Submission No 22

FORMER URANIUM SMELTER SITE, HUNTER'S HILL

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General Purpose Standing Committee No. 5
Legislative Council
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- 1 JUL 2008

Dear Mr Cohen

I refer to the General Purpose Standing Committee No. 5 Inquiry into the Former Uranium Smelter Site at Hunter Hill.

I am enclosing the New South Wales Government submission coordinated by the Department of Environment and Climate Change (DECC).

The agencies who contributed to the submission were DECC, NSW Health, NSW Planning, the State Property Authority and NSW Maritime.

Yours sincerely

Lisa Corbyn

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Director General

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NSW GOVERNMENT SUBMISSION TO THE LEGISLATIVE COUNCIL OF THE NEW SOUTH WALES PARLIAMENT GENERAL PURPOSE STANDING COMMITTEE NO. 5

INQUIRY INTO THE FORMER URANIUM SMELTER SITE IN HUNTERS HILL

EXECUTIVE SUMMARY

The NSW Government has prepared a coordinated, whole of government submission to the Parliamentary Inquiry into the former uranium processing site at Nelson Parade, Hunters Hill.

Agencies contributing to this submission include:

- The Department of Environment and Climate Change (DECC), which administers legislation to regulate radiation and the clean up of the site.
- NSW Health, which owns most of the foreshore land and the two lots which are proposed to be remediated. The department's Population Health Division also provides advice on public health matters.
- The State Property Authority, which NSW Health has contracted to manage the remediation.
- NSW Maritime, which owns portions of reclaimed foreshore land elsewhere in Nelson Parade and the land below mean high water.
- The Department of Planning, who will coordinate the necessary approvals under Part 3A of the Environmental Planning and Assessment Act for the proposed remediation. (The Minister for Planning is the approval authority)

The Government submission provides background material on the history of the site and a chronology of the surveys, investigations and remediation for the site. It explains the differences in the circumstances and contamination on the land above the foreshore and in the foreshore areas. It also addresses the Inquiry Terms of Reference. A summary is provided for each term of reference as follows:

a) Any rehabilitation or remediation of the site previously undertaken.
The main studies and investigations into the site occurred in the 1960s, 1970s and 1980s. Following a major study in 1977 the NSW Government purchased properties at numbers 7, 9 and 11 Nelson Parade. Another major study was carried out in 1987 and after this, remediation activities were carried out which were designed to consolidate and contain contamination on numbers 7 and 9.

Other investigations have been conducted by NSW Health, the Environment Protection Authority and property owners. The general conclusion of these investigations has been that the land above the foreshore does not pose a radiation or other contaminant hazard in its current use. However the foreshore areas adjacent to numbers 7, 9 and 11 Nelson Parade were determined as significant risk of harm as a result of chemical contaminants and declared a remediation site in 2007 by the DECC.

The clean up undertaken prior to and in the early 1990's on numbers 3, 5, 11 and 13 was intended to bring them into line with contemporary standards set by the National Health & Medical Research Council in 1984 by scraping up accessible contamination and burying the low level radioactive contamination on numbers 7

and 9. The material on these two lots was then covered and vegetated and the blocks were fenced to restrict public access. After these works, number 7 and 9 were no longer considered to present a significant risk of harm with these restrictions in place.

b) The extent of the contamination and radioactivity level
There appear to be two distinct sources of historical contamination on the land at Nelson Parade. One, which is primarily on the land above the foreshore, is from the operations of the uranium ore processing facility (that extracted radium and closed in about 1916) and the subsequent use of plant tailings as fill behind the retaining walls and over rock shelves. The second is foreshore land which historically was filled with industrial waste from an unknown origin and is contaminated mainly with heavy metals and hydrocarbons. This foreshore land at 7, 9 and 11 does include minor radium contamination however it is the coal tar and metal contamination that resulted in the determination of significant risk of harm.

The level of buried contamination at Nelson Parade is below the regulatory limit that defines a radioactive substance that would be regulated under the NSW Radiation Control Act, which was designed to regulate sources used in medicine and industry. However, whilst this Act does not apply to the contaminated soil at Nelson Parade, the public exposure limit in the Regulation provides a relevant benchmark for the assessment and clean up of the site for radiation contamination, based on exposure levels. For the heavy metal and hydrocarbon contaminants in the foreshore land, the 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.

c) The impact of any contamination on public health and the environment
Results from various radiation surveys reviewed from 1992 to 2008 generally indicate, that given the current land use of the properties, exposure of residents would not be expected to exceed 1mSv per year above normal background levels for a member of the public, which is the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and NSW regulatory standard.

The chemical contamination of the foreshore areas of 7, 9 and 11 has the potential to be a public health risk and therefore is subject to remediation under the Contaminated Land Management Act. These chemical contaminants also have the potential to leach into the harbour and impact on the health of the receiving aquatic ecology.

In order to minimise potential environmental impacts associated with the proposed remediation (such as mobilisation of contaminants), strict conditions and monitoring will be required while remediation is undertaken.

d) The appropriateness of the Government's planned remediation strategy
NSW Health's proposal to remediate the lands at Nelson Parade is at the development stage. Further work is underway to develop a substantive remediation proposal to be submitted to the consent authority, and to be considered by the relevant regulatory authorities. NSW Health will investigate

the removal of contamination from lots adjacent to numbers 7 and 9 if the owners are amenable.

NSW Maritime has engaged consultants, GHD to investigate reclaimed foreshore land adjacent to numbers 5 and 13. These lands are outside of the area of the uranium smelter site. However, 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. NSW Maritime will undertake sediment testing if the need is indicated by the current foreshore investigations.

e) Disposal of waste from the site

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

Most waste generated from the site is expected to be suitable for and will be required to be disposed of to a restricted solid waste landfill, largely on the basis of the metal and PAH contamination. There may need to be some treatment required before disposal to landfill.

Conclusion

The NSW Government is progressing a staged strategy for clean up of land at Nelson Parade, Hunters Hill that is designed to:

a. Remediate properties, and where appropriate foreshores, in a cost effective manner, to an acceptable level to protect people and the environment and control future exposure to radiation or other contaminants.
b. Clean up sites so that they will not be alienated from future uses.
c. Provide independent review and appropriate planning and regulatory controls for the remediation program, and
d. Effectively communicate with affected communities so that Government actions are transparent and reduce concerns about health or environmental impacts.

1. INTRODUCTION

BACKGROUND ON URANIUM

Uranium is a naturally occurring element that is found throughout nature and is present in very low quantities in most soils. It is more predominant in igneous rocks such as granite, particularly in North American and Europe where it can become a significant contributor to the natural background radiation in the community.

