

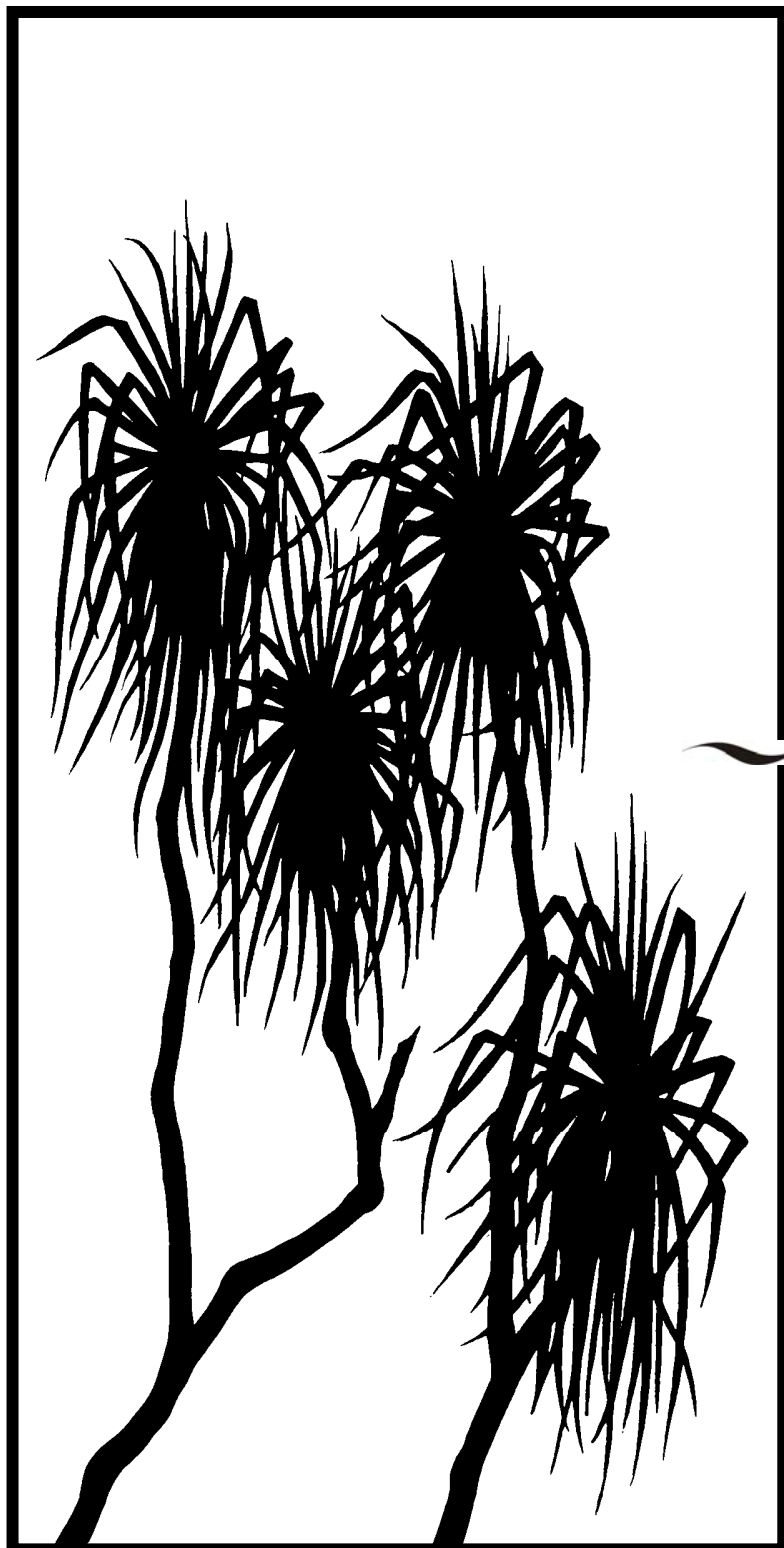


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Results of gamma dose  
rate surveys at  
remediated, former  
uranium mining and  
milling sites in the South  
Alligator River Valley

C Doering, B Ryan,  
A Bollhöfer, J Sellwood,  
T Fox & J Pfitzner

December 2010

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# **Results of gamma dose rate surveys at remediated, former uranium mining and milling sites in the South Alligator River Valley**

**C Doering, B Ryan, A Bollhöfer, J Sellwood, T Fox & J Pfitzner**

Supervising Scientist Division  
GPO Box 461, Darwin NT 0801

December 2010

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## Executive summary

Gamma dose rate surveys have been conducted at the former Rockhole Residues, Palette and El Sherana uranium mining and milling site in the South Alligator River Valley. These locations were rehabilitated during the 2009 dry season. The survey results show that the absorbed gamma dose rates at the sites have been reduced to a level which, on average, is less than the agreed guideline value of  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$  for site clean-up.

The estimated annual effective dose from external gamma radiation for an adult and a child, assuming the unlikely scenario of one month occupancy per year during the dry season, is less than 1 mSv at all sites. The estimated annual effective dose to an individual from all exposure pathways under the assumed occupancy scenario potentially approaches 1 mSv at the Palette and El Sherana sites. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has imposed a total annual radiation dose reference level of less than 10 mSv for people in the South Alligator River Valley. Based on this reference value, there is presently no unacceptable radiation risk to a member of the general public accessing the remediated sites for the period of the assumed conservative occupancy scenario.

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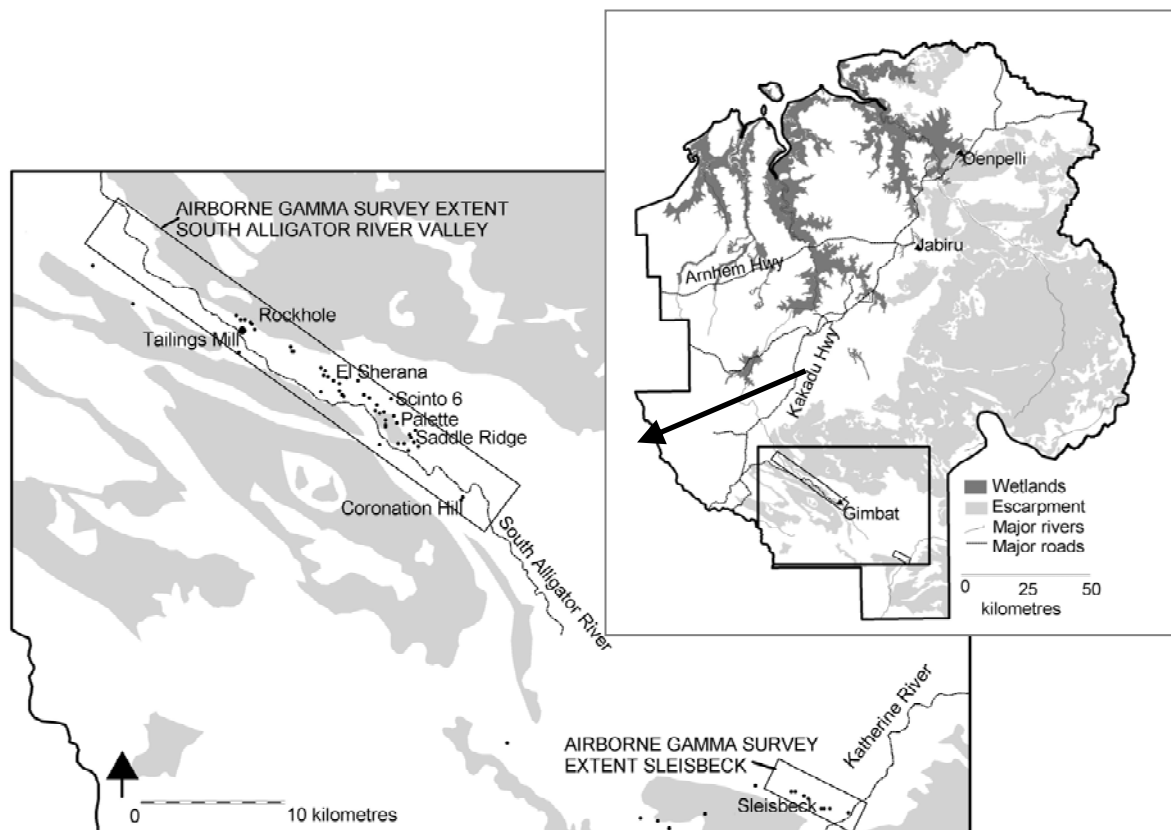


