background levels and not inclusive of them. If the background radiation level in an area is 2 mSv, the ICRP dose limit is 1 mSv above this, that is, 3 mSv. Therefore, their argument in dismissing the dose limit of 1 mSv per year as a remediation criterion because it is below background levels is flawed.

6.87 The Committee further notes that GHD's estimate of a background level for the site of 0.35 μGy/hr is high. In Chapter 4 the Committee accepted the method and evidence of Australian Radiation Services that the background level for the site is 0.1 μGy/hr (or μSv/hr), and note that this is the background level assumed by the National Health and Medical Research Council (see paragraph 6.76).

6.88 The Committee agrees with the optimisation approach recommended by the ICRP and the reduction of exposure levels to 'normal' in situations where the exposure material is present as a result of human actions, and interprets 'normal' in this context to equate to background levels. The Committee also notes that GHD's proposal is to remediate the site to background levels.

6.89 The Committee believes that the weight of evidence presented to the inquiry suggests the optimal assessment criteria for areas likely to occupied by the same individuals on a regular day to day basis is the background radiation level, with this background level being taken as 0.1 μGy/hr (or 0.1 μSv/hr).

Trucking versus barging soil and other material from the site

6.90 GHD considered two methods of removing soil from the site: barging via the Parramatta River and trucking via Nelson Parade.

6.91 Barging via the Parramatta River was considered unacceptable from an environmental perspective. GHD argued that the water level adjacent to the site in Fern Bay was too shallow to allow a barge to pull up. This would require a crane or conveyer system to transport soil from the site to the barge presenting an 'unacceptable risk for contaminated material to

330 ICRP 103, Section 6.3, quoted in Submission 13, p 8

331 Submission 22, p 2

accidentally enter the waterway.' While noting that Nelson Parade and the surrounding streets are narrow, GHD considered trucking the contaminated soil from the site to be a more environmentally acceptable option.[332]

6.92 Mr Barry Smith, General Manager of Hunter's Hill Council, questioned the assumption that the water level adjacent to the site prevented the use of a barge.[333]

6.93 NSW Maritime stated that 'the depth of water at low tide off the two seawalls at Nos 7 and 9 Nelson Parade is between 0.4 and 1.7 metres, measured at Zero Fort Denison Tide Gauge.'[334]

6.94 Mr Smith stated that the Council had objected to the removal of the contaminated soil by truck, arguing that the least impact on the community would result from barging the soil out. Mr Smith questioned how a loading platform for such a large quantity of material could be built on Nelson Parade, and how the soil could be conveyed safely from the bottom to the top of the site. Mr Smith also noted the risk posed by contaminated soil being spilt in the street.[335]

6.95 Ms Alison Fry, a nearby resident to the site, also expressed concern about Hunter's Hill residents living along the proposed trucking route being exposed to radiation as a result of contaminated soil spilling from a truck. In addition, Ms Fry noted that the road surface of Nelson Parade and nearby streets were poor and would be further damaged by heavy vehicle traffic.[336]

6.96 Mr Craig Lamberton, Director of Specialised Regulation with the Department of Environment and Climate Change (DECC) noted that the trucking and barging alternatives had to be weighed up carefully:

> You would need to weigh it up…[W]e have a simple [trucking] process that might be quicker—and there are vehicles that are completely contained so it is suitable for transport—versus a more complicated route that might offer less distraction and less disturbance to the local community but has more potential areas for weakness in the process.

Committee comment

6.97 The Committee notes that dredging of the Parramatta River adjacent to the site could be undertaken to increase the water depth, following comprehensive testing of the area as covered in Recommendation 4. Depending on the results of testing, dredging could form part of a remediation strategy for the marine environment.

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332 GHD, 'Remediation of 7-9 Nelson Parade, Hunter's Hill: Preliminary Environmental Assessment', prepared on behalf of NSW Health, November 2007, p 8

333 Mr Barry Smith, General Manager, Hunter's Hill Council, Evidence, 3 July 2008, p 36

334 Answers to questions on notice taken during evidence 3 July 2008, Mr Bruce Green, Acting General Manager, Maritime Property Division, NSW Maritime, Question 1

335 Mr Barry Smith, Evidence, 3 July 2008, p 36

336 Submission 7, Ms Alison Fry, p 1

6.98 The Committee notes that a recommendation to dredge this area of the Parramatta River was made as early as 1977 by B W Scott in his report on behalf of the Health Commission.[337]

Recommendation 8

That NSW Health and the Department of Environment and Climate Change, in consultation with NSW Maritime, further investigate the option of barging contaminated soil and other material from the site, and include in the remediation plan the reasons for choosing or rejecting this option, including reference to water levels, the depth required by loaded barges and the possibility of dredging the bay floor.

Disposal of excavated soil and other material

6.99 The disposal location for excavated soil and other material will depend on its level of contamination. If the soil and other material comes under the threshold for 'industrial waste' there are existing landfills in NSW licensed to receive it. The Committee did not receive evidence as to how excavated material would be disposed of if it were classified above the threshold for industrial waste, that is, as hazardous waste.

6.100 Mr Michael Richardson MP stated that '[t]he current Government is trying to have the Nelson Parade hazardous waste classified as industrial or inert waste.'[338]

6.101 The Friends of the Earth's Melbourne branch caution that 'in general, there is a history of reclassifying material to suit political (rather than environmental or public health) objectives.' It expressed concern that 'contaminated soil will be diluted such that it falls below regulatory criteria for management as radioactive waste' stating that this was 'not a responsible approach.'[339]

The Government's plans for soil classification and disposal

6.102 In response to a question from the Chair, Mr Craig Lamberton, Director of Specialised Regulation with the Department of Environment and Climate Change (DECC), stated that the dilution of material was 'not an acceptable way of complying with the standards' and was a method of which DECC, who have a regulatory role in relation to remediation of contaminated sites, were mindful.[340]

6.103 The NSW Government stated in its submission that soil would be assessed and disposed of according to established guidelines:

337 Scott, B W, April 1977, p 24

338 Submission 8, p 4

339 Submission 10, Friends of the Earth (Melbourne), p 7

340 Mr Craig Lamberton, Evidence, 3 July 2008, p 62

> Excavated soil will be assessed according to established guidelines and then disposed of or stored according to requirements regulated by DECC, including that waste can only be disposed of to a licensed landfill that can lawfully accept it.[341]