Uranium decays over geological scale periods of time, through a series of "daughter products" to stable non-radioactive lead. During this decay process, elements such as radium are produced, and in the past this material was extracted for use in medicine and to produce luminous paints for watches and exit signs. Radium itself decays to "radon" a radioactive but chemically inert gas which decays over a short half-life to polonium and radioactive lead-214.

HISTORY OF SITE ACTIVITIES

In the early 1900s, a facility which processed uranium ore for the extraction of radium was established over what now comprises numbers 5, 7, 9 and 11 Nelson Parade, Hunters Hill. Located below the processing plant, on the foreshore below numbers 5, 7 and 9, was a carbolic acid manufacturing plant, which operated between the late 1800s and the early 1900s. (Plate 1- 2007 aerial photo and Plate 2 (a), (b) and (c) – historical photos)

During the lifetime of its operation, between 1911 and 1916, the Radium Hill Company (now deregistered) is believed to have processed some 500 tonnes of uranium ore, yielding about 1.8 grams of radium. Reports (Scott 1977 and Radcliff 1913) indicate that about 14 per cent of the radium (0.3 grams) in the uranium ore was not able to be extracted and remained in processed tailings which were discarded in discrete stockpiles in the vicinity of the main plant on numbers 7 and 9. This residual radioactive material in the tailings was the predominant source of the low-level radiation contamination. Over thousands of years, the radium that was extracted from the ore will slowly be replaced through the natural decay of the remaining components within the depleted ore.

Following the cessation of operations, in 1916, a small proportion of the tailings are thought to have been spread to numbers 3, 5, 11 and 13 Nelson Parade with some minor incursion onto the foreshore area. However, most of the contaminated material remained in the vicinity of the original plant on numbers 7 and 9. The processed tailings had a sand-like texture. This is believed to be the reason this material was subsequently used as a component of the render and mortar in the construction of a house on number 7 in the 1920s. With the closure of the plant operations in 1916 most of the processing facility was demolished.

It is thought that in the 1920s houses were constructed on the upper portion of numbers 7 and 9, though much of the subsequent residential development of the area occurred between 1966 and 1976 (Plate 3 is an aerial photo from 1943). The Plant Superintendent's house at number 5 was demolished in 1973 and a new house built with extensive soil relocation for foundations, terracing and the construction of a swimming pool. Extensive excavations were also undertaken on number 11 in 1967 to build a substantial four storey house and terraced gardens.

Newspaper articles about radioactive contamination of dwellings at Hunters Hill appeared in the mid 1960s and numerous articles have appeared periodically since then. There has been substantial local discussion in relation to this historical legacy.

There appear to be two distinct sources of historical contamination on the land at Nelson's Parade. One is from the operations of the uranium ore processing facility that extracted radium and closed in about 1916. This impacted primarily on the land above the foreshore.

The second relates to the foreshore land that was previously the site of a lime kiln wharf and a plant where carbolic acid was manufactured from coal tar. (Plate 2a). The foreshore contamination may be associated with these activities. Coal tar and metal contamination in the foreshore land adjacent to 7, 9 and 11 Nelson Parade is likely to have resulted from the former use of the land as a carbolic acid processing plant and possibly the fill that was used in foreshore stabilisation works. The foreshore also has minor radium contamination.

Appendix A provides a more detailed chronology of activities associated with the site.

2. ROLES AND RESPONSIBILITITES IN THE REMEDIATION AT NELSON PARADE

NSW Health, DECC, NSW Maritime, the State Property Authority, and the Department of Planning have potential roles in relation to the subject land at Nelson Parade.

NSW Health
NSW Health, through the Health Administration Corporation, is the landowner of the properties the subject of the proposed remediation at numbers 7 and 9 and for the foreshore land adjacent to numbers 7, 9 and 11.

NSW Health, through its Public Health Division, also provides input into the development consent process and advice on public health matters, including relevant health standards.

NSW Maritime
NSW Maritime owns the reclaimed foreshore land adjacent to the numbers 5 and 13 and the land below the mean high water mark within the Parramatta River.

State Property Authority
The State Property Authority has been engaged by NSW Health to project manage the proposed remediation of the land owned by NSW Health. NSW Health has indicated that it wishes to clean up the residual radioactive contamination on numbers 7 and 9 so that the land will be suitable for residential use with unconstrained access. The State Property Authority on behalf of NSW Health also proposes to concurrently remediate the hydrocarbon and heavy metal contamination on the adjacent foreshore on numbers 7, 9 and 11.

NSW Health's proposal to remediate these lands at Nelson Parade is at the development stage. Further work is required before a substantive remediation proposal can be submitted to the consent authority in a form that would be supported by the relevant regulatory agencies. The State Property Authority has engaged an independent contractor to evaluate existing information on the previous remediation, to consider what additional studies need to be undertaken and to develop possible engineering options.

Department of Planning
Under the *Environmental Planning and Assessment Act 1979,* the Minister for Planning is the approval authority for a broad range of development proposals, including in some cases the remediation of land.

The Department of Planning assesses these development proposals on their merits, and provides advice to the Minister for Planning.

Independent site auditor
An independent site auditor accredited under the *Contaminated Land Management Act 1997,* will also be required to provide independent review of the planned remediation actions to the consent authority.

Department of Environment and Climate Change
The DECC has a regulatory role in relation to the *Contaminated Land Management Act 1997* and the *Radiation Control Act 1990.* DECC also has a regulatory role

relating to the potential disposal of waste under the *Protection of the Environment Operations Act 1997*.

3. LEGISLATIVE FRAMEWORK GOVERNING REMEDIATION AT NELSON PARADE

(i) Radiation Control Act 1990

In New South Wales, the principal legislation setting out standards for exposure to radiation and controlling the use of radiation and radioactive substances (principally in medicine and industry) is the *Radiation Control Act 1990* and its Regulation. The Act relates to both occupational and public exposures to radiation, and reflects a common national approach to performance standards and requirements. Note: a summary of relevant terms and units is provided at Appendix 1.

Schedule 2 of the Radiation Control Regulation 2003 details the limits for occupational and public exposure to radiation. These dose limits are 20 millisieverts (mSv) per year for occupationally exposed persons, and 1 mSv per year for a member of the public.

This standard has existed in the New South Wales Regulation since 1993 and refers to the maximum dose an individual may receive in a single year, averaged over a five year period. These dose limits are the same as those detailed in the *National Directory for Radiation Protection* (2004) published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and with those adopted internationally.