# Results of gamma dose rate surveys at remediated, former uranium mining and milling sites in the South Alligator River Valley

C Doering, B Ryan, A Bollhöfer, J Sellwood, T Fox & J Pfitzner

## 1 Introduction

There are several sites in the South Alligator River Valley, located inside the World Heritage listed Kakadu National Park, which are legacies of uranium mining and milling activities conducted in the 1950s and 1960s. Among these sites are the footprint of the former tailings area of the old South Alligator mill (Rockhole Residues) and the Palette and El Sherana mines. Figure 1 shows a map of the general area.



**Figure 1** Alligator Rivers Region, with a detailed excerpt of the southern area showing the extent of two airborne gamma surveys conducted in 2000 and 2002, the location of known uranium anomalies (from MODAT database) and some historic mining and milling areas (Supervising Scientist 2003)

These sites, together with others in the area, were effectively abandoned by operators when the uranium resource was no longer considered economically viable, with no significant initial effort made to rehabilitate or clean-up the sites. The bulk of the Rockhole mill tailings were relocated to Moline between 1985 and 1986 for reprocessing to extract gold, and hazard reduction works on several sites were carried out in 1990–92. These latter works involved burying items of mill infrastructure and immediately associated materials in trenches.

However, a significant amount of exposed above-background activity remained at several locations as documented in airborne radiometrics and ground truthing surveys conducted by the Supervising Scientist Division (Tims et al 2000, Pfitzner & Martin 2001, Pfitzner et al 2000, Pfitzner et al 2001a,b, Bollhöfer et al 2003, Bollhöfer et al 2007, Bollhöfer et al 2009a,b). A history of uranium mining, milling and past remediation activities in the South Alligator River Valley can be found in the literature (see Fisher 1968, Annabel 1977, Waggitt 2004, Bollhöfer et al 2009a).

Major works to remediate the remaining radiological vestiges of past uranium mining and milling activities in the South Alligator River Valley were undertaken during the 2009 dry season. This concentrated program of work was the result of almost a decade of detailed site characterisation investigations and extensive consultation and negotiation with the traditional owners of the land. The works included the bulk removal of contaminated material from legacy mining and milling sites using heavy machinery and placement into a purpose built containment facility at the old El Sherana Airstrip. The works were finalised in the 2009–10 wet season, after approximately 20 000 m<sup>3</sup> of material had been relocated to the new containment.

The remediation works were carried out as a condition of the 1996 lease agreement between the Gunlom Aboriginal Land Trust and the Director of National Parks, which required the lessee (Parks Australia) to develop and implement an environmental remediation plan for all legacy mine sites and associated workings in the South Alligator River Valley. The Supervising Scientist Division has provided specialist assistance to Parks Australia with the radiological assessment of the sites, including airborne (Pfitzner & Martin 2000, Pfitzner et al 2001a,b) and ground-based (Bollhöfer et al 2007, Bollhöfer et al 2009b) surveys. The results from these surveys provided the basis for the development of the remediation plan by delineating the extent and magnitude of those areas with enhanced radiological activity.

The gamma dose rate guideline value to be used as the remediation threshold for historic mining and milling sites in the SARV was set at  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{hr}^{-1}$  (approximately 10 times higher than background levels). This guideline value was derived on the basis of being able to clearly distinguish, by field measurement, the radiological signal of mining-derived material from the regional background, whilst ensuring that likely annual doses to the public are well below the reference level (10 mSv/y) imposed by ARPANSA for remediated sites in the South Alligator River Valley.

The Rockhole Residues, Palette and El Sherana legacy sites had been previously characterised by the Supervising Scientist Division to provide the pre-remediation radiological baseline against which the success of the remediation works could be quantified (Bollhöfer et al 2007, Bollhöfer et al 2009b). This report presents the results of gamma dose rate clearance surveys conducted at the three sites in the 2010 dry season, approximately one year after the conclusion of remediation works. These are the first post-remediation radiological surveys of the sites to be carried out by the Supervising Scientist Division.

## 2 Method

Gridded gamma dose rate surveys were conducted at the Rockhole Residues site on 13 July 2010, at Palette on 14 July 2010 (top bench only, since the lower bench was not accessible following the remediation works) and at El Sherana on 8 September 2010 (pit and access tracks, top area to the north of pit, and top areas to the south and west of pit). The spacing of the measurements was approximately 15 m at Rockhole Residues, 5 m at Palette and 5–10 m at El Sherana. At each site, two gamma survey instruments of the same type (instrument

details provided in Table A1 in Appendix 1) were used to measure total counts over a 100 s interval and absorbed gamma dose rates at a height of 1 m above the ground level.

The geospatial coordinates – eastings and northings – of each measurement point at each site were determined by global positioning system (GPS). At the Rockhole Residues site only, the visual boundary of the remediated area was walked on foot and the trace recorded using GPS.

