Submission
No 12

FORMER URANIUM SMELTER SITE, HUNTER'S HILL

Organisation: Medical Association for the Prevention of War

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The Chair,
Parliamentary Inquiry,
Legislative Council,
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To whom it may Concern,

Submissions to General Standing Committee Number 5

Terms of reference

That General Purpose Standing Committee No. 5 inquire into and report on the Radium Hill uranium smelter 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.

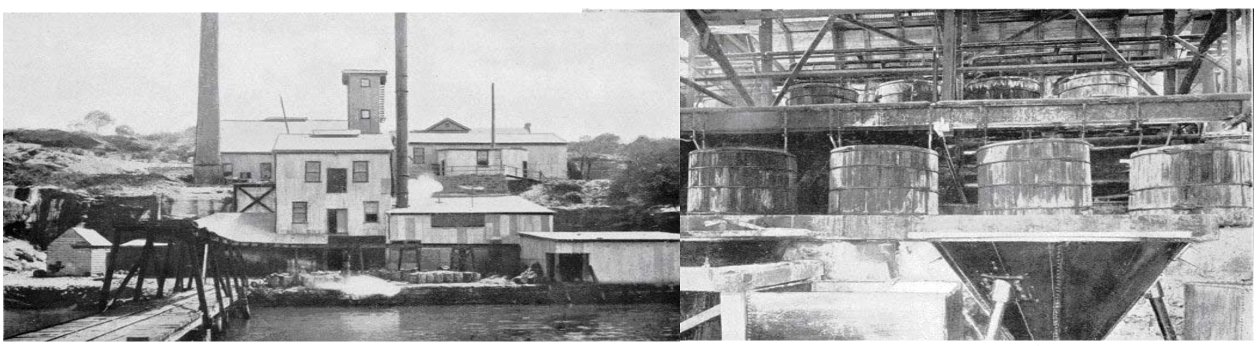
BACKGROUND

Sydney Smelting Works operated on the Parramatta River. The bush was used as a buffer between the smelting works and Woolwich houses. The uranium smelter produced luminous radium, which was used to paint clock and watch faces.

Woolwich area.... industries included shipbuilding, oil distribution, marine engine manufacturing, manufacture of chemicals, tin smelting and Australia's first producer of carnotite (an ore of uranium). (Municipality of Hunter's Hill 19th Century Maritime Heritage Problems in Managing and Accounting for Heritage Listed Items Cottee, Don)

Dr Gavin Mudd, from Monash university's civil engineering department chronicled a history of the Woolwich site dating back to 1911 when it was the site of a uranium ore processing plant, has advised the waste should be stored at the Lucas Heights nuclear research facility. *'Longer term studies would be needed about risk of elevated cancer rates . It should have been included in the plans for a national dump'.*

Woolwich Uranium Smelter 1912



Dr Gavin Mudd, Uranium Mining: Is it Environmentally Sustainable UNSW Conference 2006)

The facility closed in 1916 due to a decline in demand for radium, and the smelter was dismantled soon afterwards. Slag from a nearby tin-smelting site, which was also contaminated with traces of radioactive thorium, was used to construct local roads. Later, when the smelter closed, the 6-hectare bush site was approved for a housing development. (Hunter Hill Trust News 2004).

The NSW Government now plans to excavate 1000 tonnes of radioactive waste before putting the land on the market for residential development. The radioactive dirt is the residue of a uranium smelter that occupied the site from 1911 to 1916.

The State Government has admitted the full extent of the contamination beneath the vacant residential site in Hunters Hill, owned by the Health Department will not be known until it is unearthed. It has also admitted that a cloud still hangs over how the waste, which includes uranium 238, thorium and radium is to be classified.

Tonnes of radioactive dirt, rock and uranium tailings were dumped into the harbour on the waterfront site, where a wharf existed in the early 20th century.(SMH, February 26, 2008) The site of the former uranium smelter could be more radioactive than first thought, test records found in the national archive show, while up to 500 tonnes of radioactive waste remains in the harbour next to the toxic area.