The exposure limits in the Regulation are additional to exposures to radiation from naturally occurring materials in air, water, soil and cosmic radiation that we are all exposed to. In Sydney, this natural background radiation is in the order of 2.3 mSv per annum. (source: ARPANSA fact sheet "What's Background Radiation?")

The Radiation Control Act does not apply to the buried contamination at Nelson parade because it is below the regulatory limit that defines a radioactive substance that would be regulated under the *Radiation Control Act 1990*. However, the 1 mSv per year dose limit for a member of the public specified in the Regulation may be an appropriate benchmark against which to assess the risk arising from any potential dose received by an individual living or working in Nelson Parade.

The actual dose received depends on the time a person is present at a particular location. To provide guidance, the National Health and Medical Research Council (NH&MRC) 1984 *Radiation Safety Information Series Number 12* (RSIS 12) *Clean – Up and Disposal of Radioactive Residues From Commercial Operations Involving Mineral Sands* (Attachment 8) details radiation action levels relating to the clean-up of radiation. These levels are: for dwellings, schools, businesses and factories where regular occupancy by the same individuals occurs (0.7 µGy/hr or 70 µR/hr); where the occupancy is for a few hours per week and for garden areas (1.0 µGy/hr or 100 µR/hr); and for roads, paths and other areas of intermittent occupancy (2.5 µGy/hr or 250 µR/hr).

These NH&MRC guidelines were the basis of most historical radiological assessments and include implicit assumptions of the amount of time an individual would spend in a residence, garden, roadway, etc.

(ii) Contaminated Land Management Act

The *Contaminated Land Management Act 1997* is used to regulate the clean-up of land that is contaminated, where such land may present a "significant risk of harm" to human health or the environment. That is, if a site presents a significant risk in its current and approved state, and action must be taken to ameliorate this risk either in concert with, or if necessary independently of, any potential land development activities.

If land is contaminated but in its current form contamination is not migrating offsite (for example, in groundwater or dust) and is not representing a "significant risk of harm" to either the environment or the community, then any remediation is regulated through the planning processes associated with land development through the *Environmental Planning and Assessment Act 1979.*

The outcome sought under the *Contaminated Land Management Act 1997* is the control of the risk posed by contaminants (whatever form these take), so that, in the context of the approved land use, these materials do not pose a significant risk to human health or the environment. The removal of the designation of "significant risk of harm" may not necessarily mean the complete removal of any and all contamination (as this is rarely possible); it is the effective management of the land to attain an insignificant level of risk.

In the context of radiological contamination at Nelson Parade, in 2008 the relevant yardstick which DECC would consider in determining whether a significant risk of harm arises would be compliance with the 1 mSv per annum public dose limit cited in the New South Wales Radiation Control Regulation 2003. Previously the NH&MRC 1984 guidelines were used to guide such clean-ups.

For the heavy metal and hydrocarbon contaminants in the foreshore land, the values cited in the Guidelines for the NSW Site Auditor Scheme (2nd Edition) (DECC 2006) and/or the National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council, 1999), would be applied. In any determination all forms of likely exposure to an individual, be these from external, inhalational or ingestion of the potential contaminant would be considered.

Radionuclides are generally not addressed as environmental contaminants as the risk assessment for these materials is usually driven by public health considerations. Implicitly, controlling for these risks usually addresses potential environmental concerns.

A potential environmental concern related to radium is its potential to be bioconcentrated and bioaccumulated by plants and animals, and its transfer in food chains from lower to higher trophic levels to humans (ATSDR, 1999). However in the case of Hunters Hill earlier studies have shown that the hazard through accumulation of Ra 226 in vegetables was negligible. (Department of Public Health, 1966 Interim report on contamination of residential premises at Hunters Hill)

Under the hierarchy of appropriate persons cited in the *Contaminated Land Management Act 1997*, the person principally responsible, in this case the Radium Hill Company would normally be ordered to carry out any necessary clean-up of the radioactive contamination required at Nelson Parade. However, as this company is

no longer in existence, this responsibility falls to the land owner, in this case, NSW Health.

The *Contaminated Land Management Act 1997* empowers the DECC to accredit individuals as site auditors and to establish guidelines for them. Site auditors review the work of contaminated site consultants relating to investigation and remediation to address contamination on land (whether under the CLM Act or otherwise) and provide independent review of, for example, the nature and extent of contamination, 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.

The end products of a site audit are site audit statements and site audit reports. A site audit statement includes where relevant the auditor's conclusion regarding the suitability of a site for its current or proposed use.

A statutory site audit is one that is carried out in order to comply with requirements under the *Contaminated Land Management Act 1997* or an environmental planning instrument under the *Environmental Planning and Assessment Act 1979* or any other Act. Both the foreshore land and numbers 7 and 9 would require sign-off by an independent site auditor's report for assessment by DECC and the Consent Authority.

(iii) Environmental Planning and Assessment Act

The *Environmental Planning and Assessment Act 1979* sets the statutory framework for land use planning and development assessment in NSW. Under this legislation the primary planning instrument dealing with the remediation of land is *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55).

The aim of this policy is to promote the remediation of contaminated for the purposes of reducing the risk of harm to human health or any other aspects of the environment. It does this by:

- Specifying when consent for remediation is required and when it is not;
- Specifying matters for consideration by planning authorities relevant to rezoning, development application and development applications for remediation works; and
- Requiring all remediation to comply with standards and notification requirements.

The policy is supported by planning guidelines on *Managing Land Contamination*, which are designed to assist planning and consent authorities in carrying out their statutory responsibilities under the *Environmental Planning and Assessment Act 1979.*

Certain remediation proposal are significant enough to be considered major projects under Part 3A of the *Environmental Planning and Assessment Act 1979,* and require the approval of the Minister for Planning.

The criteria for determining whether remediation proposals are major projects is set out in *State Environmental Planning Policy (Major Projects) 2005,* and include

development for the purposes of remediation of land that is category 1 remediation work on a remediation site.

NSW Health's proposal to remediate certain land at Nelson Parade requires consent under SEPP 55 because it involves remediation work in a scenic protection area, and is classified (i.e., category 1 remediation work), and is classified as a major project under Part 3A of the *Environmental Planning and Assessment Act 1979* because it involves the remediation of land declared to be a remediation site under the *Contaminated Land Management Act 1997*.

Consequently, the Minister for Planning is the approval authority for the proposal.

The Part 3A assessment process is described briefly in the fact sheet provided at Appendix 7.