## **3 Results**

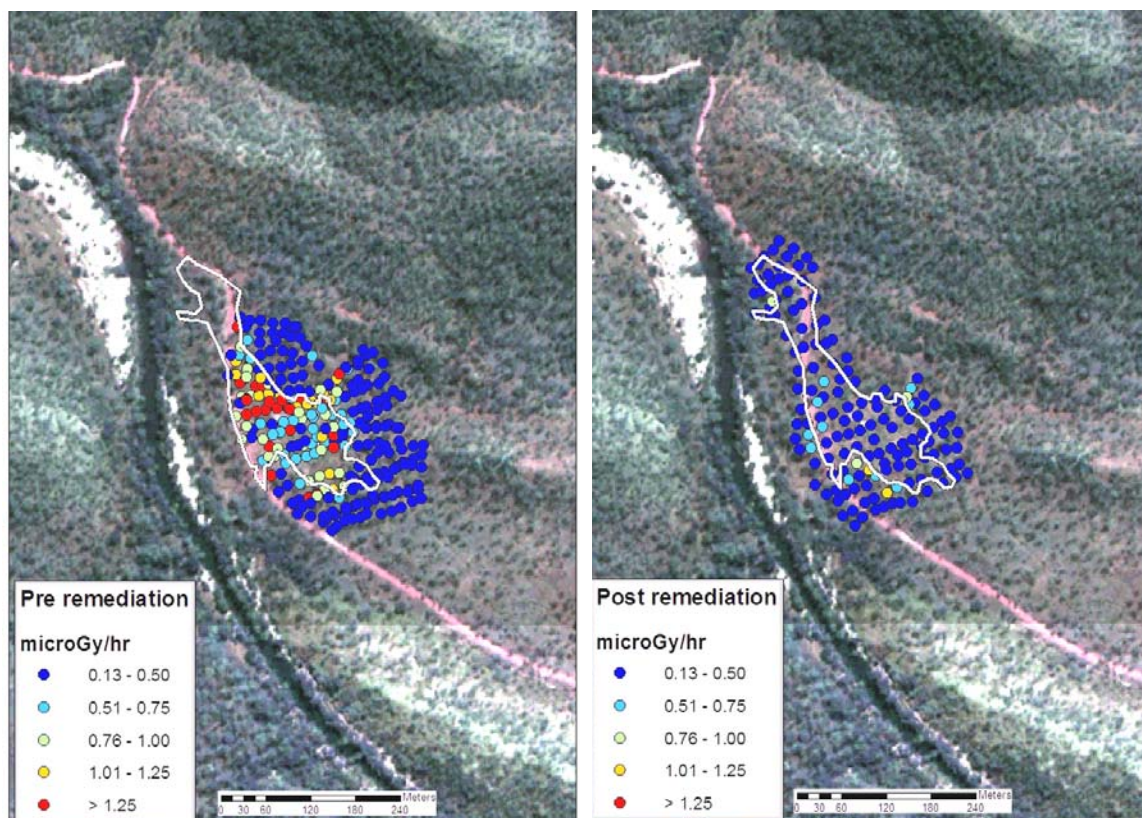
### **3.1 Tabulated results**

The survey results – eastings, northings, counts per 100 seconds and absorbed gamma dose rates – can be found in Table A2 in Appendix 2 for the Rockhole Residues site, in Table A3 in Appendix 3 for Palette and in Table A4 in Appendix 4 for El Sherana. These tables also show the calculated absorbed gamma dose rates based on the measured counts per 100 seconds and the instruments' response as determined from previous calibration against a  $^{137}\text{Cs}$  source (Bollhöfer & Fawcett 2009, Bollhöfer et al 2009b). The reported uncertainty in the calculated dose rates is one standard deviation based on counting statistics alone. All geospatial data recorded in the tables in the appendixes was collected in the WGS84 coordinate system within Zone 53. The precision of the GPS reading is typically  $\pm 10$  m.

### **3.2 Illustrative results**

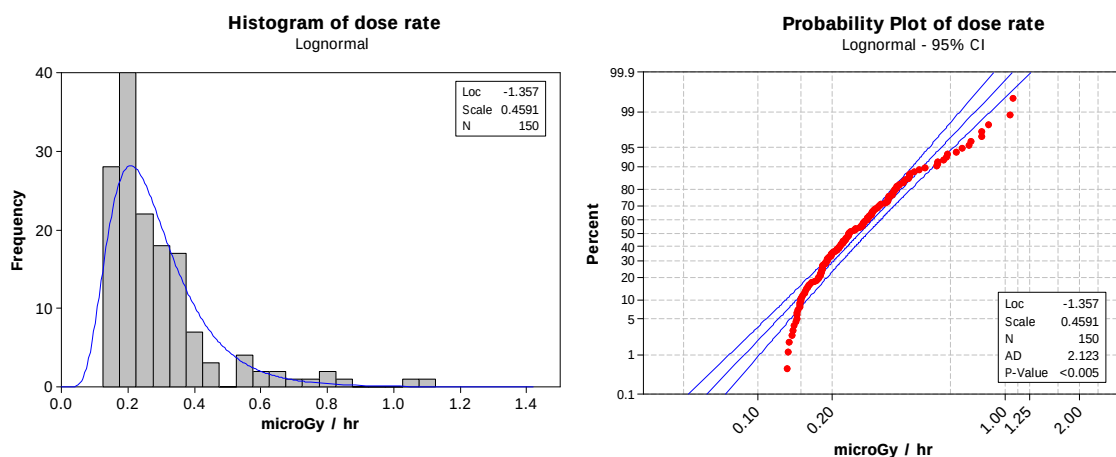
#### **3.2.1 Rockhole Residues**

Figure 2 shows the pre- and post-remediation locations of the individual measurement points at the Rockhole Residues site, the magnitude of the calculated absorbed gamma dose rates, as well as the visual boundary of the remediated area, overlaid on a Quickbird satellite image acquired in 2004.



**Figure 2** Approximate outline of the remediated area (white line) and measured pre- and post-remediation absorbed gamma dose rates at the Rockhole Residues site overlaid on Quickbird satellite data acquired in 2004. Pre-remediation gamma dose rates are from Bollhöfer et al (2007).

Figure 3 shows a histogram and probability plot of the 2010 post-remediation calculated absorbed gamma dose rates at the Rockhole Residues site. None of the 150 dose rate measurements taken across the remediated area were above the guideline value of  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$ . The histogram for the site suggests that the results are lognormally distributed, and a lognormal function has been fitted to the data. From the probability plot it can be concluded that, with 95% confidence, effectively all gamma dose rates measured at the site will be below the guideline value.



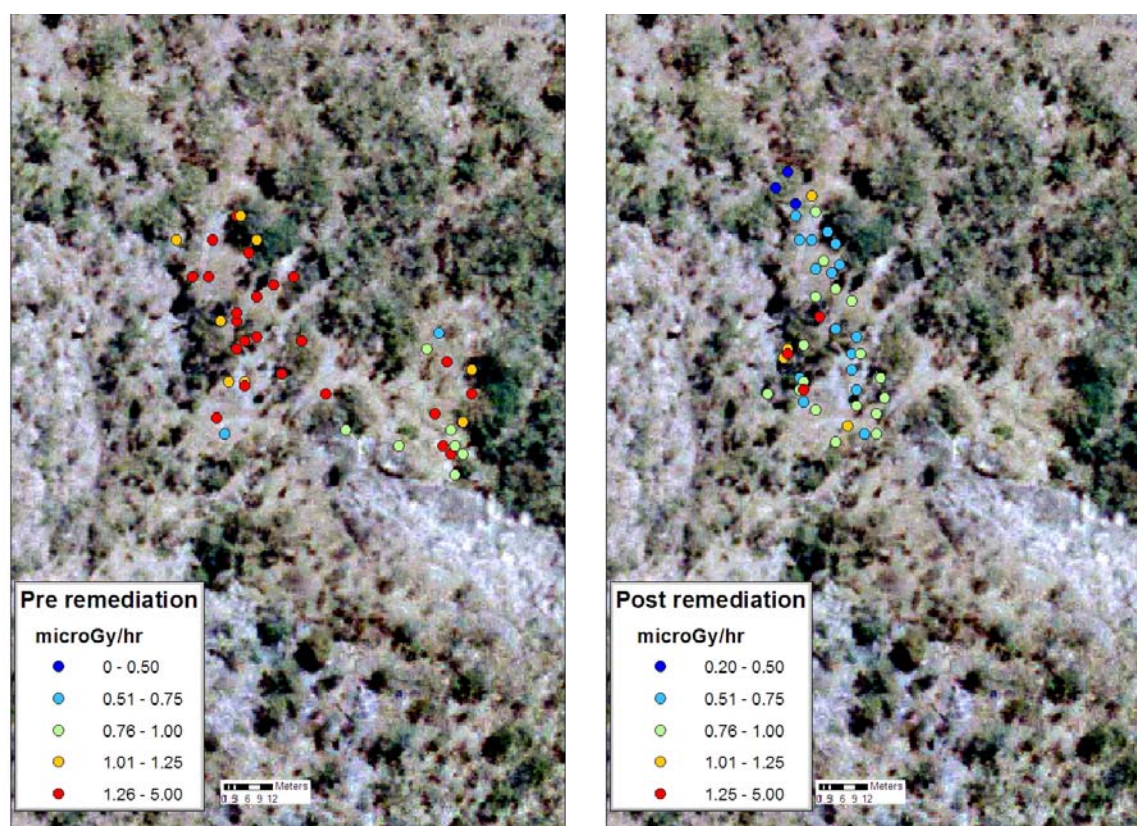
**Figure 3** Histogram and probability plot of the calculated absorbed gamma dose rates at the remediated Rockhole Residues site in 2010



