



Australian Government

Australian Radiation Protection and Nuclear Safety Agency

**RADIOLOGICAL SURVEY REPORT -
CSIRO RADIATION WASTE STORE, WOOMERA, SOUTH
AUSTRALIA**

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Technical Report (Version 1)
October 2008

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RELEASED BY APPRANSA UNDER FOI FEBRUARY 2019

Background

This report details the radiological assessment and inspection of the CSIRO Radiation Waste Store at Woomera. It has been prepared by the Health Physics Section (HPS) at the request of ARPANSA's Regulatory and Policy Branch (RPB).

The store contains approximately 10,000 drums of soil and other solid material contaminated with uranium ore processing residues. The origin and background of this material is supplied in the Report "Environmental Audit of Evetts Field Waste Facility – January 2004, ARL File H2-04-02".

Scope

This assessment is based on a survey of gamma dose rates in and around the waste store and radon in air measurements inside the store.

Site Description

The waste store is an Annexe to Hangar 5 at Evetts Field, which is situated on Department of Defence (DOD) land within the Woomera Prohibited Area. s 33 - security

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Figure 1 shows a schematic of the Annexe. There is approximately 1 m of space inside the entrance to the front of the stacked drums. The drums are stacked 3 high on crates, and take up Bays 1, 2 and 3 and Store Room 1. Just inside the entrance there are a set of makeshift stairs made from crates to access the top of the drums. These were not used for access; instead a ladder was tied to the drums. No access is available from the ground except at the entrance. There are some drums stored in Store Room 2, and none in Store Room 3.

Radiological Investigation Methods

The inspection of 3 September 2008 was attended by Rick Tinker and Tracy Wright from the HPS and Helen Topfer from the RPB of ARPANSA, along with Jeffrey Sheridan from CSIRO Corporate Property Services. The DOD provided an escort during the inspection. A range of photographs were taken during the inspection and are shown in the Appendix.

A survey of gamma dose rates was undertaken using an Exploranium GR-130 gamma ray spectrometer (Serial Number 9986+GM, calibrated on 22/08/2008). A typical uncertainty of measurement is 10% at 1 standard deviation. Where possible, measurements were repeated in locations where results have previously been obtained. Outside the Annexe, measurements were taken at all doorways into the store (with doors closed) at the surface of the building. Inside the store, 3 measurements were taken at ground level (1 m above the ground) and 6 measurements were taken on top of the drums at the surface and 1 m above the surface of the drums. The numbers of the measured drums were recorded. The locations of some of the previously measured drums were marked with orange arrows on the beams or light fittings above and orange circles on the drum lids, however some could not be found. The dose rate was also measured along the boundary wall from within the Annexe. A DOD representative used the GR-130 to take measurements along the wall adjoining Hangar 5 from inside the hangar.

The SARAD 1688-2 radon monitor (Serial Number 078/05/08, calibrated on 30/05/2008) was used to take 15 minute samples inside the Annexe.

Radiological Survey Results

The results of the gamma dose rate survey are shown in Figure 1. Dose rates varied from 80 to 550 nSv/h (surface measurement) at all entry points to the Annexe with doors closed. At door 5 where the dose rate is 550 nSv/h, the dose rate at 1 m is 320 nSv/h. This is in agreement with the sign at the entrance which states that dose rates at 1 m do not exceed 0.5 μ Sv/h. The dose rates along the wall adjoining Hangar 5 were measured from inside the hangar and ranged from 25 to 45 nSv/h. The hangar dose rate levels are lower than the average gamma dose rate found inside Australian homes of 100 nSv/h (Langroo et al, 1990).

The drum dose rates ranged from 150 to 9100 nSv/h when measured on the drum surface. At a distance of 1 m from the drum surface, the dose rates varied from 180 to 3000 nSv/h.

A comparison between dose rate measurements taken during this visit and measurements of 21 January 2004 is shown in Table 1. There is very little difference between the measurements considering that there is a 10% uncertainty in the measurements taken during this visit and that the exact positions of the detection equipment could not be replicated.

Table 1: Comparison between measurements taken during this visit and measurements of January 2004.