Site Remediation

The government owns the contaminated blocks of land at Nos. 7 and 9 Nelson Parade. At this stage there is no timetable for the work to begin.

Documents revealed that the State Government considered an option to sell off a radioactive waste dump in Hunters Hill for housing without first cleaning up the site. A letter from NSW Health in 2006 sought the then Department of Environment and Conservation's agreement "to assign the responsibility for remediation of the site to a future purchaser". The letter, from NSW Health's senior property officer, Jeff Pollard, February 2, 2006, sought the Environment Department's agreement to sell the land without removing the radioactive dirt, the residue of a uranium smelter that occupied the site from 1911 to 1916. (SMH, 2 February, 2008)

This plan was ultimately shelved, and the Government's plan now is to excavate 1000 tonnes of radioactive waste before putting the land on the market for residential development.

Health Issues:

Public concerns about the effects of the buried uranium in the area arose in the 1970s, when a Whitlam government minister, Tom Uren, drew attention to what he believed was a cluster of cancer deaths in Nelson Parade. He said a direct link to the site could not be proved, but people had been known to eat vegetables grown in and around the radioactive area before becoming ill.

A survey in 1965 had found high levels of gamma-ray radiation on the site, but residential construction was still allowed to go ahead.

In 1977 the government bought out the two families living on the contaminated site. Both houses were demolished and a fence was erected around the site (SMH Feb 2008).

There are serious long term health concerns related to radiation exposures to human, community, occupational and ecological health for the immediate and wider community.

There is paramount need for thorough long term surveillance of health effects to the community from radiation exposure to be undertaken by NSW Health.

Radiation levels

According to the NSW Health Department, the Australian Nuclear Science and Technology Organisation (ANSTO) conducted a radiological survey on properties adjoining NSW Health land in Nelson Parade on February 20th, 2008 which indicated that exposure levels were within Australian Radiation Detection and Nuclear Safety Agency (ARDANSA) recommendations for general public exposure.

A report by the NSW Department of Public Health, published on December 21, 1965, noted higher levels of gamma radiation in a neighbouring block than in the two blocks bought by the Government in 1977. Readings taken on the vacant residential block in Nelson Parade in 1965, show that people exposed to the hot spot would have received the annual allowable dose of radiation in 11 hours - the equivalent of an X-ray every 40 minutes.

"Anyone digging into that spot would have been exposed to a significant amount of radiation, and a long-time resident claims workmen on the site were 'taken ill'," said the Liberal MP Michael Richardson (SMH 20 February 2008). Mr Richardson stated that "The radioactive material on [block] No. 11 was capable of giving anyone exposed to it for eight hours a day a dose 265 times higher than this over the course of a year," he said.

Maps produced by the Cancer Council of NSW show no concentration of cancer deaths in Hunters Hill. (SMH 26 Feb 2008).

However there is no acceptable safe dose of exposure to ionising radiation.

Radiation Exposure Standards

The ICRP set its first standard in 1934. As new evidence showed the dangers of radiation exposures the dose limit was reduced. However, once the nuclear power industry was established the ICRP came under its influence and has since resisted further reduction of dose limits despite overwhelming evidence of a need to do so.

The medical journal *Lancet* suggested that the ICRP's reluctance could be because it was concerned about "financial and practical consequences of a reduction" for the nuclear industry.

Data from studies on Japanese atomic bomb survivors, published in 1986, shows the cancer risk of ionising radiation to be at least five times greater than that on which the ICRP had based its 1956 dose limit.

The ICRP 1956 dose limit, for workers, was 50 milliSieverts (milliSv) and 1 milliSv for members of the public. However, despite acknowledging radiation to be five times more dangerous the ICRP reduced its limit to only 20 milliSv for workers a little less than half the previous limit. Public exposure was not reduced at all and was kept at 1 milliSv.

The dose limit should have been 10 milliSv for workers and 0.2 for members of the public (MAUM).