6.104 The NSW Government further stated that assessment of the soil would be in terms of its radioactive and non-radioactive characteristics according to the DECC publication, *Waste Classification Guidelines (2008)* and that '[t]he required sampling and verification program during excavation will need to be developed in consultation with the DECC.'[342]

6.105 Mr Lamberton explained that before soil could be sent to an industrial landfill it would be assessed against two criteria:

> [T]he total amount of activity in the soil, and the concentration of activity or how many becquerels, the unit measure of radioactivity, are in the ground or soil. It would need to pass both of those tests.[343]

6.106 Mr Lamberton also pointed out that a landfill accepting waste it was not licensed to would be breaking the law:

> Landfills being what they are, they are not interested in putting their licence at risk and their very substantial business at risk by breaking these requirements.[344]

Guidelines for landfills

6.107 Ms Corbyn, the Director General of DECC, explained that the waste a landfill could receive was determined by 'the engineering standards of the landfill, its development consent and the classes of waste that it can receive under the EPA licence.' Ms went on to state that 'we expect excavated material to be assessed according to established guidelines and then disposed of or stored according to the regulatory requirements.'[345]

6.108 DECC is the licensing authority for landfills in NSW by virtue of administering the *Protection of the Environment Operations Act 1997*, outlining the performance standards for landfills in *Environmental Guidelines: Solid Waste Landfills (1996)* and *Environmental Guidelines for Industrial Waste Landfilling (1998).*[346]

Expectations about the classification of soil at Nelson Parade

6.109 Mr Lamberton stated that 'The data we have received so far shows that the radiological material would be classified as restricted solid waste, or industrial in the old parlance.'

6.110 Ms Catriona Maloney, General Manager of Safety and Radiation Services with the Australian Nuclear Science and Technology Organisation, anticipated that the contaminated material

341 Submission 22, p 3

342 Submission 22, p 22

343 Mr Craig Lamberton, Evidence, 3 July 2008, pp 61-62

344 Mr Craig Lamberton, Evidence, 3 July 2008, p 62

345 Ms Lisa Corbyn, Evidence, 3 July 2008, p 58

346 Submission 22, p 22; Ms Lisa Corbyn, Evidence, 3 July 2008, p 58

could be disposed of at an industrial land fill but that it would need to be covered with soil or concrete in accordance with the Near Surface Disposal Code recommended by ARPANSA.[347]

6.111 ARPANSA stated in its submission that the relevant Australian guidance for the disposal of the soil is NHMRC document *Code of practice for near-surface disposal of radioactive waste in Australia*. ARPANSA commented that previous surveys indicated the soil from Nelson Parade would have a radium-226 activity level 'one hundred times less than the limit for low-level radioactive…designated as Category C in the Near Surface Disposal Code and could be disposed in a facility applying this code.'[348]

6.112 Mr Lamberton stated that it was the chemically contaminated soil containing polymeric hydrocarbons, tars and heavy metals, rather than the radioactively contaminated soil, that would require treatment before it could be disposed of as industrial waste.[349] Mr Lamberton suggested that immobilisation of this contamination by mixing it with concrete and forming a concrete block to prevent leaching might be an appropriate treatment strategy, but that those carrying out the remediation would need to demonstrate that they could meet the relevant standards:

> We would need to issue an immobilisation approval for that material. So the proponents, in this case the consultants, would need to demonstrate to us that they could meet those standards. If that were done, they could demonstrate it and when they actually achieved that it would be approved to go to a landfill that accepted restricted solid waste.[350]

Disposal of waste at ANSTO's Lucas Heights facility

6.113 Some inquiry participants suggested that ANSTO's Lucas Heights facility was an appropriate disposal site for contaminated soil from Nelson Parade. This would potentially be an option considered if the soil was classified as hazardous waste. However, the Committee heard that ANSTO would be unable to accept the soil from Nelson Parade.

6.114 Dr Gavin Mudd, Dr Gavin Mudd, Lecturer in the Department of Civil Engineering at Monash University, suggested that the best long-term solution for the management of the excavates soil would be to store it at ANSTO's Lucas Heights facility.[351]

6.115 The Friends of the Earth's Sydney branch also suggested Lucas Heights as a disposal location, noting its proximity to Hunter's Hill.[352]

6.116 However, ANSTO stated that under the *Australian Nuclear Science and Technology Act 1987*, the material could not be stored at Lucas Heights.[353]

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347 Ms Catriona Maloney, Evidence, 4 July 2008, p 29

348 Submission 13, Australian Radiation Protection and Nuclear Safety Agency, p 9

349 Mr Craig Lamberton, 3 July 2008, pp 61-62

350 Mr Craig Lamberton, 3 July 2008, p 67

351 Dr Gavin Mudd, Lecturer, Evidence, 4 July 2008, p 2

352 Submission 16, Friends of the Earth (Sydney), p 2

353 Submission 5, Australian Nuclear Science and Technology Organisation, p 2

6.117 Mr Steven McIntosh, Senior Adviser on Government Liaison with the Australian Nuclear Science and Technology Organisation, explained that ANSTOs Act had been amended following legal action bought by Sutherland Shire in relation to ANSTO accepting radioactive waste from Fisherman's Bend in Victoria:

> They succeeded in their action in the Land and Environment Court. Our Act was then subsequently amended to…restrict, not the type of waste that could be stored but the origin of the waste that could be stored at the site…[T]he waste that is currently at Hunters Hill does not fall within those categories of waste that we are allow to store so we could not legally do so.[354]

Committee comment

6.118 The Committee notes the Government's commitment to assess and dispose of material excavated from the site according to the DECC publications, *Waste Classification Guidelines (2008)*, *Environmental Guidelines: Solid Waste Landfills (1996)* and *Environmental Guidelines for Industrial Waste Landfilling (1998).* The Committee also notes the relevance of the NHMRC document *Code of practice for near-surface disposal of radioactive waste in Australia,* and, in relation to non-radioactive, chemically contaminated material, the DECC publication *Guidelines for the NSW Site Auditor Scheme* and/or the *National Environmental Protection Measure on the Assessment of Site Contamination*.

6.119 The Committee notes that according to the Department of Environment and Climate Changes *Waste Classification Guidelines, Part 3:Waste Containing Radioactive Material (2008)*, liquid or solid waste with a specific activity greater than 100 becquerels per gram may be classified as hazardous waste.