At this stage, NSW Health's proposal is in the early stages of the assessment process. On 12 February 2008, the Department of Planning issued the Director General's Requirements for the project in consultation with several agencies including the DECC, NSW Health, NSW Maritime and Hunters Hill Council. The Director General's Requirements set out the studies or supporting information needed for an Environmental Assessment of the project.

Once this environmental assessment has been prepared, it will be made publicly available, and the public and relevant agencies will be invited to make submission on the proposal.

Following the exhibition period, the proponent will be asked to formally respond to all the issues raised in submissions.

It is important to note that the Minister for Planning may constitute an independent panel of experts at any stage of the assessment process to strengthen the rigour of the technical assessment of any proposal.

At the end of the process, the Department of Planning completes its independent review of the proposal and reports to the Minister for Planning.

The Minister for Planning will then determine whether or not the proposal should proceed; and it does proceed, impose 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.

4. DETAILED INFORMATION IN RELATION TO THE TERMS OF REFERENCE OF THE INQUIRY

(a) Rehabilitation or remediation of the site previously undertaken

(b) the extent of the contamination and radioactivity level

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

1. Residential Lots

There have been a number of investigations, studies and surveys of the site beginning in the 1960s, and remediation was undertaken predominantly in the 1980s and 1990s following purchase of numbers 7, 9 and 11, and the foreshore adjacent to 7, 9, 11, by NSW Health. Key documents on these investigations and remediations are identified as references in the attachment and are summarised below.

The Department of Health commissioned radiation studies at Nelson Parade, Hunters Hill in 1965 and 1966 (Department of Health 1966) when the existence of the uranium ore processing facility some (50 years previously) became known. These appear to be the first detailed studies undertaken at Nelson Parade in relation to radiation.

The studies included an assessment of radioactivity inside homes as well as in vegetables/herbs and in surrounding soils on four residential blocks. House numbers were not referenced but are considered to have been numbers 5, 7, 9 and 11 Nelson Parade. The vegetables/herbs are believed to have been tested from number 7.

The results showed localised areas of elevated radium-226 in soil and low levels of radium in the vegetables assessed. Based on an assessment of potential exposures, the then Department of Health concluded that the radiation dose was not unacceptable. Minutes of a NSW Radiological Advisory Council meeting in April 1966 indicate that the Council agreed that no significant health hazard existed to the residents in the dwellings.

In 1976, the Department of Health carried out further radiological studies in relation to the residences on numbers 5, 7, 9 and 11 Nelson Parade (Fleischmann 1976 & 1984). These were the areas associated with the processing facility and considered most likely to be affected by any contamination. Radon (a naturally occurring, short lived, radioactive gas that arises from radium decay) was measured.

Radon occurs in very low levels in most homes due to the decay of Uranium/radium in building materials and underlying soils. The goal for Radon levels in Australian homes is 200 Bq/m^3 (NHMRC 1996 and Environment Australia 2001). The results for the houses on numbers 5, 9 and 11 were well within this goal. However, on number 7 the radon levels were considered to be elevated in several rooms (ranging from 240-2900 Bq/m^3). Some soil was removed from under the house and radon levels dropped significantly. (Fleischmann 1976 & 1984)

In 1977, the Department of Health commissioned a comprehensive radiological review of data from all the sites known to have been previously impacted (Scott 1977); that is, numbers 3, 5, 7, 9, 11 and 13 Nelson Parade. This found that most

contamination was on numbers 7 and 9 Nelson Parade, with some contamination on number 13 and smaller quantities on numbers 3, 5 and 11 and on the foreshore.

In relation to numbers 7 and 9, the Scott Report found that the present exposure to external radiation in the grounds of these blocks was acceptable because of the limited number of hours spent in the grounds by the residents. However, the report concluded that radon levels within the dwelling arising from the concentrated tailings below and used in construction of number 7 were unacceptable and that the owners should be advised to find alternative accommodation.

The Scott Report recommended the government purchase numbers 7 and 9. The report recommended the contaminated soil from these lots be removed, and advised "the main requirement for safe disposal is that the soil shall never again be allowed to produce a radon hazard. This means it must be disposed of in such a situation that a building will never be erected upon it".

Following the investigation, and prior to 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 (Scott 1977). This is believed to have removed any known radiological contamination from number 3.

Following consideration of the above studies, the NSW Government agreed that the Department of Health purchase numbers 7, 9, and 11 Nelson Parade. Number 9 was purchased in 1978, number 11 in 1980 and number 7 in March 1983.

In 1987, investigations commissioned by the Department of Health were undertaken by Sinclair Knight and Partners and the Australian Nuclear Science and Technology Organisation (ANSTO). The scope of work was gamma radiation surveys on 5, 7, 9 and 11 and 13 Nelson Parade and the foreshore area of numbers 7, 9 and 11 (Sinclair Knight Partners/ANSTO 1987). The results of this sampling showed that the main impacted areas were in the southwest corner of number 9 and small areas within the grounds of number 7 (the unoccupied house was not assessed) – see figure 1.

This study also showed that gross leaching of radionuclides does not occur from soil samples collected from the site. The study noted the spread of the contaminated material is consistent with its use as fill behind retaining walls and over rock shelves. The report considered that generally the levels of radioactivity measured were in good agreement with earlier surveys carried out by the Department of Health.

The 1987 report also found that, although the site had been used for radium extraction, no levels of activity have been found that are higher than those typically encountered in uranium mining and milling. Consequently, the rehabilitation techniques developed for uranium mining were applicable to the site.

In September 1987 contaminated 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. (Department of Health, 1988).

NSW Health engaged the then Department of Public Works to undertake further remediation work at Nelson Parade. The remediation works undertaken between

1992 and 1993 included the demolition houses on numbers 7 and 9 Nelson Parade, with contaminated material from numbers 5, 11, and 13 being placed on the vacant numbers 7 and 9 Nelson Parade, and the placement area was covered, landscaped, vegetated, and fenced. (EPA, 13 May 1993)

Following the placement of the contaminated material, the then Environment Protection Authority (EPA) - noting that the radiation control administration was transferred from NSW Health to the EPA in 1992 - surveyed numbers 5, 11, and 13 Nelson Parade and foreshore areas adjacent to these. The survey found that the radiation levels on Numbers 5, 11 and 13 complied with the relevant radiation dose limits prescribed by the National Health and Medical Research Council standard (NH&MRC 1984) for relevant types of land use and occupancy and concluded no further remediation of these properties was necessary. (EPA, 12 November 1992)

Radon sampling was again carried out in the vacant house on number 7 as part of this survey. Radon levels in the vacant house on number 7 Nelson Parade were found to remain in excess of the desirable limit for continuous occupancy. Radon tests were not done on other lots in 1992 as these had previously been shown (Scott 1977) to have been free of a radon hazard.