In summary there are serious on-going concerns related to the following issues:

- The need for the government to provide clear comprehensive public report on the history of the site;
- There is need for long term surveillance of health effects to the immediate and wider community from radiation exposure to be undertaken by NSW Health to obtain accurate epidemiological evidence.
- There are health issues for those occupationally exposed at the site, and in the vicinity over the decades
- Obtain specific details regarding sites where the waste was disposed - ascertain exact locations of where waste has been disposed over the decades e.g, the harbour, local area and other waste sites
- If site remediation occurs, the government to provide specific information where the existing waste will be disposed e.g. Lucas Heights to secure the waste for thousands of years
    - Make Public Action Plans & timetable for site remediation
- Adequate compensation to workers and local residents involved
- Community concerns must be addressed with full public reporting and with adequate compensation
- Adequately funded studies of the environmental health of the harbour and waterways for radiation contamination including harbour floor, marine life, micro-organisms, algae, sea grasses & siltation to be undertaken.
    - Deeper siltation samples may be required.
    - Such studies, undertaken by those with credible expertise, should include tidal and water movements and potential disturbance of contaminents.
    - If necessary, remediation of the harbour and waterways, should be undertaken, fully funded by the government.
- Implementation of best practice remediation of site and waterways
- Adoption of the Precautionary Principle for any future developments in the vicinity of the smelter.

Yours sincerely,

Lynne Saville
RN, OHN, MApp Sc (Env Health)

APPENDIX

The ICRP set its first standard in 1934. As new evidence showed the dangers of radiation exposures the exposure was not reduced at all and was kept at 1 milliSv.

The dose limit should have been 10 milliSv for workers and 0.2 for members of the public.

The new limit means that the annual risk of death (from cancer) for a uranium miner is 1 in 1250, which is nearly ten times the risk of fatal injury in Australian industry generally, which is 1 in 20,000.

Even so the uranium industry has protested that the ICRP's new limits would be uneconomic for underground mining. In the Roxby mine underground miners have received up to 30 milliSv a year.

The dose limits which the NHMRC has adopted permit a health risk which is clearly unacceptable. Not only do uranium miners have a high risk imposed on them but also radiographers in industry and many workers in medical institutions. {MAUM)

Health Effects of Ionising Radiation

The fetus and children are more sensitive to radiation exposure than adults.

It is well known that high doses of ionizing radiation can cause harm, but there is continuing scientific uncertainty about effects at low doses. At levels of dose routinely encountered by members of the public and most present-day radiation workers, there is little or no epidemiological evidence of health effects. Radiation protection standards recognize that it is not possible to eliminate all radiation exposure, but they do provide for a system of control to avoid unnecessary exposure and to keep doses in the low dose range.

What are some obvious effects of radiation exposure?

Extreme doses of radiation to the whole body (around 10 sievert and above), received in a short period, cause so much damage to internal organs and tissues of the body that vital systems cease to function and death may result within days or weeks. Very high doses (between about 1 sievert and 10 sievert), received in a short period, kill large numbers of cells, which can impair the function of vital organs and systems. Acute health effects, such as nausea, vomiting, skin and deep tissue burns, and impairment of the body’s ability to fight infection may result within hours, days or weeks. The extent of the damage increases with dose. These effects are called 'deterministic’ effects and will not be observed at doses below certain thresholds. By limiting doses to levels below the thresholds, deterministic effects can be prevented entirely.

How does radiation effect human tissue?

The body is made up of different cells. For example we have brain cells, muscle cells, blood cells etc. The genetic material of the cell is found in the nucleus in the form of genes which are in turn combined into strand-like structures called chromosomes. It is the genes within a cell that determine how a cell functions. If damage occurs to the genes then it is possible for a cancer to occur. This means the cell has lost the ability to control the rate at which it reproduces. If genes are damaged in reproductive organs a mutation may occur. Such a mutation may be passed on to children.

Cancers and heritable mutations are called stochastic (probabilistic) effects. The cancer or mutation behaves the same whether the organ received a high absorbed dose or a low one, all that changes are the odds (probability) of a cancer forming or a mutation occurring. There are no types of cancers that are formed only as a result of radiation. Some types of cancers, however, show a bigger rate increase for a given radiation dose than others. Cancer risks are also known to vary with age at exposure and attained age, with risks being higher for those exposed as children.