6.120 In relation to this threshold, the Committee further notes that certain soil samples analysed during the 1966 Radiation Branch survey conducted by R J Bayliss and the 1977 Health Commission survey conducted by B W Scott, presented in Chapter 4, showed activity levels in excess of 100 becquerels per gram, but that subsequent surveys reported that activity levels in soil samples taken from the site were below 100 becquerels per gram. The Committee notes the difficulty in extrapolating from measures that may have been taken from small samples of known hotspots to the activity level of larger quantities of soil, but acknowledges the possibility that at least some of the excavated soil from the Nelson Parade site may have a specific activity above 100 becquerels per gram and therefore be classified as hazardous waste.

6.121 The Committee notes the lack information presented during the inquiry relating to disposal options for material classified as hazardous waste.

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354 Mr Steven McIntosh, Senior Adviser, Government Liaison, Australian Nuclear Science and Technology Organisation, Evidence, 4 July 2008, p 28

Recommendation 9

That NSW Health's remediation plan include a clear description of an on-site method for classifying excavated soil and other material and the classification criteria to be used, and that contaminated soil and other material be subsequently disposed in a landfill licensed to accept it.

Recommendation 10

That NSW Health's remediation plan include a strategy for dealing with contaminated soil and other material classified as hazardous waste according to the Department of Environment and Climate Change's *Waste Classification Guidelines, Part 3:Waste Containing Radioactive Material (2008)*, including a strategy for on-site containment should a disposal location for hazardous waste not be available.

Recommendation 11

That NSW Health notify residents of progress in the development of the remediation plan and that once a plan has been assessed and accepted, NSW Health make it available to residents and organise community feedback sessions, involving the independent site auditor to clarify its details.

Remediation cost

6.122 Mr Michael Richardson MP stated in his submission that 'the [NSW Health] hopes to recover its [remediation] costs by selling the land for housing.[355]

6.123 The NSW Government stated in its submission that its remediation strategy was designed to be 'cost-effective.'[356]

6.124 Dr Kerry Chant, Acting Chief Health Officer with NSW Health stated the Department's aim was to 'to remediate this site appropriately' and that it was unknown whether 'there will be any opportunity for profit.' Dr Chant agreed that as existing landowners, NSW Health would be legally liable to remediate the site irrespective of costs.[357]

355 Submission 8, p 7

356 Submission 22, p 3

357 Dr Kerry Chant, Evidence, 3 July 2008, p 54

6.125 NSW Health stated that whilst there was no current budget allocation for the remediation works, a preliminary estimate for the proposed works on numbers 7 and 9 was 'around $3.5 million' and that '[t]his would be funded by the sale of lots, estimated at around $4 million.'[358]

Committee comment

6.126 The Committee notes that estimated remediation costs would increase if it were agreed to include contaminated areas beyond the site in the remediation plan.

6.127 The Committee believes that remediation of all identified contaminated areas should proceed irrespective of cost, and that the costs of remediation be borne by the NSW Government.

Recommendation 12

That NSW Health's remediation plan include a commitment that the costs of remediation to all areas requiring it will be borne by the NSW Government.

[358] Answers to questions taken on notice during evidence 3 July 2008, Dr Kerry Chant, Acting Chief Health Officer, NSW Health, Question 3, p 2

Appendix 1 Submissions

No	Author
1	Ms Katie McGrath
2	Ms Julienne Nurse
3	Mrs Phillipa Clark
4	Dr Nicholas Brunton (Henry David York Lawyers)
5	Dr Ron Cameron (ANSTO)
6	Mr Gerardus Van Nunen
7	Ms Alison Fry
8	Mr Michael Richardson MP
9	Mrs Olive Taylor
10	Dr Jim Green (Friends of the Earth, Melbourne)
11	Mrs Joan Conlan
12	Ms Lynne Saville (Medical Association for the Prevention of War)
13	Dr John Loy (Australian Radiation Protection and Nuclear Safety Agency)
14	Confidential
15	Ms Corinne Young
16	Ms Holly Creenaune (Friends of the Earth, Sydney)
17	Mr David Morgan
18	Mr Barry Smith (Hunter's Hill Council)
19	Mr Graham Camp
20	Dr Gavin Mudd (Monash University)
21	Mr Anthony Whittet
22	Ms Lisa Corbyn (Department of Environment and Climate Change)
23	Mr Benjamin Nurse

Appendix 2 Witnesses at hearings

Date	Name	Position and Organisation
3 July 2008	Mr Gregory McGrath	Former resident of Nelson Parade
	Ms Katie McGrath	Former resident of Nelson Parade
	Ms Phillipa Clark	Nelson's Parade residents group
	Ms Penny Daven	Nelson's Parade residents group
	Ms Kathie Frankland	Nelson's Parade residents group
	Dr Nicholas Brunton	Legal representative to owners of No. 21 Nelson Parade, Henry David York Lawyers
	Clr Susan Hoopman	Mayor, Hunter's Hill Council
	Mr Barry Smith	General Manager, Hunter's Hill Council
	Dr Kerry Chant	A/ Deputy Director General, Population Health and A/ Chief Health Officer, NSW Department of Health
	Professor Wayne Smith	Director, Environmental Planning, NSW Department of Health
	Dr Lisa Corbyn	Director General, NSW Department of Environment and Climate Change
	Mr Craig Lamberton	Director, Specialised Regulation, NSW Department of Environment and Climate Change
	Mr Chris Wilson	Executive Director, Major Projects Assessments, NSW Department of Planning
	Mr Bruce Green	A/ Property Manager, Maritime Property Division, NSW Maritime
4 July 2008	Dr Gavin Mudd	Lecturer, Engineering Department, Monash University
	Mr Peter Burns	Australian Radiation Protection and Nuclear Safety Agency
	Mr Andrew Humpherson	Australian Nuclear Science Technology Organisation
	Ms Cait Maloney	Australian Nuclear Science Technology Organisation
	Mr Steve McIntosh	Australian Nuclear Science Technology Organisation
	Dr Joe Young	Australian Radiation Services
	Professor Tilman Ruff	Medical Association for the Prevention of War
	Mr Benjamin Nurse	Former resident of Nelson Parade
	Ms Julienne Nurse	Former resident of Nelson Parade

Appendix 3 Tabled Documents

Thursday 3 July 2008

Public Hearing, Parliament House, Sydney

Death Certificates for Mr Fabian J. McGrath and Mrs Iris M. McGrath – *tabled by Mr Greg McGrath*

Document titled 'Nelson Parade from 1950 to 2008' – *tabled by Ms Phillipa Clark, Nelson Parade Residents Group*

Report from Brinks and Associates titled 'Environmental Site Assessment - Lot 2 DP230691, Number 13 Nelson Parade, Hunter's Hill' – *tabled by Ms Phillipa Clark, Nelson Parade Residents Group*