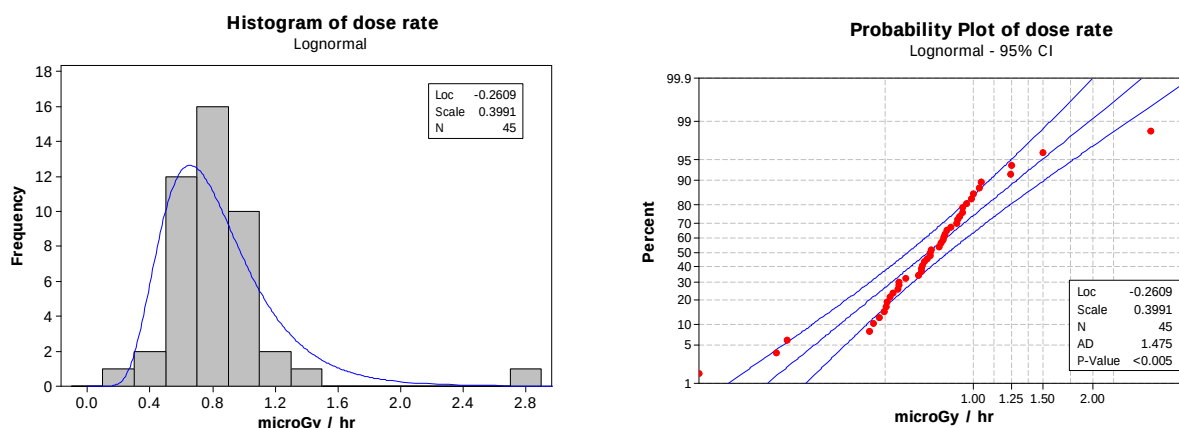
### 3.2.2 Palette

Figure 4 shows the location of the individual measurement points at the remediated Palette mine, as well as the magnitude of the calculated absorbed gamma dose rates, overlaid on an aerial photograph of the site acquired in 2005. The figure also shows an equivalent plot of the pre-remediation gamma survey results for the site. Whereas both the upper and lower benches at the site were readily accessible at the time of the pre-remediation survey, only the upper bench was safely accessible following the remediation works, with the lower bench being covered by large boulders and rocks.

Figure 5 shows a histogram and probability plot of the calculated absorbed gamma dose rates at the remediated Palette mine in 2010, with a lognormal distribution fitted to the results. The probability plot for the site indicates that approximately 90% of the area surveyed is characterised by absorbed gamma dose rates less than the guideline value of  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$ . In general, dose rates above  $1 \mu\text{Gy}\cdot\text{h}^{-1}$  were only measured close to the cliff face. The one measurement exceeding  $1.5 \mu\text{Gy}\cdot\text{h}^{-1}$  – the upper bound of the guideline value – was due to the presence of a single small piece of mineralised material (approximately  $5 \text{ cm}^3$ ), believed to be pitchblende, present on the ground surface.



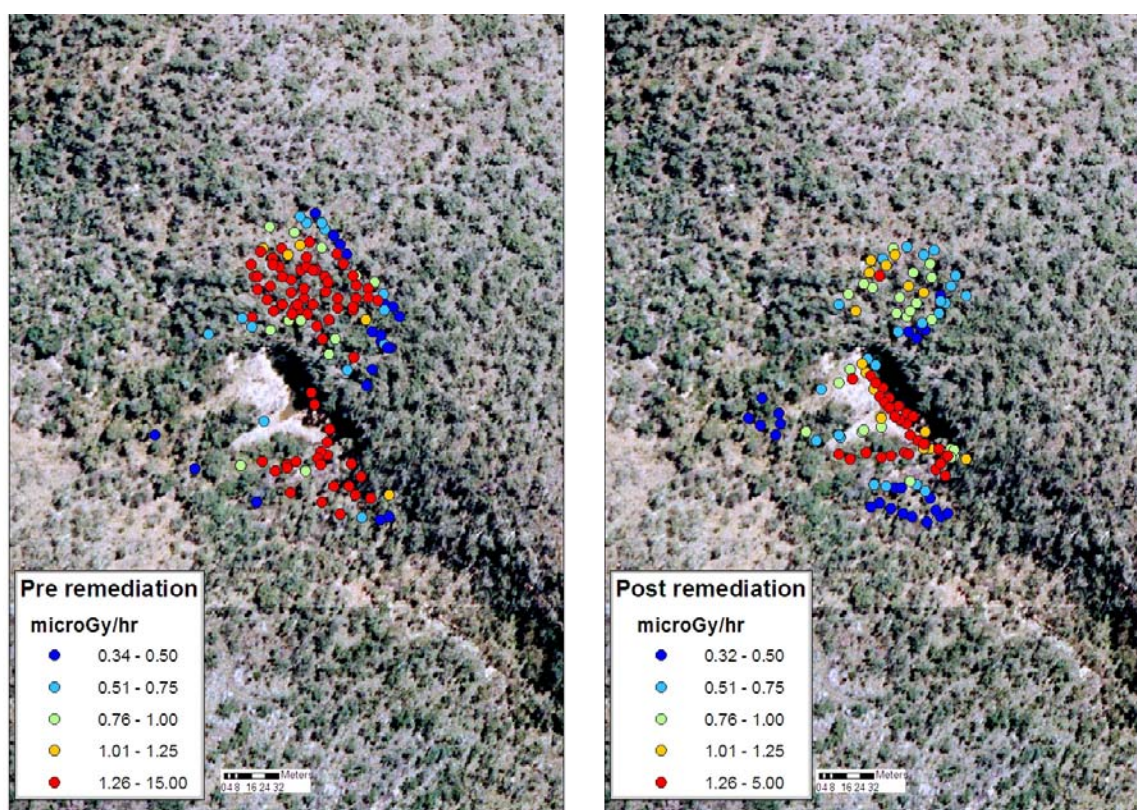
**Figure 4** Measured pre- and post-remediation absorbed gamma dose rates at Palette mine overlaid on an aerial photograph of the area. Pre-remediation gamma dose rates are from Bollhöfer et al (2009b).



**Figure 5** Histogram and probability plot of the calculated absorbed gamma dose rates at the remediated Palette mine in 2010

### 3.2.3 El Sherana

Figure 6 shows the pre- and post-remediation locations of the individual measurement points at the remediated El Sherana mine, as well as the magnitude of the calculated absorbed gamma dose rates, overlaid on an aerial photograph of the site acquired in 2005.