Doses below the thresholds for deterministic effects may cause cellular damage, but this does not necessarily lead to harm to the individual: the effects are probabilistic or 'stochastic' in nature. There is good epidemiological evidence – especially from studies of the survivors of the atomic bombings - that, for several types of cancer, the risk increases roughly linearly with dose. There is statistically significant risk in the range 0 - 100 millisievert and useful risk estimates for doses as low as 50 - 100 millisieverts. The risk factor averaged over all ages and cancer types is about 1 in 10,000 per millisievert. The risk of inducing a heritable mutation is estimated to be about 2* in 100,000 per millisievert. Because of the chance nature of cell damage, not everyone who is exposed to the same amount of radiation will get cancer.

The fetus and children are more sensitive to radiation exposure than adults. An absorbed dose to the fetus of 100 – 500 millisievert can cause developmental problems such as malformation or reduced IQ.

While these studies indicate evidence of radiation-induced effects, epidemiological research has been unable to establish unequivocally that there are effects of statistical significance at doses below a few tens of millisieverts. Nevertheless, given that no threshold for stochastic effects has been demonstrated, and in order to be cautious in establishing health standards, the proportionality between risk and dose observed at higher doses is presumed to continue through all lower levels of dose to zero. This is called the linear, no-threshold (LNT) hypothesis and it is used for developing radiation protection standards.

What if a radiation dose is received over a long period of time?

There is evidence that a dose accumulated over a long period carries less risk than the same dose received over a short period. Except for accidents and medical exposures, doses are not normally received over short periods, so that it is appropriate in determining standards for the control of exposure to use a risk factor that takes this into account. While not well quantified, a reduction of the high-dose risk factor by a factor of two has been adopted internationally, so that for radiation protection purposes the risk of radiation-induced fatal cancer is taken to be about 1 in 20,000 per millisievert of dose for the population as a whole.

* *Hereditary Effects of Radiation,* UNSCEAR 2001 Report to the General assembly, with Scientific Annex

Exposure to Radiation ARPANSA (Aust Govt)

Exposure Limits

The International Commission on Radiological Protection (ICRP) has set the following limits on exposure to ionising radiation:

- The general public shall not be exposed to more than 1 mSv per annum (over and above natural background).
- Occupational exposure shall not exceed 20 mSv per annum

These limits exclude exposure due to background and medical radiation.

Monitoring Of Radiation Exposure

People who are occupationally exposed to ionising radiation can be monitored with a dosemeter which is worn as a badge attached to clothing. At monthly intervals the dosemeter is sent to a laboratory where the radiation exposure can be read. In Australia the average radiation worker receives a dose of 0.12 mSv per annum.

Tables

Man's Exposure To Ionising Radiation

Source Of Exposure	**Exposure**
Natural Radiation (Terrestrial and Airborne)	1.2 mSv per year
Natural Radiation (Cosmic radiation at sea level)	0.3 mSv per year
Total Natural Radiation	**1.5 mSv per year**
Seven Hour Aeroplane Flight	0.05 mSv

Chest X-Ray	0.04 mSv
Nuclear Fallout (From atmospheric tests in 50's & 60's)	0.02 mSv per Year
Chernobyl (People living in Control Zones near Chernobyl)	10 mSv per year
Cosmic Radiation Exposure of Domestic Airline Pilot	2 mSv per year

Health Risks Arising From Low Doses of Ionising Radiation

Effect	Risk	Normal Incidence
Risk of cancer from 1 mSv of radiation	1 in 17,000*	57 in 17,000**
Risk of severe hereditary effect from 1 mSv of radiation	1 in 77,000	1,770 in 77,000

* Age standardized lifetime probability for whole population.
**Age standardized incidence rate for whole population (not necessarily fatal).

The risk of obtaining cancer from 1 mSv of radiation exposure is equivalent to the risk of getting cancer from smoking approximately 100 cigarettes.

