



Submission of Australian Radiation Services Pty. Ltd. to the NSW Legislative Council on the
Inquiry into the former uranium smelter site at Hunter's Hill

by Dr. Joseph G. Young

Statement

The following is a brief summary of the work undertaken by Australian Radiation Services (ARS) in carrying out a preliminary radiation survey of number 11 Nelson Parade, Hunter's Hill, NSW.

1. In March 2008 ARS were approached and asked if we were interested in:
 - undertaking an external gamma radiation survey of the site, and
 - how we would undertake such a survey.
2. ARS set-up a team comprising Dr. Malcolm Cooper (Consultant Environmental Scientist with ARS), Mr. Darren Billingsley (Senior Health Physicist with ARS) and myself to work on the project.
3. We advised our client, Environmental Resources Management Pty Ltd (ERM), that we would undertake an external gamma radiation survey of the site and, depending on the results of the radiation survey, we would decide if we needed to undertake a radionuclide assessment of the soil at the site.
4. On 9 April 2008 Mr. Billingsley visited the site with:
 - a contamination monitor,
 - an ultra sensitive GR-130 mini-spectrometer, and
 - a Mini 6-80 / MC-71 Environmental Survey Monitor.
5. All of the equipment used to undertake the radiation survey had current calibration stickers.
6. Mr. Billingsley commenced his external gamma radiation survey of the site at around 11:30 am on 9 April 2008. It was evident after a short time on site that he was identifying elevated external gamma radiation levels using the GR-130 hand held mini-spectrometer.
7. He then set-up the Environmental Survey Monitor on a stand and proceeded to undertake a 3 m x 3 m grid survey of the external gamma radiation level at 1 m above the ground.
8. One hundred and twenty eight (128) measurements were taken at 27 locations across the accessible sections of the back yard at number 11.
9. Because levels of gamma radiation can vary over short time periods, the measurements we undertook with the Environmental Survey Monitor were recorded in the integrate mode over a long period of time in order to ensure that reliable and statistically valid data was collected. The data was collected at some locations for over 1 hour with the Environmental Survey Monitor.
10. The environmental monitor has a linear response to dose rate over a wide dynamic range.
11. The external dose rates on number 11 Nelson Parade varied from ~0.2 to ~1.6 microgray per hour ($\mu\text{Gy}\cdot\text{h}^{-1}$).
12. The natural background radiation level measured by ARS approximately 250 m from number 11 was found to be ~0.12 $\mu\text{Gy}\cdot\text{h}^{-1}$.

13. The average external gamma radiation level across the site was $\sim 0.52 \mu\text{Gy}\cdot\text{h}^{-1}$. Approximately 4 times that of the background measured at Kelly's Bush.
14. The natural background radiation measurements were recorded at the nearby Kelly's Bush Reserve. We later found out that this location possibly may have been contaminated with residue from a tin processing plant.
15. Since we had measured elevated external gamma radiation levels on number 11 Nelson Parade soil samples were also taken. ERM took 7 soil samples (some at surface level and some at depth) in order for ARS to assess the levels of radioactive material in the soil (or more precisely the activity concentration of the radionuclides in the soil).
16. The soil samples were taken along the boundary of number 11, adjacent to number 9 Nelson Parade where the highest gamma dose rates were recorded.
17. Each soil sample was prepared by drying, grinding and homogenising. A portion of each sample was transferred to its own standard plastic container and analysed using high-resolution gamma ray spectroscopy at the ARS laboratory.
18. Three duplicate samples were sent to the National Radiation Laboratory (NRL) of New Zealand for independent assessment and quality control checks.
19. Good agreement was obtained between ARS and NRL.
20. The activity concentrations in the soil samples taken by ERM from number 11 when compared to the soil sample taken from Kelly's Bush were between 50 and 350 times greater depending on the type of radioactive material or radionuclide.
21. Based on our measurements and those of ANSTO, we estimated that the potential annual effective dose from external gamma radiation that someone could receive by residing at number 11 Nelson Parade was between ~ 0.7 and ~ 2.5 mSv above natural background radiation levels based on the assumptions listed in our May 2008 report.
22. As stated earlier, we were advised that Kelly's Bush may have been contaminated with residue from a tin processing plant. So we returned to Sydney this week and undertook a comprehensive series of background measurements with another highly sensitive environmental monitor, namely a Health Physics Instrument Model 1010 ion chamber monitor. All measurements were taken over a lengthy period of time to ensure accurate dose rate measurements were obtained.
23. Data collected from 5 locations showed that the typical background radiation levels in the area varied from ~ 0.07 to $\sim 0.1 \mu\text{Gy}\cdot\text{h}^{-1}$ as was expected and in agreement with published data for Australia and reported by the United Nations Committee on the Effects of Atomic Radiation (UNSCEAR). These measurements confirmed our original finding of $0.12 \mu\text{Gy}\cdot\text{h}^{-1}$ in Kelly's Bush in April 2008.
24. In addition, we also used a Rotem R-200 hand held protection level monitor identical to the one used by ANSTO in the survey they conducted in February 2008.
25. It was noted that at low dose rates, near typical natural background levels, the R-200 underestimated the dose rate by approximately a factor of 2. However, when measuring higher dose rates, such as those found on number 11 Nelson Parade, the instrument performed to the manufacturers design specification and good agreement was obtained between the HPI 1010 and R-200 monitor.

26. As stated in our report of May 2008, to properly assess the potential effective dose to someone living at number 11 Nelson Parade it is important to estimate the dose that may be received from other sources and pathways of exposure. These include:

- radon gas that may enter the dwelling from contaminated soil through the floor;
- inhalation and ingestion of dust particles;
- eating of vegetables and herbs grown in contaminated soil; and
- physical contact with soil during residential use (e.g. gardening, children playing etc.)

Australian Radiation Services Pty. Ltd.

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