Media statement from NSW Health dated 25 June 2008, titled 'Nelson Parade Hunter's Hill' – *tabled by Dr Nicholas Brunton, Henry Davis York, Lawyers*

Document titled 'Chronology of Events and Actions Former Uranium Smelter Nelson's Parade Hunter's Hill' – *tabled by Mr Barry Smith, Hunter's Hill Council*

Map titled 'Radium Concentrations at Surface, 1987' – *tabled by Mr Barry Smith, Hunter's Hill Council*

Document titled 'Conversion of radiological units' – *tabled by Dr Kerry Chant, NSW Department of Health*

Document titled 'SI Radiation Measurement Units: Conversion Factors'– *tabled by Dr Kerry Chant, NSW Department of Health*

Document from ARPANSA titled 'What's Background Radiation' – *tabled by Dr Kerry Chant, NSW Department of Health*

ANSTO Health Physics Report titled 'Radiological survey of specific properties on Nelson Parade, Hunter's Hill and the roadway' dated 20 February 2008 – *tabled by Dr Kerry Chant, NSW Department of Health*

Letter from NSW Health to Ms Carruthers re: remediation of 7 and 9 Nelson Parade. – *tabled by Dr Kerry Chant, NSW Department of Health*

Friday 4 July 2008

Public Hearing, Parliament House, Sydney

Document titled '11 Nelson Parade Hunter's Hill, New South Wales – Radiation Assessment (Preliminary Findings)' – *tabled by Dr Joe Young, Australian Radiation Services*

Document titled '11 Nelson Parade Hunter's Hill, New South Wales – Background Radiation Assessment' – *tabled by Dr Joe Young, Australian Radiation Services*

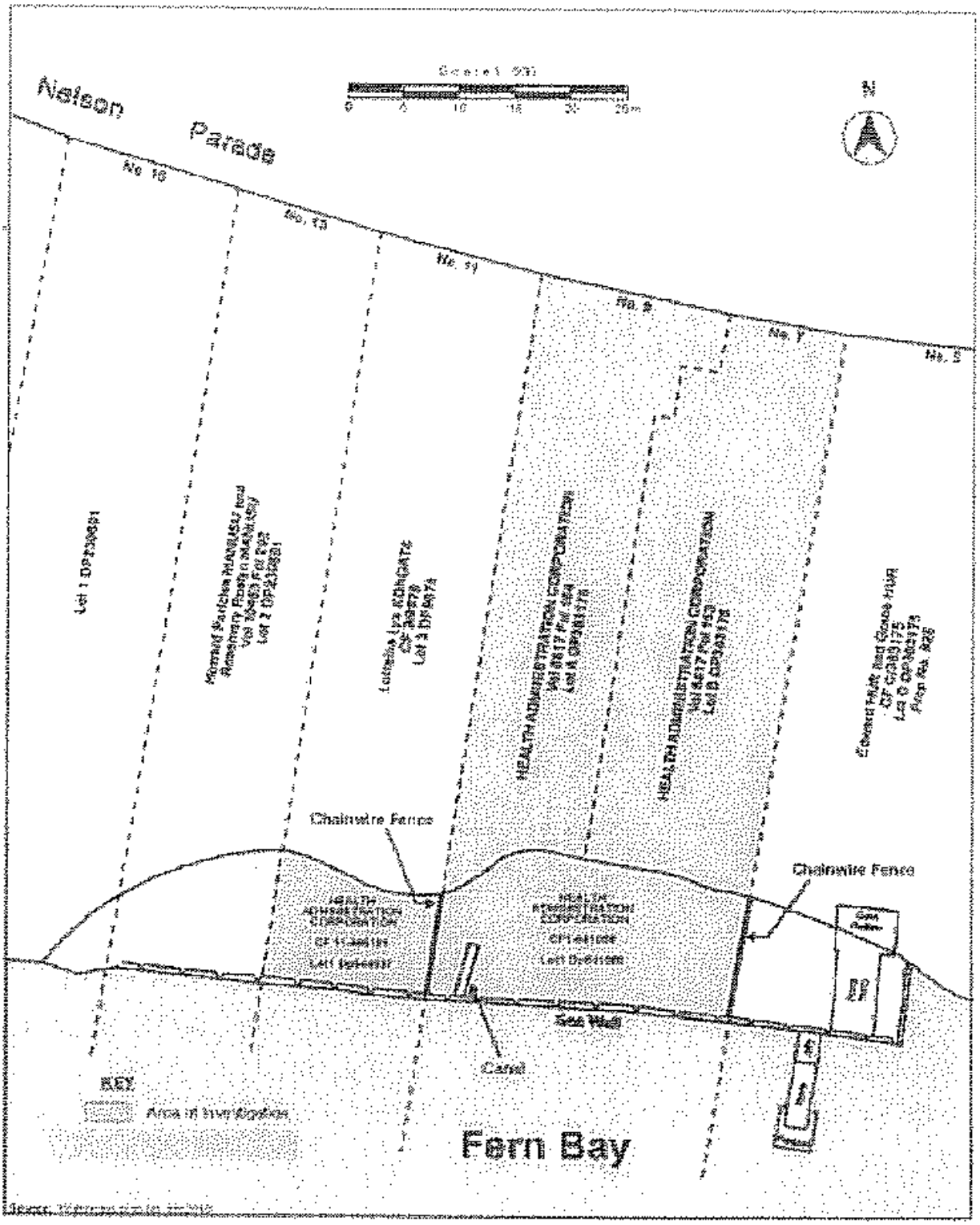
Photographs of sites in Hunter's Hill used for background radiation assessment testing – *tabled by Dr Joe Young, Australian Radiation Services*

Document titled ' Submission of Australian Radiation Services Pty Ltd to the NSW Legislative Council on the Inquiry into the former uranium smelter site at Hunter's Hill' – *tabled by Dr Joe Young, Australian Radiation Services*

Powepoint presentation titled 'Health effects of radiation exposure' – *presented by Professor Tilman Ruff, Medical Association for the Prevention of War*

Correspondence and other documents relating to Nelson Parade properties – *tabled by Mr Benjamin Nurse and Ms Julienne Nurse*

Appendix 4 Map of Nelson Parade



Appendix 5 Minutes

Minutes No 8

Friday 16 May 2008
Room 1102, Parliament House, at 10.00am

1. Members present

Mr Ian Cohen *(Chair)*
Mr Rick Colless
Ms Kayee Griffin (*Catanzariti*)
Mr Charlie Lynn
Mr Robert Brown
Ms Helen Westwood
Mr Mick Veitch (*Voltz*)

2. Substitutions

The Chair advised that he had received written advice from the Government Whip that Mr Veitch would be substituting for Ms Voltz and Ms Griffin would be substituting for Mr Catanzariti for the purposes of this meeting.