In 1999, NSW Health commissioned Egis Consulting to undertake soil sampling and gamma radiation surveys focussed on numbers 7 and 9 Nelson Parade and the foreshore area of numbers 7, 9 and 11. These investigations confirmed that the material with elevated dose rates lies in the cliff and former garden areas in the southern portion of number 7 Nelson Parade and the southern portion of number 9 Nelson Parade. (see figure 2)

The survey also identified the location where soil transfer (from surrounding properties) probably occurred, and also found areas of radioactivity on small areas of the foreshore land below number 11 Nelson Parade. The results of the study generally confirmed the findings of earlier investigations in 1987 undertaken by Sinclair Knight and Partners.

In 2000, the resident on number 13 Nelson Parade commissioned a geotechnical survey, carried out by ANSTO, to assess external gamma radiation levels at number 13. The survey did not find radiation levels that would give a dosage above the recommended public dose limit, except for a small area on the lawn. (Brink and Associates, 2001)

This survey noted that such extended exposure within a small area of the lawn is unrealistic and the consultant considered the material to be relatively safe in its present location. While the consultant concluded that the site was suitable for its current use, it was also found that the construction of a new dwelling in the lawn area would require either basements with substantial cross ventilation or removal of the area of contaminated soil.

A 2008 investigation of concerns over the potential impact from radiological contamination on public health was undertaken by NSW Health in conjunction with DECC. NSW Health commissioned ANSTO to perform a gamma radiation survey on and adjacent to land occupied by the former processing site. This survey was not designed to be a comprehensive health risk assessment but rather an indicative survey to determine whether it was believed there was a current public health issue with regard to radiological contamination. NSW Health also reviewed a previous

gamma radiation survey undertaken by ANSTO in 2000 on number 13 Nelson Parade.

The results of the 2008 ANSTO survey correlate with the other recorded post-mitigation radiation assessments undertaken in 1999 (Egis Consulting Australia, 1999). The 2008 ANSTO report notes lower levels than those estimated in 1999.

Results from these surveys indicated 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 New South Wales regulatory standards for general public exposure of 1 mSv per year above normal background levels. The dose limits for ionising radiation apply to the sum of the relevant doses from external exposure over a year.

It should be noted that for any given location, the dose estimated assumes a 24-hour 365-day a year exposure at those exact locations. As there are only a few isolated areas slightly above background, coupled with the fact that people do not usually stay in the one spot 24 hours a day 365 days per year, it would be expected that with the current land use, the overall effective dose to residents from gamma radiation would fall below 1 mSv per year.

On 11 March 2008, NSW Health wrote to the owners of numbers 3, 5 and 11 Nelson Parade and advised them of the results of these surveys.

The previous clean-ups at Nelson Parade pre-date the *Contaminated Land Management Act 1997*. However, the cleanup undertaken prior to or in the early 1990s on numbers 5, 11 and 13 brought them into line with contemporary standards set by the NH&MRC by scraping up accessible contamination associated with the processing facility and emplacing this low-level radioactive contamination on numbers 7 and 9. The materials on these lots were then capped and vegetated and the blocks fenced to restrict public access.

As the low level radioactive materials were contained in this emplacement, public access was prevented, and the external radiation levels complied with the relevant National Health and Medical Research Council's standard (NH&MRC 1984), numbers 7 and 9 no longer presented a unacceptable risk of harm, and therefore did not require further regulation or clean up for that approved land use. In 1993, the EPA declared these lands "unhealthy building lands" under the *Unhealthy Building Land Act 1990,* thereby preventing the use of these lots for residential development.

However, as NSW Health is now proposing to change the land use, and hence occupancy of the land to permit residential and public access, numbers 7 and 9 will now require extensive remediation.

2. Foreshore and sediments

2.1 Radiological contaminants

DECC records show that there have been three radiological surveys of the foreshore area of numbers 7, 9 and 11. The first was in 1966 when localised areas with elevated levels of radium-226 were found in the foreshore area. (Department of Health, 1966)

Radiological surveys were also undertaken in 1976 or 1977 at water level in the harbour shoreline, with the results showing uneven distribution of contamination in the land reclaimed from the harbour. One area had a radiation concentration of 137 Bq/g. The average radium contamination over the rest of the area was 8 Bq/g. The average gamma dose rate was 0.5 uSv/h (Fleischmann & Gandy, 1984).

Measured in 1977, at the harbour level there were a few spots which gave a count rate of around 500 cps (1.5 uSv/h) but generally the measured rates were low. The 1977 report recommended that no attempt be made to reclaim the sediments. This was considered justified by the low average activity of the sand and by the low probability of a future radon hazard arising in an area covered by several metres of water. (Scott 1977)

Regarding shoreline sediments leachability, the Sinclair Knight & Partners (1987) report stated: "The activities of radionuclides leached (under laboratory conditions using demineralised water) from high activity soil samples were all below detection limits of 5 to 10 Bq/L, depending on the radionuclide. Regarding shoreline sediments sampling, the 10 Bq/g reading is one tenth of the value of a material to be classified as a radioactive substance in New South Wales legislation.

The levels of radionuclides at the site, adjacent foreshore areas and subtidal areas are not considered to pose a significant risk of harm to the environment due to their low levels, low mobility and/or lack of exposure pathways - noting that subtidal areas have been subject to accretion of sediments over any contaminated materials thus limiting exposure.

NSW Maritime has engaged consultants to investigate reclaimed foreshore land adjacent to numbers 5 and 13. These lands are outside of the area of the former uranium smelter site. However, should the investigation reveal levels of contamination that warrant remediation, NSW Maritime will liaise with NSW Health and DECC to develop an integrated remediation strategy.

2.2 Chemical contaminants

The foreshore land adjacent to numbers 7, 9 and 11 has been filled in the past with industrial waste from an unknown origin. This contaminated soil, which is considered to be unrelated to the radium processing facility, contains heavy metals and hydrocarbons which do pose a "significant risk of harm" to the environment in their current foreshore emplacement.

Polycyclic Aromatic Hydrocarbons (PAHs), arsenic and lead are present in the soil at the foreshore site adjacent to 7, 9 and 11 Nelson Parade in concentrations significantly exceeding the Health Investigation Levels for residential land and for open space/recreational use as listed in the *National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council, 1999).*

Total Petroleum Hydrocarbons (TPHs) in the soil at the site are present in concentrations exceeding the guidelines for sensitive land use in the *Guidelines for Assessing Service Station Sites* (EPA, 1994).