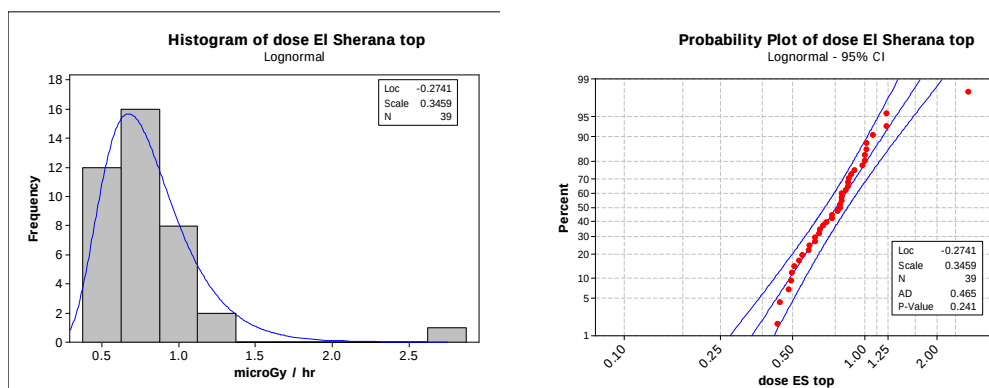


**Figure 6** Measured pre- and post-remediation gamma dose rates at El Sherana mine overlaid on an aerial photograph of the area. Pre-remediation gamma dose rates are from Bollhöfer et al (2009b).

Figure 7 shows a histogram and probability plot of the calculated absorbed gamma dose rates at the remediated El Sherana mine in 2010. Only the results for the top area to the north of the pit are included in the figure, since this was the only area at the site subject to extensive remediation works. The histogram for the remediated area north of the El Sherana pit suggests



that the results are lognormally distributed. The probability plot indicates that around 95% of this area is characterised by absorbed gamma dose rates less than the guideline value of  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$ . Dose rates above  $1 \mu\text{Gy}\cdot\text{h}^{-1}$  were typically associated with small fragments of remnant mineralised material on the ground surface.



**Figure 7** Histogram and probability plot of the calculated absorbed gamma dose rates on top of the remediated El Sherana mine in 2010

A number of workings at the bottom of the pit were surveyed in 2008 before remediation started (Bollhöfer et al 2009b). These areas consisted of two waste piles and four benches in the pit wall to the southeast of the pit. The bench on top of the pit wall exhibited gamma dose rates of approximately  $1 \mu\text{Gy}\cdot\text{h}^{-1}$ . The remaining three benches, the bottom of the pit, and the two waste piles exhibited average gamma dose rates of about  $2 \mu\text{Gy}\cdot\text{h}^{-1}$  and above. In particular there was a small area of mineralisation accessible from one of the benches that exhibited absorbed gamma dose rates of above  $7 \mu\text{Gy}\cdot\text{h}^{-1}$  before remediation. As part of the remediation at El Sherana the material from the two waste piles was shifted and pushed against the benches to the southeast of the pit also covering the small area of mineralisation, to reduce average gamma dose rates in the area.

It can be seen in Figure 6 that post-remediation absorbed gamma dose rates were lower after removal of the two waste piles south of the pit. However, absorbed gamma dose rates were still generally higher in the pit and along the upper small access track compared to other areas, due to remnant mineralised material. Highest dose rates ( $3\text{--}4 \mu\text{Gy}\cdot\text{h}^{-1}$ ) were measured immediately to the southeast of the pit, in an area that was not subject to remediation.

### 3.3 Statistical summary

Table 1 provides a statistical summary of the calculated absorbed gamma dose rates across the remediated areas at each site, as well as for two areas at the El Sherana site – pit and access, and south and west of the pit – that were not subject to major remediation works. The corresponding pre-remediation values, calculated from the results of previous gamma dose rate surveys (Bollhöfer et al 2007, Bollhöfer et al 2009b) are also given in the table, shown in parentheses. The typical environmental background absorbed gamma dose rate in the general area is approximately  $0.13 \mu\text{Gy}\cdot\text{h}^{-1}$  (Supervising Scientist 2008).

**Table 1** Statistical summary of absorbed gamma dose rates (in  $\mu\text{Gy h}^{-1}$ ) at the remediated Rockhole Residues, Palette and El Sherana sites measured in the 2010 dry season. The numbers in parentheses are the corresponding pre-remediation values for the specified areas.<sup>1</sup>

| Statistic | Rockhole Residues | Palette (top bench) | El Sherana (N of pit) | El Sherana (pit & access) | El Sherana (S & W of pit) |
|-----------|-------------------|---------------------|-----------------------|---------------------------|---------------------------|
| Median    | 0.23 (0.35)       | 0.78 (1.66)         | 0.79 (1.47)           | 1.27 (1.87)               | 0.40                      |
| Mean      | 0.29 (0.57)       | 0.83 (1.88)         | 0.81 (2.62)           | 1.39 (1.85)               | 0.44                      |
| Geo mean  | 0.26 (0.40)       | 0.77 (1.66)         | 0.76 (1.57)           | 1.28 (1.47)               | 0.43                      |
| Min       | 0.13 (0.13)       | 0.21 (0.56)         | 0.44 (0.34)           | 0.70 (0.33)               | 0.32                      |
| Max       | 1.08 (3.89)       | 2.79 (4.34)         | 2.70 (13.63)          | 4.07 (7.28)               | 0.76                      |
| N         | 150 (258)         | 45 (20)             | 39 (90)               | 60 (60)                   | 23                        |

<sup>1</sup> Pre-remediation values for the Rockhole Residues site were calculated from Bollhöfer et al (2007), and those for the Palette and El Sherana sites from Bollhöfer et al (2009b).

Within the remediated areas at each site, there has been a reduction by around a factor of two in absorbed gamma dose rates following the remediation works. ‘Average’ (geometric mean) dose rates within the remediated areas at all sites are currently below the  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$  guideline value. Because the bottom of the pit and access tracks at the El Sherana site were not subject to any major remediation works, absorbed gamma dose rates in these areas have not changed substantially and exhibit an average value which is higher than for the remediated areas to the north of the pit, but within the tolerance of the guideline value.

## 4 Discussion

The remediation of legacy uranium mining and milling sites in the South Alligator River Valley was a prescribed radiation activity under the Australian Radiation Protection and Nuclear Safety Act 1998 which required the issue of a ‘facility licence’ to Parks Australia by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Through issuing the licence, ARPANSA effectively imposed an upper bound on the gamma dose rate at 1 m above ground level of  $7.5 \mu\text{Sv}\cdot\text{h}^{-1}$  and a reference level on annual dose to an individual accessing the remediated sites of less than 10 mSv, commensurate with radiological criteria specified in the project plan (Parks Australia 2009).

Table 2 shows the estimated annual effective doses to an adult and a child from external gamma radiation assuming the possible albeit unlikely scenario that the remediated sites are occupied for one month (30 days) per year during the dry season. The doses were calculated on the basis of the geometric mean dose rates given in Table 1 of this report and using conversion factors of  $0.69 \text{ Sv}\cdot\text{Gy}^{-1}$  for an adult and  $0.79 \text{ Sv}\cdot\text{Gy}^{-1}$  for a child as given in Table 8 of Annex A of UNSCEAR (2000). The doses in Table 2 are also compared to annual effective doses that would be received at natural background sites in the South Alligator River Valley during the same one month occupancy period assuming an environmental background absorbed gamma dose rate of  $0.13 \mu\text{Gy}\cdot\text{h}^{-1}$  (Supervising Scientist 2008).

Estimated annual effective doses to an adult and child from external gamma radiation at the remediated Rockhole Residues site are approximately twice as high as the dose that would be received from typical environmental background radioactivity, and around six times higher at the remediated areas at Palette and El Sherana mines. In all cases, however, the estimated annual effective doses from external gamma radiation are less than 1 mSv.