3. Previous minutes

Resolved, on the motion of Ms Westwood: That draft Minutes No. 7 be confirmed.

4. Consideration of terms of reference – the Radium Hill uranium smelter site

4.1 Call for submissions and advertising process for Inquiry

Resolved, on the motion of Ms Westwood: That the Inquiry and the call for submissions be advertised on 28 May 2008, in the Sydney Morning Herald, the Daily Telegraph and relevant local newspapers and that the closing date for submissions be 30 June 2008.

4.2 Invitations to stakeholders to make a submission

Resolved, on the motion of Mr Brown: That the Committee write to stakeholders identified by the Secretariat, and any additional stakeholders identified by Committee members notified to the Secretariat by 5.00pm Friday 30 May 2008, informing them of the Inquiry and inviting them to make a submission.

5. Adjournment

The Committee adjourned at 10.10am *sine die*.

Beverly Duffy
Clerk to the Committee

Minutes No 9

Thursday 5 June 2008
Member's Lounge, Parliament House, at 1.06pm

1. Members present

Mr Ian Cohen *(Chair)*
Mr Rick Colless
Mr Tony Catanzariti
Mr Charlie Lynn
Mr Robert Brown
Ms Helen Westwood
Ms Linda Voltz

2. Previous minutes

Resolved, on the motion of Mr Colless: That draft Minutes No. 8 be confirmed.

3. Inquiry into the former uranium smelter site at Hunter's Hill

Resolved on the motion of Mr Colless: That a half-day site visit to the former uranium smelter site on Nelson's Parade, Hunter's Hill be conducted on Monday 30 June, with a hearing day to be held on Thursday 3 July and that Friday 4 July be retained as a reserve hearing day.

Resolved on the motion of Mr Brown: That the witnesses for the Inquiry's public hearing(s) be drawn from the following:

- NSW Department of Health
- NSW Department of Premier and Cabinet
- NSW Department of Environment and Climate Change/ NSW Radiation Advisory Council
- NSW Department of Planning
- NSW Department of Lands
- Hunter's Hill Council
- NSW Maritime
- CSIRO
- Australian Radiation Protection and Nuclear Safety Agency
- Australian Nuclear Science and Technology Organisation
- National Health and Medical Research Council
- Australian Medical Association
- Australian Conservation Foundation
- Medical Association for the Prevention of War
- Friends of the Earth
- Relevant NSW universities and academics
- Local residents/relatives of former residents

4. Adjournment

The Committee adjourned at 1:21 pm until 9.30am, Monday 30 June 2008, at Parliament House.

Jonathan Clark
Clerk to the Committee

Minutes No 10

Thursday 26 June 2008
Room 1102, Parliament House, at 10.30 am

1. Members present

Mr Ian Cohen *(Chair)*
Mr Tony Catanzariti
Mr Robert Brown
Ms Linda Voltz

2. Previous minutes

Resolved, on the motion of Mr Brown: That draft Minutes No. 9 be confirmed.

3. Correspondence

The Committee noted the following correspondence had been received:

- 20 June 2008 – Letter from the National Health and Medical Research Council declining the Committee's invitation to contribute to the inquiry into the former uranium smelter site in Hunter's Hill.
- 23 June 2008 – Email from Peter and Michelle Vassiliou, owners of 11 Nelson Pde, appointing Dr Nicholas Brunton from Henry Davis York, Lawyers, as their representative, with the Committee's approval, at the hearing for the inquiry into the former uranium smelter site in Hunter's Hill, and giving the Committee permission to enter their property during the site visit.
- 24 June 2008 – Email from Dr Nicholas Brunton requesting permission from the Committee to appear at the hearing for in inquiry into the former uranium smelter site at Hunter's Hill on behalf of Mr and Mrs Vassiliou, owners of 11 Nelson Pde.

4. Inquiry into the former uranium smelter site at Hunter's Hill

Submissions
Resolved on the motion of Mr Brown: That submission No 1 be published

Dr Nicholas Brunton's appearance at hearing
Resolved on the motion of Mr Brown: That Dr Nicholas Brunton of Henry Davis York, Lawyers, be permitted to represent Mr and Mrs Peter Vassiliou at the Thursday 3 July hearing.

5. Site visit/media presence

Resolved, on the motion of Mr Brown: That the secretariat advise any media outlets who wish to film the committee on the site visit that brief file footage could be taken at the beginning of the visit in front of lots 5,9 or 11 but not on lot 11.

6. Second hearing day

Resolved on the motion of Ms Voltz: That the Committee hold a second hearing day on Friday 4 July 2008.

7. Other Business

The Chair requested that the Secretariat seek to have a Geiger counter made available for the site visit.

8. Adjournment

The Committee adjourned at 10.45am.

Jonathan Clark
Clerk to the Committee

Minutes No. 11

Monday 30 June 2008
Nelson Parade, Hunter's Hill, 10.00 am

1. Members present

Mr Ian Cohen *(Chair)*
Mr Rick Colless
Mr Tony Catanzariti
Mr Robert Brown
Ms Linda Voltz
Ms Helen Westwood
Mr Charlie Lynn

2. Site visit

The Committee attended Nelson Parade and was met by the following:

Professor Wayne Smith - Director, Environmental Health, NSW Health
Mr Craig Lamberton - Director, Specialised Regulation, DECC

The Committee was granted access to No 11 Nelson Parade by Dr Nicholas Brunton, legal representative for the owners. Professor Wayne Smith and Mr Craig Lamberton provided a tour of the outside area of No 11, particularly the rear of the property, which included views over Lots 7 and 9.

Members were also granted access to the inside of No 11 Nelson Parade.

3. Adjournment

The Committee adjourned at 11:30 am.

Jonathan Clark
Clerk to the Committee

Minutes No. 12

Thursday 3 July 2008
Jubilee Room, Parliament House, 8.55 am

1. Members present

Mr Ian Cohen
Mr Rick Colless
Ms Kayee Griffin *(Catanzariti)*
Mr Robert Brown
Ms Linda Voltz
Ms Helen Westwood
Mr Charlie Lynn

2. Substitutions

Ms Kayee Griffin for Mr Tony Catanzariti.