PAHs and lead is present in groundwater at the site in concentrations significantly exceeding the relevant trigger values for the protection of aquatic ecosystems as

listed in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).* Noting that this was in unfiltered samples; later sampling and analysis following filtering indicated acceptable levels in groundwater; the contaminants are thus associated with particulate material.

The land is currently approved to be used as residential land and is proposed to be used for open space/recreation. There is therefore a risk of harm to potential users through exposure to the soil by direct skin contact and ingestion.

The contamination, lead, arsenic, PAHs and TPHs, poses a "significant risk of harm" because the contaminant concentrations exceed the relevant guideline levels for its intended use, the coal tar pitch may be mobilised in hot weather, and there is a likely exposure pathway to the contamination if the residential areas are redeveloped. The site is adjacent to the Parramatta River and there is a potential for contaminants to migrate offsite via groundwater and surface water into the River and impact aquatic ecosystems.

As such, DECC is regulating these lands under the *Contaminated Land Management Act 1997.*

DECC has declared the affected foreshore area a remediation site and is working with the land owner, NSW Health, to obtain a remediation strategy for these lands. When DECC is satisfied with the proposed strategy it may enter into a Voluntary Remediation Agreement with NSW Health, or if a satisfactory agreement could not be reached, DECC could serve a Remediation Order outlining its requirements to clean up the site.

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

NSW Health has been the custodian of 7 and 9 Nelson Parade since they were purchased in 1983 and 1978, respectively. Number 11, which was purchased by the Government in 1980, was sold in 1989 to the former owner of number 7. In August 2007, the title to numbers 7 and 9 was transferred to the Health Administration Corporation.

Because NSW Health has never used 7 and 9 for delivery of Health Services and has no future health related use for these sites, NSW Health considers numbers 7 and 9 Nelson Parade to be surplus to requirements and in accordance with Government policy is seeking to divest the land. As the land owner, NSW Health has taken appropriate steps to develop a remediation strategy for these properties prior to their divestment.

In October 2001, NSW Health engaged the Department of Public Works to manage remediation and disposal of numbers 7 and 9 Nelson Parade, and the disposal of the sites continues to be managed by State Property Authority on behalf of NSW Health. The remediation strategy refers to numbers 7 and 9 Nelson Parade, Hunters Hill and foreshore land adjoining 7, 9 and 11 Nelson Parade. The overall goal of the remediation project is to render the site suitable, from environmental and health perspectives, for low density residential use.

The Premier's endorsement of the disposal in 2001 was on the basis that the site would be remediated prior to disposal, and public access to the foreshore retained

In 2002, GHD were commissioned to prepare a desktop review of clean up criteria for the remediation of the radioactive soil on 7-9 Nelson Parade. GHD were subsequently appointed to undertake testing of the foreshore area (2004) and supplementary foreshore groundwater monitoring (2005). This culminated in the preparation of the Remediation Action Plan (RAP) and Technical Specification for 7-9 Nelson Parade and the adjoining foreshore land at 7-11 Nelson Parade in 2006.

NSW Health will also investigate the removal of contamination from lots adjacent to numbers 7 and 9 if the owners are amenable.

There are a number of key stages in the remediation and validation strategy which is to be conducted in a logical, staged manner.

1. Planning approval sought - The current proposal by NSW Health to remediate its land at Nelson Parade, Hunters Hill, is a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. As such, the Minister for Planning is the approval authority for the proposal.

Director-General's requirements for the project were issued on 12 February 2008, and cover a broad range of issues. NSW Planning understands that the environmental assessment is currently being prepared.

2. Appointment of a project manager

The environmental consultant, GHD, will be responsible for the overall project management of the remediation works and will work with all relevant stakeholders to ensure a successful project delivery. In broad terms, GHD's role will be the following:

(i) Manage the tendering process (on behalf of SPA and Health) for suitably qualified Contractors bidding for the remediation works – this includes selection of a panel of contractors who will be invited to tender for the work; preparation and issue of tender documents, receipt and evaluation of tenders, assessment and recommendation of preferred tenderer to SPA and Health.

(ii) Review and approve the work plans prepared by the Contractor, including the Environmental Management Plans and Occupational Health and Safety Plans, Project Management, Quality Management and Emergency Response Procedures.

(iii) Fulfil the role of Site Superintendent; that is, field supervision of the remediation works undertaken by the appointed contractor, to ensure compliance with the requirements of the Remedial Action Plan (RAP), remediation specification, work plans and planning approvals.

(iv) Undertake validation and characterisation sampling in accordance with the requirements of the RAP. "Real time" radioactivity assessment will also be undertaken by GHD's Site Superintendent. All chemical analyses (laboratory work) will be carried out by ANSTO. GHD will provide ongoing feedback to the Contractor as laboratory results come to hand, including confirmation of classifications for landfill purposes.

(v) Upon completion of the remediation and validation works, GHD will provide a Remediation Validation Report detailing the works undertaken, methodologies adopted, results obtained and conclusions drawn from these results. The report will

be prepared in accordance with the requirements of the "Guidelines for Consultants Reporting on Contaminated Sites" (EPA 1998), and will serve as the final validation report for the entire site, upon review and approval from the appointed Site Auditor for this project, Graeme Nyland of Environ Australia.

3. The Remediation Process

The remediation program has seven distinct stages. The Contractor will provide the detailed specification of the remediation process in its tender submission. The seven stages are:

Stage 1: Pre-Remediation Survey
Survey of pre-existing landforms at the site, prior to commencing any remediation works.

Stage 2: Site Establishment
Prior to establishment at the site, all plans, programs, licences, certificates and other documents necessary for the commencement of work must be completed and approved. These documents will be the responsibility of the appointed Contractor and are anticipated to include: a work program and logic diagram; all licences and approval from regulatory authorities, insurance certificates, Workcover Authority notifications, a management plan and work procedures covering all aspects of the work, namely OH&S, Environmental Management Plan, Project Management, Quality Management and Emergency Response Procedures.

Stage 3: Soil Excavation
The initial excavation areas will be marked based on the pre-existing analysis and data. The Contractor will be responsible for:

- Establishing a conveyor type system to transport excavated soils to the designated loading zone on Nelson Parade;
- Excavation of contaminated soil (under the direction of the supervising environmental consultant);
- Surveying all formed excavations (via the use of a professionally certified surveyor);
- Maintenance of the necessary environmental and OH&S controls throughout the excavation works; and
- Assisting the supervising environmental consultant in the collection of validation samples.