**Table 2** Estimated annual effective dose (in mSv) from external gamma radiation to an adult and a child occupying the remediated sites or an environmental background area for a period of 1 month per year during the dry season.

| Person | Rockhole Residues | Palette (top bench) | El Sherana (N of pit) | El Sherana (pit & access) | El Sherana (S & W of pit) | Background |
|--------|-------------------|---------------------|-----------------------|---------------------------|---------------------------|------------|
| Adult  | 0.13              | 0.38                | 0.38                  | 0.64                      | 0.21                      | 0.065      |
| Child  | 0.15              | 0.44                | 0.43                  | 0.73                      | 0.24                      | 0.075      |

The radiation dose from other pathways, such as inhalation of radon and particulate-bound radionuclides and ingestion of radionuclides through the consumption of bush foods, is believed to be small relative to the external gamma dose (see Waggit (2004) and references therein). For the assumed one month per year occupancy of the remediated sites, and assuming that doses from the ingestion and inhalation pathways are similar to the dose received from external gamma radiation, the total annual dose from all pathways at El Sherana and Palette potentially approaches 1 mSv, but is unlikely to be substantially higher. This level of dose is approximately a factor of ten less than the 10 mSv reference level on annual dose for remediated sites in the South Alligator River Valley imposed by ARPANSA through the licensing process.

## 5 Conclusions

The remediation works conducted in the 2009 dry season at the Rockhole Residues, Palette and El Sherana legacy sites have reduced the absorbed gamma dose rates at these sites to average levels that are below the  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$  guideline value agreed for site clean-up. They are also well below the recommended limit of  $7.5 \mu\text{Sv}\cdot\text{h}^{-1}$  at 1 m above the ground surface imposed by ARPANSA for the remediation of the historical mine sites in the South Alligator River Valley. The average (geometric mean) absorbed gamma dose rates at 1 m above the ground surface are  $0.26 \mu\text{Gy}\cdot\text{h}^{-1}$  at the Rockhole Residues site (which is equal to an effective dose rate of  $0.21 \mu\text{Sv}\cdot\text{h}^{-1}$  for a child),  $0.77 \mu\text{Gy}\cdot\text{h}^{-1}$  at Palette ( $0.61 \mu\text{Sv}\cdot\text{h}^{-1}$ ) and  $0.76 \mu\text{Gy}\cdot\text{h}^{-1}$  at El Sherana ( $0.60 \mu\text{Sv}\cdot\text{h}^{-1}$ ) at the top area to the north of the pit. Individual measurements of absorbed gamma dose rate above the guideline value of  $1.25 \pm 0.25 \mu\text{Gy}\cdot\text{h}^{-1}$  at the Palette and El Sherana sites were generally associated with the occurrence of small quantities of remnant mineralised material.

Occupancy of the remediated sites for a period of 30 days per year during the dry season, which is considered an unlikely scenario, will result in an annual effective dose to an adult and a child from external gamma radiation of less than 1 mSv. For the same assumed occupancy scenario, a conservative estimate of the annual effective dose to an individual from all exposure pathways is 1 mSv, which is a factor of ten less than the reference level on total annual dose imposed by ARPANSA for remediated sites in the South Alligator River Valley. Consequently, there is not likely to be any unacceptable radiation dose to a person for the assumed 30 day occupancy.

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## Appendix 1 Details of gamma survey instruments

**Table A1** Details of instruments used for post-remediation gamma dose rate surveys at the Rockhole Residues, Palette and El Sherana sites

|               | GM1                           | GM3                           |
|---------------|-------------------------------|-------------------------------|
| Description   | Environmental dose rate meter | Environmental dose rate meter |
| Manufacturer  | Mini-instruments              | Mini-instruments              |
| Model         | 6-80                          | 6-80                          |
| Serial number | 01065                         | 01049                         |

## Appendix 2 Tabulated gamma survey results for Rockhole Residues

**Table A2** Eastings, northings, gamma survey instrument (GM tube) used, counts per 100 seconds, measured and calculated absorbed gamma dose rates, uncertainty in calculated dose rates and comments recorded on fieldsheets

| GPS                            | Way pt | Easting | Northing | GM tube | Counts 100 s <sup>-1</sup> | Meas $\mu\text{Gy h}^{-1}$ | Calc $\mu\text{Gy h}^{-1}$ | +/- $\mu\text{Gy h}^{-1}$ | Comments     |
|--------------------------------|--------|---------|----------|---------|----------------------------|----------------------------|----------------------------|---------------------------|--------------|
| Gamma dose rate survey results |        |         |          |         |                            |                            |                            |                           |              |
| GPS1                           | 3      | 225292  | 8508652  | GM1     | 758                        | 0.50                       | 0.41                       | 0.01                      |              |
| GPS1                           | 4      | 225302  | 8508657  | GM1     | 662                        | 0.40                       | 0.36                       | 0.01                      |              |
| GPS1                           | 5      | 225310  | 8508667  | GM1     | 416                        | 0.20                       | 0.22                       | 0.01                      |              |
| GPS1                           | 6      | 225322  | 8508676  | GM1     | 363                        | 0.20                       | 0.19                       | 0.01                      |              |
| GPS1                           | 7      | 225330  | 8508688  | GM1     | 315                        | 0.15                       | 0.16                       | 0.01                      |              |
| GPS1                           | 8      | 225375  | 8508653  | GM1     | 289                        | 0.15                       | 0.15                       | 0.01                      |              |
| GPS1                           | 9      | 225361  | 8508634  | GM1     | 302                        | 0.15                       | 0.16                       | 0.01                      |              |
| GPS1                           | 10     | 225342  | 8508620  | GM1     | 401                        | 0.20                       | 0.21                       | 0.01                      |              |
| GPS1                           | 11     | 225325  | 8508609  | GM1     | 672                        | 0.40                       | 0.36                       | 0.01                      |              |
| GPS1                           | 12     | 225321  | 8508606  | GM1     | 1452                       | 0.90                       | 0.80                       | 0.02                      | Natural      |
| GPS1                           | 13     | 225317  | 8508598  | GM1     | 784                        | 0.50                       | 0.43                       | 0.02                      | Natural      |
| GPS1                           | 14     | 225339  | 8508561  | GM1     | 408                        | 0.20                       | 0.22                       | 0.01                      | Natural      |
| GPS1                           | 15     | 225360  | 8508570  | GM1     | 376                        | 0.30                       | 0.20                       | 0.01                      |              |
| GPS1                           | 16     | 225380  | 8508575  | GM1     | 570                        | 0.40                       | 0.31                       | 0.01                      |              |
| GPS1                           | 17     | 225391  | 8508581  | GM1     | 330                        | 0.20                       | 0.17                       | 0.01                      |              |
| GPS1                           | 18     | 225421  | 8508531  | GM1     | 479                        | 0.30                       | 0.26                       | 0.01                      |              |
| GPS1                           | 19     | 225402  | 8508523  | GM1     | 495                        | 0.30                       | 0.27                       | 0.01                      |              |
| GPS1                           | 20     | 225376  | 8508517  | GM1     | 548                        | 0.40                       | 0.29                       | 0.01                      | Bottom gully |
| GPS1                           | 21     | 225356  | 8508513  | GM1     | 415                        | 0.30                       | 0.22                       | 0.01                      |              |
| GPS1                           | 22     | 225359  | 8508461  | GM1     | 436                        | 0.25                       | 0.23                       | 0.01                      |              |
| GPS1                           | 23     | 225381  | 8508471  | GM1     | 1052                       | 0.60                       | 0.58                       | 0.02                      |              |
| GPS1                           | 24     | 225389  | 8508478  | GM1     | 668                        | 0.40                       | 0.36                       | 0.01                      | Fines        |
| GPS1                           | 25     | 225409  | 8508484  | GM1     | 751                        | 0.40                       | 0.41                       | 0.01                      | Fines        |
| GPS1                           | 26     | 225432  | 8508499  | GM1     | 421                        | 0.25                       | 0.22                       | 0.01                      |              |
| GPS1                           | 27     | 225515  | 8508503  | GM1     | 427                        | 0.25                       | 0.23                       | 0.01                      | Edge road    |
| GPS1                           | 28     | 225507  | 8508490  | GM1     | 1027                       | 0.50                       | 0.56                       | 0.02                      | Natural      |
| GPS1                           | 29     | 225501  | 8508478  | GM1     | 1553                       | 0.90                       | 0.86                       | 0.02                      | Natural      |
| GPS1                           | 30     | 225486  | 8508473  | GM1     | 866                        | 0.50                       | 0.47                       | 0.02                      |              |
| GPS1                           | 31     | 225461  | 8508465  | GM1     | 626                        | 0.40                       | 0.34                       | 0.01                      |              |
| GPS1                           | 32     | 225435  | 8508452  | GM1     | 508                        | 0.30                       | 0.27                       | 0.01                      | Fines        |
| GPS1                           | 33     | 225418  | 8508446  | GM1     | 516                        | 0.30                       | 0.28                       | 0.01                      | Fines        |
| GPS1                           | 34     | 225388  | 8508438  | GM1     | 1318                       | 0.80                       | 0.73                       | 0.02                      | Fines        |
| GPS1                           | 35     | 225369  | 8508427  | GM1     | 966                        | 0.60                       | 0.53                       | 0.02                      |              |