References

1. Recommendations of the International Commission on Radiological Protection, ICRP Publication **60**. Annals of the ICRP **21**, p22 (ICRP 1990).
2. P. Jelfs *et al*, Cancer in Australia 1983 - 85, Australian Institute of Health and Welfare Cancer Series **1**, p101 (Australian Government Printing Service, 1992).
3. Radiation: Doses, Effects, Risks. United Nations Environment Programme (Nairobe, 1985).
4. A. Czeizel *et al*, in Multiple Congenital Abnormalities, p27 (Akademia Kiado, Budapest, 1988)
5. Cohen,B.L. Catalog of risks extended and updated, Health Physics 61/3:317-333 (1991)

Annex 4 - Health Effects of Ionizing Radiation and Standards for Control of Exposure

It is well known that high doses of ionizing radiation can cause harm, but there is continuing scientific uncertainty about effects at low doses. At levels of dose routinely encountered by members of the public and most present-day radiation workers, there is little or no epidemiological evidence of health effects. Radiation protection standards recognise that it is not possible to eliminate all radiation exposure, but they do provide for a system of control to avoid unnecessary exposure and to keep doses in the low dose range.

Extreme doses of radiation to the whole body (around 10 sievert and above), received in a short period, cause so much damage to the body that vital systems cease to function and death may result within days or weeks. Very high doses (between about 1 sievert and 10 sievert), received in a short period, kill large numbers of cells, which can impair the function of vital organs and systems. Acute health effects, such as nausea, vomiting, skin and deep tissue burns, and impairment of the body.s ability to fight infection may result within hours, days or weeks. The extent of the damage increases with dose. However, .deterministic. effects such as these are not observed at doses below certain thresholds. By limiting doses to levels below the thresholds, tissue reactions can be prevented entirely.

Doses below the thresholds for tissue reactions may cause cellular damage, but this does not necessarily lead to harm to the individual: the effects are probabilistic or 'stochastic' in nature. It is known that doses above about 100 millisievert, received in a short period, lead to an increased risk of developing cancer later in life. There is good epidemiological evidence . especially from studies of the survivors of the atomic bombings . that, for several types of cancer, the risk increases roughly linearly with dose, and that the risk factor averaged over all ages and cancer types is about 1 in 100 for every 100 millisievert of dose (i.e. 1 in 10,000 per millisievert).

At doses below about 100 millisievert, the evidence of harm is not clear-cut. While some studies indicate evidence of radiation-induced effects, epidemiological research has been unable to establish that there are effects of statistical significance at doses below a few tens of millisieverts. Nevertheless, given that no threshold for stochastic effects has been demonstrated, and in order to be cautious in establishing health standards, the proportionality between risk and dose observed at higher doses is presumed to continue through all lower levels of dose to zero. This is called the linear, no-threshold (LNT) hypothesis and it is made for radiation protection purposes only.

There is evidence that a dose accumulated over a long period carries less risk than the same dose received over a short period. Except for accidents and medical exposures, doses are not normally received over short periods, so that it is appropriate in determining standards for the control of exposure to use a risk factor that takes this into account. While not well quantified, a reduction of the high-dose risk factor by a factor of two has been adopted internationally, so that for radiation protection purposes the risk of radiation-induced fatal cancer (the risk factor) is taken to be about 1 in 20,000 per millisievert of dose for the population as a whole.

If the LNT hypothesis is correct, any dose carries some risk. Therefore, measures for control of exposure for stochastic effects seek to avoid all reasonably avoidable risk. This is called optimising protection. However, risk in this sense may often be assessed in terms of risk to a population, and may not ensure sufficient protection of the individual. Consequently, the optimisation approach is underpinned by applying dose limits that restrict the risk to individuals to an acceptable level. The fundamental regulatory philosophy is expressed in three principles, based on the recommendations of the International Commission on Radiological Protection (ICRP), which may be summarised as follows:

Justification: human activities that cause exposure to radiation may be permitted only if they do more good than harm;

> *Optimisation of protection*: exposure to radiation from justified activities should be kept as low as reasonably achievable, social and economic factors being taken into account; and
>
> *Limitation of individual dose*: doses must not exceed the prescribed dose limits.