Additional excavation may be necessary to identify any residual contaminated soil which fails to meet the project validation criteria. Soils excavated from all areas will be transported to a designated loading zone in Nelson Parade and loaded directly into haulage vehicles for transport off-site. Excavated soil will not be stockpiled within the designated loading zone. Materials transported to and from the site will be appropriately covered to reduce dust generation. Wheel wash facilities and/or rumble grids will also be installed at access gates to the work to minimise off-site soil migration.

All personnel working at the site shall be required to change clothing on-site and place 'dirty' clothes within a sealed bag for laundering purposes. Alternatively, workers may wear disposable suits, to ensure no off-site contamination. The Contractor will be required to provide a Dust Management Sub-Plan to minimise dust

emissions during remediation. This will need to include, among other measures, the installation of dust suppression sprays over the site, to keep all exposed surfaces moist.

Stage 3A: Validate Formed Excavations
The validation process will be overseen by Graeme Nyland, an EPA accredited contaminated land auditor.

Stage 3B: De-Watering
Throughout the excavation process, de-watering will generally be undertaken only on an 'as needed' basis. In most areas, excavations are unlikely to extend beneath the water table. However, de-watering may be necessary in the foreshore area. Water pumped from the formed excavations will be transferred to an on-site holding tank where an evaluation of suitable disposal/reuse options will be undertaken.

Stage 4: Off Site Disposal
Excavated soil is to be assessed, validated and then if appropriate transferred directly to the haulage vehicles, via the project conveyor system and subsequently directly to the receiving landfill, licensed to accept the waste.

Stage 5: Backfill and Compaction
Upon receipt of successful validation results, the site will be re-instated to pre-existing grades via the importation, placement and compaction of clean fill material.

Stage 6: Revegetation
Upon placement of the topsoil horizon, the Contractor will revegetate the site to preclude erosion of backfilled soils.

Stage 7: Demobilisation
Following completion of remediation works, the contractor will remove all plant and equipment on site. All equipment will be thoroughly washed down prior to leaving the site and the wash down area will be fully bunded to preclude any potential for contamination sediment to run off onto the site or surrounding area. Following completion of the washdown process, any potentially contaminated sediment will be collected and placed into an appropriately secured container for transport to an appropriately licensed landfill.

Public consultation
State Property Authority, on behalf of NSW Health, engaged Elton Consulting to help consult the local community and identified stakeholders and provide information about proposed remediation works. Consultation activities were undertaken in conjunction with technical studies to identify potential environmental and social impacts associated with the remediation works and appropriate mitigation measures.

The consultation approach provides for a series of newsletters to be produced and distributed at various stages in the planning and remediation process to inform the local community and provide updates on progress of the works. To date, three newsletters have been prepared and distributed – see Attachment 5.

Newsletter 1 was distributed to 850 properties in the area during the environmental assessment phase and served as an invitation to attend a community information and feedback session held on 11 December 2007. The immediately adjoining 12

residents in Nelson Parade were also contacted individually with a letter offering the opportunity of a one on one briefing.

Newsletter 2 was distributed at the community information and feedback session.

Newsletter 3 was distributed to approximately 100 residents in the immediate area.

A resident initiated neighbourhood meeting was held on 19 February 2008 in response to the media coverage generated by the project. Members from the project team comprising Elton Consulting, GHD and State Property Authority attended to provide information and respond to questions regarding the remediation process.

(e) Disposal of waste from the site

Excavated material will be assessed according to established guidelines and then disposed of or stored according to requirements regulated by the DECC. DECC will ensure that any excavated material will only be disposed of to a licensed landfill that can lawfully accept it. Landfills are licensed to meet stringent design, engineering and management requirements.

DECC licenses a range of landfills. These include general solid waste and restricted solid waste (formerly called industrial waste) landfills. The specific performance standards for these landfills are outlined in the DECC publications: *Environmental Guidelines: Solid Waste Landfills (1996)* and *Environmental Guidelines for Industrial Waste Landfilling (1998).*

Any excavated material will need to be assessed to determine how it should be managed. In terms of its radioactive and non-radioactive characteristics, the assessment will take place under the *Waste Classification Guidelines* (2008) and waste must only be disposed of to a facility licensed, designed and managed to take waste of classifications that are specified on the facility's licence. The relevant guideline for radioactive materials is provided at Appendix 6.

With the exception of around 550 square metres of chemically contaminated fill near the foreshore (initial data provided by GHD Pty Ltd on behalf of NSW Health - *Lot 7 & 9 Nelson Parade & Adjoining Foreshore Land, Hunters Hill – May 2005*), soil at the site is expected to be classified as restricted solid waste.

Indications are that the fill near the foreshore has elevated levels of polycyclic aromatic hydrocarbons (PAH) that may, depending on the stability of the PAHs, require treatment before disposal to landfill. Treatment techniques, such as cement stabilisation, for PAH contaminated soil are well established and are routinely used for the remediation of former gasworks sites.

Because there is only minimal low-level radioactive material in the foreshore areas, radioactivity levels in the excavated material are not expected to render it unsuitable for disposal at a landfill that is licensed to receive restricted solid waste. However, if radioactive material is found at levels that exceed the Waste Guidelines, this material will need to be stored appropriately and, depending upon the levels, managed under the *Radiation Control Act.*

Prior to disposal of contaminated material, NSW Health will need to demonstrate to the consent authority and DECC's satisfaction that the selected landfill was licensed to receive that waste, and that any required pre-treatment and/or immobilisation of contaminants would be achieved prior to landfill disposal. The required sampling and verification program during excavation will to be developed in consultation with the DECC.

APPENDIX 1 - GUIDE TO RADIATION MEASUREMENTS

Radioactive materials, whether natural or man-made, emit radiation either as discrete sub-atomic particles, such as alpha or beta particles, or as electromagnetic radiation, such as gamma radiation which is similar to light or ultra-violet radiation but having much higher energy.

Level of radioactivity (Becquerel)
The Becquerel (Bq) is the relevant unit of measure to describe the amount of radioactivity in material. The Becquerel is a very small unit, so most levels of radioactivity are reported as thousands of Bq (using the prefix kilo (k)) or millions of Bq (using the prefix mega (M)). Most radioactive sources used in medicine or industry are expressed in terms of MBq.

Under the *Radiation Control Act 1990*, a radioactive substance is one which has an activity concentration of greater than 100 Bq per gram and a total activity exceeding the relevant standard (between 40 kBq and 40 MBq) depending on the radiotoxicity of the radionuclide; (40 kBq in the case of radium). Common household smoke detectors contain about 37 kBq of the radioactive isotope Americium.