| GPS                            | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments             |
|--------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|----------------------|
| Gamma dose rate survey results |           |         |          |            |                               |                             |                             |                            |                      |
| GPS1                           | 36        | 225351  | 8508422  | GM1        | 584                           | 0.35                        | 0.32                        | 0.01                       |                      |
| GPS1                           | 37        | 225378  | 8508389  | GM1        | 347                           | 0.20                        | 0.18                        | 0.01                       |                      |
| GPS1                           | 38        | 225396  | 8508395  | GM1        | 409                           | 0.25                        | 0.22                        | 0.01                       | Edge                 |
| GPS1                           | 39        | 225417  | 8508402  | GM1        | 417                           | 0.25                        | 0.22                        | 0.01                       | Fines                |
| GPS1                           | 40        | 225434  | 8508411  | GM1        | 543                           | 0.30                        | 0.29                        | 0.01                       |                      |
| GPS1                           | 41        | 225457  | 8508420  | GM1        | 425                           | 0.20                        | 0.23                        | 0.01                       |                      |
| GPS1                           | 42        | 225481  | 8508437  | GM1        | 463                           | 0.30                        | 0.25                        | 0.01                       |                      |
| GPS1                           | 43        | 225504  | 8508448  | GM1        | 555                           | 0.40                        | 0.30                        | 0.01                       |                      |
| GPS1                           | 44        | 225525  | 8508459  | GM1        | 359                           | 0.25                        | 0.19                        | 0.01                       |                      |
| GPS1                           | 45        | 225539  | 8508468  | GM1        | 363                           | 0.20                        | 0.19                        | 0.01                       |                      |
| GPS1                           | 46        | 225569  | 8508430  | GM1        | 375                           | 0.20                        | 0.20                        | 0.01                       | Road                 |
| GPS1                           | 47        | 225551  | 8508429  | GM1        | 356                           | 0.20                        | 0.19                        | 0.01                       | Natural              |
| GPS1                           | 48        | 225531  | 8508418  | GM1        | 499                           | 0.30                        | 0.27                        | 0.01                       | Natural              |
| GPS1                           | 49        | 225521  | 8508412  | GM1        | 621                           | 0.40                        | 0.34                        | 0.01                       |                      |
| GPS1                           | 50        | 225501  | 8508404  | GM1        | 624                           | 0.35                        | 0.34                        | 0.01                       |                      |
| GPS1                           | 51        | 225489  | 8508400  | GM1        | 500                           | 0.25                        | 0.27                        | 0.01                       |                      |
| GPS1                           | 52        | 225472  | 8508389  | GM1        | 491                           | 0.30                        | 0.26                        | 0.01                       |                      |
| GPS1                           | 53        | 225451  | 8508380  | GM1        | 1942                          | 1.25                        | 1.08                        | 0.02                       |                      |
| GPS1                           | 54        | 225437  | 8508372  | GM1        | 527                           | 0.30                        | 0.28                        | 0.01                       |                      |
| GPS1                           | 55        | 225423  | 8508367  | GM1        | 971                           | 0.60                        | 0.53                        | 0.02                       |                      |
| GPS1                           | 56        | 225406  | 8508352  | GM1        | 336                           | 0.20                        | 0.18                        | 0.01                       |                      |
| GPS1                           | 57        | 225393  | 8508347  | GM1        | 288                           | 0.15                        | 0.15                        | 0.01                       |                      |
| GPS1                           | 58        | 225432  | 8508305  | GM1        | 311                           | 0.20                        | 0.16                        | 0.01                       |                      |
| GPS1                           | 59        | 225442  | 8508316  | GM1        | 299                           | 0.20                        | 0.16                        | 0.01                       |                      |
| GPS1                           | 60        | 225459  | 8508326  | GM1        | 307                           | 0.20                        | 0.16                        | 0.01                       |                      |
| GPS1                           | 61        | 225470  | 8508330  | GM1        | 349                           | 0.20                        | 0.18                        | 0.01                       |                      |
| GPS1                           | 62        | 225483  | 8508335  | GM1        | 361                           | 0.25                        | 0.19                        | 0.01                       |                      |
| GPS1                           | 63        | 225492  | 8508336  | GM1        | 368                           | 0.25                        | 0.19                        | 0.01                       |                      |
| GPS1                           | 64        | 225509  | 8508337  | GM1        | 387                           | 0.25                        | 0.20                        | 0.01                       |                      |
| GPS1                           | 65        | 225529  | 8508351  | GM1        | 347                           | 0.25                        | 0.18                        | 0.01                       |                      |
| GPS1                           | 66        | 225550  | 8508362  | GM1        | 324                           | 0.20                        | 0.17                        | 0.01                       |                      |
| GPS1                           | 67        | 225567  | 8508370  | GM1        | 286                           | 0.15                        | 0.15                        | 0.01                       |                      |
| GPS1                           | 68        | 225583  | 8508375  | GM1        | 286                           | 0.15                        | 0.15                        | 0.01                       |                      |
| GPS1                           | 37        | 225378  | 8508389  | GM1        | 347                           | 0.20                        | 0.18                        | 0.01                       |                      |
| GPS2                           | 3         | 225301  | 8508635  | GM3        | 655                           | 0.40                        | 0.35                        | 0.01                       |                      |
| GPS2                           | 4         | 225315  | 8508643  | GM3        | 713                           | 0.40                        | 0.39                        | 0.01                       |                      |
| GPS2                           | 5         | 225329  | 8508654  | GM3        | 395                           | 0.20                        | 0.21                        | 0.01                       |                      |
| GPS2                           | 6         | 225340  | 8508667  | GM3        | 305                           | 0.15                        | 0.16                        | 0.01                       | Across road on ridge |
| GPS2                           | 7         | 225349  | 8508678  | GM3        | 278                           | 0.15                        | 0.14                        | 0.01                       | Across road on ridge |