3. Previous minutes

Resolved, on the motion of Mr Brown: That draft Minutes No. 10 and No 11 (site visit) be confirmed.

4. Inquiry into the former uranium smelter site at Hunter's Hill

4.1 Declaration of interest

Mr Brown advised the Committee that his son was at one time a resident of 11 Nelson Parade.

4.2 Publication of submissions

Resolved, on the motion of Mr Colless: That according to section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975* and Standing Order 223(1), the Committee authorise the publication of Submissions No. 2 – 13 and 15 – 23.

Resolved on the motion of Mr Colles: That Submission No. 14 be kept confidential at the request of the submission maker.

4.3 Possible witness for Friday 4 July

Resolved, on the motion of Mr Colless: That the Committee invite Mr Benjamin Nurse to provide evidence to the Committee on Friday 4 July 2008.

Resolved, on the motion of Mr Brown: That the Committee seek written advice from the Clerk of the Parliaments in relation to the use of information contained in confidential submissions.

4.4 Public hearing

Witnesses, the public and media were admitted.

The Chair made an opening statement regarding the broadcasting of proceedings and other matters.

The following witnesses were sworn and examined:

- Ms Katie McGrath, former resident in Nelson Parade.
- Mr Gregory McGrath, former resident in Nelson Parade.

Mr McGrath tabled the following documents:

- death certificates for Fabian McGrath and Iris McGrath.

The evidence concluded and the witnesses withdrew.

The following witnesses were sworn and examined:
- Ms Phillipa Clark, Co-ordinator, Nelson Parade Residents Group.
- Ms Penny Daven, Member, Nelson Parade Residents Group.
- Ms Kathie Frankland, Member, Nelson Parade Residents Group.

Ms Clark tabled the following documents:

- document titled 'Nelson Parade from 1950 to 2008'
- report from Brink and Associates titled 'Environmental Site Assessment – Lot 2 DP230691, Number 13 Nelson Parade, Hunter's Hill'

The evidence concluded and the witnesses withdrew.

The following witness was sworn and examined:
- Dr Nicholas Brunton, Legal representative of Mr and Mrs Vassiliou, owners of 11 Nelson Parade, Henry Davis York, Lawyers.

Dr Brunton tabled the following document:

- media statement from NSW Health dated 25 June 2008, titled 'Nelson Parade Hunter's Hill'.

The evidence concluded and the witness withdrew.

The following witnesses were sworn and examined:
- Clr Susan Hoopman, Mayor, Hunter's Hill Council.
- Mr Barry Smith, General Manager, Hunter's Hill Council.

Mr Smith tabled the following documents:

- document titled 'Chronology of Events and Actions Former Uranium Smelter Nelson's Parade Hunter's Hill'
- map titled 'Radium Concentrations at Surface, 1987'.

The evidence concluded and the witnesses withdrew.

The following witnesses were sworn and examined:
- Dr Kerry Chant, A/Deputy Director General, Population Health and A/Chief Health Officer, NSW Health.
- Professor Wayne Smith, Director, Environmental Health, NSW Health.

Dr Chant tabled the following documents:

- document titled 'Conversion of radiological units'
- document titled 'SI Radiation Measurement Units: Conversion Factors'

- document from ARPANSA titled 'What's Background Radiation'
- ANSTO Health Physics Report titled 'Radiological survey of specific properties on Nelson Parade, Hunter's Hill and the roadway' dated 20 February 2008
- letter from NSW Health to Ms Carruthers re: remediation of 7 and 9 Nelson Parade.

The evidence concluded and the witnesses withdrew.

The following witnesses were sworn and examined:

- Ms Lisa Corbyn, Director General, NSW Department of Environment and Climate Change.
- Mr Craig Lamberton, Director, Specialised Regulation, NSW Department of Environment and Climate Change.
- Mr Chris Wilson, Executive Director, Major Project Assessments, NSW Department of Planning.

The evidence concluded and the witnesses withdrew.

The following witness was sworn and examined:

- Mr Bruce Green, A/General Manager, Maritime Property Division, NSW Maritime.

The evidence concluded and the witness withdrew.

4.3 Tabled documents

Resolved, on the motion of Mr Brown: That, according to section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975*, and standing order 224, the Committee authorises the Clerk to the Committee to publish the following documents tendered during the public hearing:

- document titled 'Chronology of Events and Actions Former Uranium Smelter Nelson's Parade Hunter's Hill', and a map titled 'Radium Concentrations at Surface, 1987', tabled by Mr Barry Smith, General Manager, Hunter's Hill Council.
- document titled 'Conversion of radiological units', document titled 'SI Radiation Measurement Units: Conversion Factors', and letter from NSW Health to Ms Carruthers re: remediation of 7 and 9 Nelson Parade, tabled by Dr Kerry Chant, A/Deputy Director General, Population Health and A/Chief Health Officer, NSW Health.

Resolved on the motion of Mr Colless: That answers to QON taken during the hearing be received within 2 weeks of the date that the letter requesting the answers is sent.

The Deputy Clerk tabled written advice in response to the Committee's earlier request.

Mr Colless moved: That the Committee invite a particular submission author to appear in camera.

Question put.

The Committee divided.

Ayes: Mr Colless Mr Cohen Mr Lynn
Noes: Ms Westwood, Ms Voltz, Mr Brown, Ms Griffin

The question was resolved in the negative.

Resolved, on the motion of Ms Westwood: That the Committee write to the Department of Environment and Climate Change regarding other possibly contaminated sites in the Hunter's Hill area requesting that the

Department undertake testing for contamination at these sites and advise the Committee of the results of testing as soon as possible.

5. Adjournment

The Committee adjourned at 4.50pm until Friday 4 July 2008 at 9:15am.

Jonathan Clark
Clerk to the Committee

Minutes No. 13

Friday 4 July 2008
Room 814/815, Parliament House, 9:15 am

1. Members present

Mr Ian Cohen
Mr Rick Colless
Ms Kayee Griffin *(Catanzariti)*
Mr Robert Brown
Ms Linda Voltz
Ms Helen Westwood
Mr Charlie Lynn

2. Substitutions

Ms Kayee Griffin for Mr Tony Catanzariti.

3. Inquiry into the former uranium smelter site at Hunter's Hill

3.1 Public hearing

Witnesses, the public and media were admitted.

The Chair made an opening statement regarding the broadcasting of proceedings and other matters.