The amount of radioactivity in soil or air is expressed as a concentration of a number of Becquerels in a given mass, usually grams for solid material, such as soil, or for liquids (Bq/g), or as Becquerels per cubic metre for concentrations in air (Bq/m^3).

Dose equivalent (Sievert)
The characteristics of the radiation determine how it interacts with matter, but for the purposes of comparing this effect, the unit of Sieverts (Sv) is the contemporary unit of radiation dose equivalent. In environmental and public health usage this dose equivalent is usually expressed over a period of time, usually in hours, to give a dose-rate.

The Sievert is a large unit and most measurements are reported in thousandths of a Sievert (milliSievert – mSv) or millionths of a Sievert (microSievert – uSv). Most commonly, dose rates are quoted in uSv/hr or mSv/hr.

The NSW regulatory dose limit for a member of the public is 1 mSv per year. In Sydney a typical member of the public receives about 2.3 mSv per year from natural background radiation.

In 1993 the annual dose limit was reduced from 5 mSv/y to 1 mSv/y for the public and from 50 mSv to 20 mSv for occupationally exposed persons.

In older literature, the non-standard unit "Rem" (Roentgen equivalent man) was used instead of Sieverts. 1 mSv equals 100 mRem.

Absorbed dose (Gray)
When ionizing radiation interacts with the human body, it gives its energy to the body tissues. The amount of energy absorbed per unit weight of the organ or tissue is called absorbed dose and is expressed in units of Gray (Gy).

For electromagnetic gamma radiation, Grays and Sieverts are an equivalent measure, although the relationship does not hold for alpha particles, for example.

APPENDIX 2 – CHRONOLOGY FOR THE NELSON PARADE SITE OF THE FORMER URANIUM PROCESSING FACILITY

The Department of Environment and Climate Change and NSW Health have constructed a chronological timeline for activities at Nelson Parade. The historical records are, however, limited.

All references to house numbers are the current descriptors.

< 1911	Site used to manufacture carbolic acid; other structures present include a lime kiln and wharf
1911-1916	Site developed and used for processing uranium ore by the Radium Hill Company
Post 1916	Processing facility demolished; Superintendent's house retained on number 5
Circa 1920	Homes built on numbers 7and 9.
1965-66	First Department of Health radiological study - houses, soil and vegetables
1966-1976	Residential redevelopment of numbers 3 -11.
Circa 1967	Number 11 constructed involving extensive excavation as the house built is four stories high.
1970	Reclaimed land adjoining No 11 was transferred from the Maritime Services Board to the adjoining private owner.
1973	Superintendent's house at 5 demolished.
1976	Further Department of Health radiological studies focusing on numbers 5, 7, 9 and 11 and 13, including radon assessment.
1977	Investigation and report by Report by B. W Scott on numbers 3, 5, 7, 9, 11 and foreshore.
1977	Owner of number 3 removes small area of contamination identified near cliff and places it in plastic bags behind the seawall on number 7.
1978	New South Wales Government purchases number 9 (title held in the name of the Crown)
1980	New South Wales Government purchases number 11 (title held in the name of the Crown)
1983	Health Commission of NSW purchases 7 (title held in the name of Health Administration Corporation)
1987	Sinclair Knight Partners/ANSTO soil gamma radiation survey of 5, 7, 9, 11 and 13 Nelson Parade and foreshore areas.

1989	Following soil removal from number 11 Department of Health writes to Hunters Hill Council stating that it has issued a clear certificate for the property under the provisions of the Public Health Act. Number 11 sold to the family which owned number 7 prior to its purchase in 1983.
1992	Houses on numbers 7 and 9 Nelson Parade demolished; some soil removed and area landscaped and fenced.
	Repair/reconstruction of retaining foreshore wall on numbers 7, 9 and 11
1992	NSW Environment Protection Authority (EPA) created, Government transfers regulatory responsibility for radiation from NSW Health to EPA.
1992/1993	Numbers 5, 7, 9, 11, and 13 Nelson Parade and adjacent foreshore area were surveyed by the EPA after the rehabilitation work. EPA concludes that the levels of radiation on numbers 5, 11 and 13 Nelson Parade are below the recommended levels for current occupancy. (EPA 12 November 1992)
1993	EPA declares numbers 7 and 9 Nelson Parade as Unhealthy Building Land under the Unhealthy Building Land Act 1990 preventing future residential building; notice number 866 – issued 17/09/1993)
1999-2000	NSW Health commissioned Egis Consulting to undertake soil sampling and gamma radiation surveys focussed on Numbers 7 and 9 Nelson Parade and the foreshore area. The results of the study generally confirmed the findings of earlier investigations in 1987 undertaken by Sinclair Knight and Partners.
2000	The owner of number 13 commissions Brink and Associates who in turn commissioned ANSTO to undertake a survey of radiation levels at number 13 Nelson Parade.
2001	NSW Health obtains approval for the sale of numbers 7 and 9 Nelson Parade and engages Department of Public Works to manage.
2000–2005	NSW Health commissioned remedial action plan reports on numbers 7 and 9 Nelson Parade and the foreshore land adjacent to numbers 7, 9 and 11.
2005	NSW Health notified DECC under section 60 of the Contaminated Land Management Act 1997 about elevated levels of polycyclic aromatic and petroleum hydrocarbons as well lead and arsenic in the foreshore area adjacent to numbers 7 and 9 and 11 Nelson Parade.
2006	DECC determined that the fill in the foreshore land adjacent to numbers 7, 9 and 11 Nelson Parade was contaminated in such a way as to present a significant risk of harm under the terms of the Contaminated Land Management Act.
2006	DECC issued a draft declaration of remediation site relating to the foreshore land adjacent to numbers 7, 9 and 11 Nelson Parade to NSW Health.

2007	DECC finalised the declaration of the foreshore area adjacent to numbers 7, 9 and 11 Nelson Parade as a remediation site under the *Contaminated Land Management Act 1997*
2007	Titles of 7 and 9 Nelson Parade transferred to Health Administration Corporation.
Jan 2008	Health applies to Department of Planning for development approval to remediate numbers 7 and 9 Nelson Parade.
Feb 2008	Department of Planning issues Director-General's requirements for remediation project.
Feb 2008	NSW Health engages ANSTO to undertake an indicative radiological survey
March 2008	NSW Health writes to owners of 3, 5 and 11 Nelson Parade advising survey results.

APPENDIX 3 - REFERENCES

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