Measurement location	Dose rate - this visit (nSv/h) *	Dose rate - previous visit (nSv/h)
Door 1, 1 m above ground at door surface	80	70
Entrance door (door 2), 1 m above ground at door surface	180	150
Door 3, 1 m above ground at door surface	180	200
Door 4, 1 m above ground at door surface	130	200
Door 5, 1 m above ground at door surface	550	500
Door 6, 1 m above ground at door surface	300	200
Door 7, 1 m above ground at door surface	180	200
Door 8, 1 m above ground at door surface	100	-
Inside entrance, 1 m above ground	230	200
Inside store room 2, 1 m above ground	150	150
Inside store room 3, 1 m above ground	180	150
At drum 8242, 1 m above	200	300
At drum 8242, drum surface	150	-
At drum 2122, 1 m above	1350	1500
At drum 2122, drum surface	5000	-
At drum 9374, 1 m above	220	350
At drum 9374, drum surface	180	-
At drum 3746, 1 m above	300	-
At drum 3746, drum surface	330	-
At drum 1791, 1 m above	3000	-
At drum 1791, drum surface	9100	-
At drum 6523, 1 m above	760	900
At drum 6523, drum surface	760	-

* Uncertainty 10% (1sd)

The results of the radon-222 survey are shown in Table 2. Results are an average concentration of radon-222 levels measured over 15 minutes. Levels ranged from 24 to 94 Bq/m³. The highest radon level of 94 Bq/m³ was measured next to an ajar lid of drum 3613 indicating the possible leakage of radon-222.

The levels of radon-222 measured in the January 2004 study ranged from 8 to 60 Bq/m³. These levels were measured over several years, and although similar, can not be directly compared with the measurements taken during this visit.

Table 2: Results of radon survey inside Annexe.

Measurement location	Radon concentration (Bq/m ³)
Inside entrance on floor close to drums	70 ± 41
Next to ajar lid of drum 3613	94 ± 47
On ground in gap between drums, near drum 2122	24 ± 24
On ground near drums in Store Room 2	70 ± 41

Conclusion

The annual occupational limit is 20 mSv (APRANSA , RPS 1). Given a typical 2000 hour working year an hourly limit of 10000 nSv can be derived. Comparison of the gamma dose rates around the Annexe store are clearly well below this limit with a maximum of 550 nSv/h. Inside the Annexe the gamma dose rate levels ranged from 150 to 9100 nSv/h. With no more than 2 day inspections over a year, the annual occupational limit will not be exceed.

The low radon-222 levels measured during this visit indicate that ventilation within the Annexe is adequate to maintain levels below the action levels in the workplace. The recommended action level for radon concentration in air in workplaces is set at 1000 Bq/m³ (APRANSA , RPS 1).

The gamma dose rates and radon-222 levels in Annexe are well below action limits and present no radiation hazard.

Limitations of this Report

This report has been prepared in accordance with the scope and services described, in consultation with ARPANSA's Regulation and Policy Branch (RPB). It may not contain sufficient information for the purposes of other parties or other uses. To the best of our knowledge the information contained in this report is accurate at the date of issue.

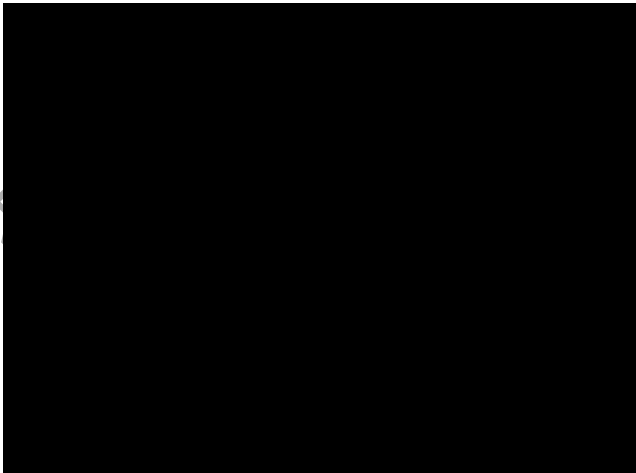
REFERENCES

Williams, G. A., Environmental Audit of Evetts Field Waste Facility – January 2004, ARL File H2-04-02”.

Langroo, M. K., Wise K. N., Duggleby, J. C. and Kotler, L. H., “A nationwide survey of Radon-222 and gamma radiation levels in Australian homes”, Health Physics (1991), 61, 753-761.

ARPANSA, Radiation Protection Series No. 1 (RPS 1), Recommendations for Limiting Exposure to Ionizing Radiation (Printed 1995 - Republished 2002) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (Printed 1995 - Republished 2002)

Appendix – Photos from the inspection



(a)



(b)

Photo 1: (a) the condition of the ceiling has deteriorated, and (b) the ceiling material has fallen onto the drums.



(a)



(b)

Photo 2: (a) a drum is marked with an orange arrow above, and (b) the drum lid is marked with an orange circle.



Photo 3: The SARAD radon monitor was lowered into a gap in the drums to measure the radon concentration at ground level.



Photo 4: A ladder just inside the entrance was used to access the top of the drums. The crate-stairs are also shown.

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