The following witness was sworn and examined:

- Dr Gavin Mudd, Lecturer, Department of Civil Engineering, Monash University

The evidence concluded and the witness withdrew.

The following witness was sworn and examined:

- Mr Peter Burns, Director, Environmental and Radiation Health Branch, Australian Radiation Protection and Nuclear Safety Agency

The evidence concluded and the witness withdrew.

The following witnesses were sworn and examined:

- Mr Steve McIntosh, Senior Advisor, Government Liaison, Australian Nuclear Science and Technology Organisation
- Ms Cait Maloney, Director of Safety, Australian Nuclear Science and Technology Organisation
- Mr Andrew Humpherson, General Manager, Government and Public Affairs, Australian Nuclear Science and Technology Organisation

The evidence concluded and the witnesses withdrew.

The following witness was sworn and examined:

- Dr Joe Young, Principal Consultant Health Physicist, Australian Radiation Services

Mr Young tabled the following documents:

- document titled '11 Nelson Parade Hunter's Hill, New South Wales – Radiation Assessment (Preliminary Findings)'

- document titled '11 Nelson Parade Hunter's Hill, New South Wales – Background Radiation Assessment'
- photographs of sites in Hunter's Hill used for background radiation assessment testing
- document titled 'Submission of Australian Radiation Services Pty Ltd to the NSW Legislative Council on the Inquiry into the former uranium smelter site at Hunter's Hill'.

The evidence concluded and the witness withdrew.

The following witness was sworn and examined:

- Professor Tilman Ruff, Vice President, Medical Association for the Prevention of War, and Associate Professor, Nossal Institute for Global Health, University of Melbourne

Professor Ruff tabled a slide presentation titled 'Health effects of radiation exposure'

The evidence concluded and the witness withdrew.

The following witnesses were sworn and examined:

- Mr Benjamin Nurse, former Nelson Parade resident
- Ms Julienne Nurse, former Nelson Parade resident

Mr Nurse tabled the following documents.

- correspondence and other documents relating to Nelson Parade properties.

The evidence concluded and the witnesses withdrew.

4. Deliberative meeting

4.1 Tabled documents

Resolved, on the motion of Mr Colless: That, according to section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975*, and standing order 224, the Committee authorises the Clerk to the Committee to publish the documents tendered during the public hearing:

- document titled '11 Nelson Parade Hunter's Hill, New South Wales – Radiation Assessment (Preliminary Findings)', tabled by Dr Joe Young
- document titled '11 Nelson Parade Hunter's Hill, New South Wales – Background Radiation Assessment', tabled by Dr Joe Young
- photographs of sites in Hunter's Hill used for background radiation assessment testing, tabled by Dr Joe Young
- document titled 'Submission of Australian Radiation Services Pty Ltd to the NSW Legislative Council on the Inquiry into the former uranium smelter site at Hunter's Hill', tabled by Dr Joe Young
- slide presentation, tabled by Professor Tilman Ruff.

The Clerk tabled a draft resolution regarding an issue discussed at the deliberative meeting on 3 July 2008, and a related draft letter.

The Committee deliberated further in relation to the matter.

Ms Westwood left the meeting.

Resolved, on the motion of Ms Voltz on behalf of Ms Westwood:

That the Committee write to the Department of Environment and Climate Change following evidence given about other possibly contaminated sites in the Hunter's Hill area requesting that the Department undertake testing for radiation contamination at properties surrounding the intersection of Alfred and Margaret Street in the vicinity of the former tin smelter, residences in Nelson Parade, and 2 Gladstone Avenue, and advise the Committee of the results of testing as soon as possible.

Resolved on the motion of Mr Brown: That the Committee write to the Australian Nuclear Science and Technology Organisation providing them with information from the inquiring about the sensitivity of certain radiation detection equipment and its appropriateness for certain types of testing.

5. Adjournment

The Committee adjourned at 3.30pm *sine die*.

Jonathan Clark
Clerk to the Committee

Minutes No. 14

Friday 26 September 2008
Room 1136, Parliament House, 10:00 am

1. Members present

Mr Ian Cohen
Mr Rick Colless
Ms Penny Sharpe *(Catanzariti)*
Mr Robert Brown
Ms Linda Voltz
Ms Helen Westwood
Mr Charlie Lynn

2. Substitutions

Ms Penny Sharpe for Mr Tony Catanzariti.

3. Confirmation of Minutes

Resolved on the motion of Mr Brown: That Minutes 13 be confirmed.

4. Correspondence

Committee noted the following items of correspondence:

Received

- 3 July 2008 – Faxed letter from Dr George Collins, Acting Chief Executive Officer, ANSTO, to Chair, advising of ANSTO's involvement in radiological surveys of Nelson Parade in 1977 and 1987.
- 10 July 2008 – Email from Dr Gavin Mudd to Secretariat, providing copy of Dr Mudd's paper on Radon as response to question on notice arising from 4 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 11 July 2008 – 14 July 2008 Emails from (identity suppressed) to Secretariat providing copy of radiological survey on number 21, privately commissioned by owners, and permission to quote from the survey.
- 11 July 2008 – Letter from (identity suppressed) providing Certificate of Title for 21 Nelson Parade.
- 18 July 2008 – Letter from NSW Maritime to Secretariat providing answers to questions on notice arising from 3 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 21 July 2008 – Email from NSW Health providing answers to questions on notice arising from 3 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 5 August 2008 – Letter from Ms Lisa Corbyn, Director General, DECC, to Chair, advising that further testing in and around Nelson Parade would be considered as part of a remedial action plan.
- 5 August 2008 – Letter from Mr Andrew Humpherson, General Manager, Government and Public Affairs, ANSTO, to Chair providing comment on equipment used during radiological testing of Nelson Parade.
- 11 August 2008 – Letter from Hunter's Hill Council to Secretariat providing copies of Development Application relating to 7 and 9 Nelson Parade as response to question on notice arising from 3 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.

- 12 August 2008 – Email from Julienne Nurse to Secretariat providing answer to question on notice arising from 4 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 15 August 2008 – Email from Dr Gavin Mudd to Secretariat clarifying certain issues raised in his submission to evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 25 August 2008 – Email from Dr Nicholas Brunton to Secretariat providing answer to question on notice arising from 3 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.
- 27 August 2008 – Email from NSW Health providing clarification of questions on notice arising from 3 July 2008 evidence to inquiry in Former uranium smelter plant at Hunter's Hill.