Determining what is an acceptable risk for regulatory purposes is a complex value judgement. The ICRP reviewed a number of factors in developing its recommendations, which have in general been internationally endorsed, including by the World Health Organization, the International Labour Organization and the International Atomic Energy Agency. Australia.s Radiation Health Committee, now established under the ARPANS Act^, has recommended that the international standards be adopted in Australia. The recommended dose limits are summarised as follows:

*for details, see ARPANSA.s *Recommendations for limiting exposure to ionizing radiation (2002)*

In most situations, the requirements for limiting individual risk ensure that doses are below deterministic thresholds, but for cases where this does not apply, the recommended limits are as follows:

*for details, see ARPANSA.s *Recommendations for limiting exposure to ionizing radiation (2002)*

In the case of occupational exposure during pregnancy, the general principle is that the embryo or fetus should be afforded the same level of protection as is required for a member of the public. For medical workers, the ICRP recommends that there should be a reasonable assurance that fetal dose can be kept below 1 mGy# during the course of the pregnancy. This guidance may be generalised to cover all occupationally exposed pregnant workers by keeping the fetal dose below 1 mSv. A full explanation of radiation protection principles and of the recommended standards for Australia is given in ARPANSA/NOHSC Radiation Protection Series No. 1: *Recommendations for limiting exposure to ionizing radiation (1995)* and *National standard for limiting occupational exposure to ionizing radiation* (both republished in 2002).

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^ The *Australian Radiation Protection and Nuclear Safety Act (1998).*

The gray (Gy) is a unit of radiation dose. For X-rays and gamma radiation, it is numerically equivalent to the sievert.

Occupational Health effects of Uranium Mining

HEALTH

Uranium threatens the health of mine workers and the communities surrounding the mines. According to the International Physicians for the Prevention of Nuclear War, uranium mining has been responsible for the largest collective exposure of workers to radiation. One estimate puts the number of workers who have died of lung cancer and silicosis due to mining and milling alone at 20,000.

Mine workers are principally exposed to ionising radiation from radioactive uranium and the accompanying radium and radon gases emitted from the ore. Ionising radiation is the part of the electromagnetic spectrum that extends from ultraviolet radiation to cosmic rays. This type of radiation releases high energy particles that damage cells and DNA structure, producing mutations, impairing the immune system and causing cancers.

Uranium mining companies, including WMC and ERA, claim that they can minimise the risk to “acceptable levels” by attention to proper ventilation of the shafts, and close monitoring of workers to radioactive exposure. However, each time International Commission for Radiation Protection and other experts/organisations conduct a review on "safe" levels of radiation exposure, they conclude that low levels of ionising radiation are more dangerous than was previously decided. On average, these organisations have concluded that the actual danger is twice as bad as they thought twelve years before. This means that people are legally exposed to a certain dose of radiation one year and the next year they are told that the dose was far too high.

The new limits mean that the annual risk of death (from cancer) for a uranium miner is 1 in 1250, which is nearly ten times the risk of fatal injury in Australian industry generally, which is 1 in 20,000.
Even so the uranium industry has protested that the ICRP's new limits would be uneconomic for underground mining. In the Roxby mine underground miners have received up to 30 milliSv a year. The dose limits which the NHMRC has adopted permit a health risk which is clearly unacceptable.

It is widely agreed in the scientific community that there is no safe level of radiation exposure. Because it can take more than twenty or more years for cancer produced by low levels of ionising radiation to become apparent, it is not easy to trace the cause. It is imperative that long term medical records be kept of all workers, residents and their children, including those conceived after leaving Olympic Dam and Ranger, and yet this is not being done.

At present there is no independent monitoring of the Roxby Downs or Jabiru communities. We are the only 'developed' nation which has no such monitoring system in place. In twenty years time, when the health effects of uranium are emerging, the people will be left to pick up the costs, just like the asbestos mining communities before them.

References

Information by the Medical Association for the Prevention of War (WA) and the MAUM public education sheet on Ionising Radiation And Health.