Sent

- 21 July 2008 – Letter from Chair to Ms Lisa Corbyn, Director General, DECC, requesting radiological testing of properties on and near Nelson Parade.
- 21 July 2008 – Letter from Chair to Mr Andrew Humpherson, General Manager, Government and Public Affairs, ANSTO, providing section of transcript from 4 July 2008 hearing addressing equipment used during radiological testing of Nelson Parade.

Resolved, on the motion of Mr Brown: That correspondence sent by the Secretariat to Professor Tilman Ruff, Dr Gavin Mudd and Professor Wayne Smith be tabled.

5. xxx

6. The former uranium smelter site at Hunter's Hill

Consideration of the Chair's Draft Report

The Chair submitted his draft report titled 'The former uranium smelter site at Hunter's Hill,' which, having been circulated was taken as being read.

The Committee proceeded to consider the draft report in detail.

Initial section read.

Resolved, on the motion of of Ms Westwood: That the word 'smelter' in the terms of reference be footnoted to explain the Committee's preference for the word 'refinery' throughout the report, and that this footnote be omitted from its current place in Chapter 2.

Recommendations read.

Resolved, on the motion of Ms Voltz: That Recommendation 2 be amended by inserting the word "estimated" in the last sentence, before the words "completion of proposed remediation works."

Resolved, on the motion of Ms Westwood: That recommendation 3 be amended by inserting prior to bullet point one the words "all local residents are notified and consulted on the process of testing"

Resolved, on the motion of Mr Brown: That Recommendation 4 be amended by inserting the words " in consultation with NSW Maritime" immediately after "the Department of Environment and Climate Change."

Resolved, on the motion of Ms Voltz: That Recommendation 7 be amended by omitting the words "elsewhere in Hunter's Hill that have been identified by retesting as requiring remediation, including the

marine environment adjacent to the site" and inserting instead "and any other site identified as contaminated by radioactive material in the vicinity of the uranium refinery site."

Resolved, on the motion of Mr Brown: That Recommendation 8 be amended by inserting the words "and the Department of Environment and Climate Change, in consultation with NSW Maritime" after "NSW Health."

Resolved, on the motion of Ms Voltz: That the recommendations be adopted.

Chapter One read.

Resolved, on the motion of Mr Lynn: That paragraph 1.8 be amended by omitting the words "drafting of this report" after "people who assisted in the" and omitting the words " in particular Professor Tilman Ruff, Dr Gavin Mudd and Dr Joe Young" after "technical information."

Resolved, on the motion of Ms Voltz: That chapter one be adopted.

Chapter Two read.

The Clerk tabled correspondence between the Secretariat and Professor Ruff, Dr Mudd and Professor Smith as requested by the Committee.

Resolved, on the motion of Ms Voltz: That paragraph 2.10 be amended, by inserting the words "based on the limited data available" after the words "Hunter's Hill site" at the end of the second sentence.

Resolved, on the motion of Mr Brown: That paragraph 2.10 be amended by omitting the words, "However, according to" from the beginning of the fourth sentence and forming a new paragraph following footnote 25.

Resolved, on the motion Ms Voltz: That paragraph 2.22 be amended by inserting the words "on numbers 3, 5, 11 and 13" in the first sentence after "known locations."

Resolved, on the motion of Mr Colless: That chapter two be adopted.

Chapter Three read.

Resolved, on the motion of Mr Brown: That chapter three be adopted.

Chapter Four read.

Resolved, on the motion of Mr Brown: That paragraph 4.70 be amended by omitting the word "other" and inserting instead "the following."

Resolved, on the motion of Mr Brown: That paragraph 4.72 be omitted and replaced by "In response to the question from The Hon Rick Colless MLC, "The Government now says that the ANSTO test proves that No. 11 is below the ARPANSA guidelines. Would you agree with that?" Ms Maloney stated, "I do not believe there are appropriate guidelines against which one could make a statement. In other words, the hourly rate depends on the occupancy factor and I would also need to know what the radon was and the like. I do not believe we would have made such an assumption."

Resolved, on the motion of Mr Brown: That paragraph 4.73 be amended by omitting the second sentence.

Resolved, on the motion of Ms Voltz: That chapter four be adopted.

Chapter Five read.

Resolved, on the motion of Ms Voltz: That paragraph 5.21 be amended by ending the first sentence at "9" and inserting the sentence "No 11 was also purchased by the Department of Health at the request of owners of No. 11."

The Committee broke for lunch at 1:00 pm and reconvened at 2:00 pm.

Chapter 4 re-examined

Resolved, on the motion of Ms Voltz: That paragraph 4.69 be omitted.

Resolved, on the motion of Mr Brown: That paragraph 4.101 be omitted.

Resolved, on the motion of Mr Brown: That paragraph 5.26 be amended by:

- omitting the word "evidence" and inserting instead "a submission"
- creating a new paragraph at "Mr Craig Lamberton" and omitting the word "the" before "material from the demolition."

Resolved, on the motion of Mr Brown: That paragraph 5.83 be amended by omitting the last sentence and inserting instead "The Committee believes NSW Health and its predecessors have failed to clarify the community understanding of contamination issues in Nelson Parade, and that the loss of official records in relation to the missing drums of radioactive material has further aggravated this situation."

Resolved, on the motion of Mr Colless: That chapter five be adopted.

Chapter Six read.

Resolved, on the motion of Mr Brown: That paragraph 6.97 be omitted, inserting instead "The Committee notes that dredging of the Parramatta River adjacent to the site could be undertaken to increase the water depth, following comprehensive testing of the area as covered in Recommendation 4. Depending on the results of testing, dredging could form part of a remediation strategy for the marine environment."

Resolved, on the motion of Ms Voltz: That paragraph 6.102 be amended by inserting the words "In response to a question from the Chair" at the beginning of the paragraph.

Resolved, on the motion of Mr Brown: That wherever the word "soil" appears in the report, the Secretariat consider adding "and other material" where appropriate, including in Recommendation 9.

Resolved on the motion of Ms Voltz: That chapter six be adopted.

Resolved on the motion of Mr Brown: That:

- the report, as amended, be the report of the Committee.
- the Committee present the report to the House, together with transcripts of evidence, submissions, answers to questions on notice, tabled documents, minutes of proceedings and correspondence relating to the inquiry, in accordance with Standing Order 231.

The Chair indicated the report would be tabled on September 30, 2008.

The Committee decided not to hold a press conference on the tabling of the report and agreed that the Chair would be available to field inquiries from the media.

7. Adjournment

The Committee adjourned at 3.00pm *sine die*.

Jonathan Clark
Clerk to the Committee