| GPS                            | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments                  |
|--------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|---------------------------|
| Gamma dose rate survey results |           |         |          |            |                               |                             |                             |                            |                           |
| GPS2                           | 8         | 225367  | 8508666  | GM3        | 272                           | 0.15                        | 0.14                        | 0.01                       | Across road on ridge      |
| GPS2                           | 9         | 225356  | 8508655  | GM3        | 279                           | 0.175                       | 0.14                        | 0.01                       | Across road on ridge      |
| GPS2                           | 10        | 225342  | 8508642  | GM3        | 616                           | 0.20                        | 0.33                        | 0.01                       | Back across road          |
| GPS2                           | 11        | 225329  | 8508637  | GM3        | 420                           | 0.25                        | 0.22                        | 0.01                       |                           |
| GPS2                           | 12        | 225319  | 8508630  | GM3        | 504                           | 0.30                        | 0.27                        | 0.01                       |                           |
| GPS2                           | 13        | 225306  | 8508621  | GM3        | 661                           | 0.40                        | 0.36                        | 0.01                       |                           |
| GPS2                           | 14        | 225297  | 8508617  | GM3        | 402                           | 0.20                        | 0.21                        | 0.01                       |                           |
| GPS2                           | 15        | 225298  | 8508590  | GM3        | 514                           | 0.30                        | 0.28                        | 0.01                       | Gully into creek          |
| GPS2                           | 16        | 225318  | 8508588  | GM3        | 727                           | 0.45                        | 0.40                        | 0.01                       |                           |
| GPS2                           | 17        | 225324  | 8508588  | GM3        | 715                           | 0.40                        | 0.39                        | 0.01                       |                           |
| GPS2                           | 18        | 225349  | 8508594  | GM3        | 580                           | 0.35                        | 0.31                        | 0.01                       | Ripped Section            |
| GPS2                           | 19        | 225360  | 8508603  | GM3        | 288                           | 0.15                        | 0.15                        | 0.01                       |                           |
| GPS2                           | 20        | 225378  | 8508612  | GM3        | 343                           | 0.175                       | 0.18                        | 0.01                       |                           |
| GPS2                           | 21        | 225393  | 8508550  | GM3        | 534                           | 0.30                        | 0.29                        | 0.01                       |                           |
| GPS2                           | 22        | 225401  | 8508555  | GM3        | 337                           | 0.175                       | 0.18                        | 0.01                       |                           |
| GPS2                           | 23        | 225379  | 8508549  | GM3        | 819                           | 0.50                        | 0.45                        | 0.02                       | Ripped Section            |
| GPS2                           | 24        | 225363  | 8508545  | GM3        | 525                           | 0.35                        | 0.28                        | 0.01                       | Next to concreted section |
| GPS2                           | 25        | 225351  | 8508538  | GM3        | 366                           | 0.20                        | 0.19                        | 0.01                       |                           |
| GPS2                           | 26        | 225355  | 8508489  | GM3        | 385                           | 0.25                        | 0.20                        | 0.01                       |                           |
| GPS2                           | 27        | 225373  | 8508487  | GM3        | 340                           | 0.20                        | 0.18                        | 0.01                       |                           |
| GPS2                           | 28        | 225390  | 8508499  | GM3        | 1291                          | 1.00                        | 0.71                        | 0.02                       | Low point                 |
| GPS2                           | 29        | 225412  | 8508502  | GM3        | 344                           | 0.20                        | 0.18                        | 0.01                       |                           |
| GPS2                           | 30        | 225422  | 8508513  | GM3        | 348                           | 0.20                        | 0.18                        | 0.01                       |                           |
| GPS2                           | 31        | 225471  | 8508486  | GM3        | 357                           | 0.20                        | 0.19                        | 0.01                       |                           |
| GPS2                           | 32        | 225458  | 8508476  | GM3        | 336                           | 0.20                        | 0.18                        | 0.01                       |                           |
| GPS2                           | 33        | 225441  | 8508470  | GM3        | 575                           | 0.40                        | 0.31                        | 0.01                       |                           |
| GPS2                           | 34        | 225422  | 8508465  | GM3        | 492                           | 0.30                        | 0.26                        | 0.01                       |                           |
| GPS2                           | 35        | 225402  | 8508456  | GM3        | 533                           | 0.35                        | 0.29                        | 0.01                       |                           |
| GPS2                           | 36        | 225386  | 8508450  | GM3        | 691                           | 0.45                        | 0.37                        | 0.01                       |                           |
| GPS2                           | 37        | 225368  | 8508443  | GM3        | 464                           | 0.30                        | 0.25                        | 0.01                       |                           |
| GPS2                           | 38        | 225354  | 8508441  | GM3        | 458                           | 0.275                       | 0.24                        | 0.01                       |                           |
| GPS2                           | 39        | 225357  | 8508407  | GM3        | 347                           | 0.20                        | 0.18                        | 0.01                       |                           |
| GPS2                           | 40        | 225372  | 8508409  | GM3        | 1214                          | 0.90                        | 0.67                        | 0.02                       |                           |
| GPS2                           | 41        | 225393  | 8508416  | GM3        | 436                           | 0.25                        | 0.23                        | 0.01                       |                           |
| GPS2                           | 42        | 225408  | 8508425  | GM3        | 489                           | 0.25                        | 0.26                        | 0.01                       |                           |
| GPS2                           | 43        | 225423  | 8508428  | GM3        | 603                           | 0.35                        | 0.33                        | 0.01                       |                           |
| GPS2                           | 44        | 225438  | 8508433  | GM3        | 395                           | 0.20                        | 0.21                        | 0.01                       |                           |
| GPS2                           | 45        | 225453  | 8508440  | GM3        | 376                           | 0.25                        | 0.20                        | 0.01                       |                           |
| GPS2                           | 46        | 225470  | 8508448  | GM3        | 532                           | 0.35                        | 0.29                        | 0.01                       |                           |

| GPS                            | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments               |
|--------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|------------------------|
| Gamma dose rate survey results |           |         |          |            |                               |                             |                             |                            |                        |
| GPS2                           | 47        | 225493  | 8508459  | GM3        | 443                           | 0.30                        | 0.24                        | 0.01                       |                        |
| GPS2                           | 48        | 225504  | 8508468  | GM3        | 1156                          | 0.75                        | 0.64                        | 0.02                       |                        |
| GPS2                           | 49        | 225512  | 8508470  | GM3        | 404                           | 0.30                        | 0.21                        | 0.01                       |                        |
| GPS2                           | 50        | 225524  | 8508480  | GM3        | 516                           | 0.35                        | 0.28                        | 0.01                       |                        |
| GPS2                           | 51        | 225559  | 8508452  | GM3        | 379                           | 0.25                        | 0.20                        | 0.01                       |                        |
| GPS2                           | 52        | 225549  | 8508445  | GM3        | 345                           | 0.20                        | 0.18                        | 0.01                       |                        |
| GPS2                           | 53        | 225536  | 8508437  | GM3        | 682                           | 0.40                        | 0.37                        | 0.01                       |                        |
| GPS2                           | 54        | 225522  | 8508428  | GM3        | 747                           | 0.50                        | 0.41                        | 0.01                       |                        |
| GPS2                           | 55        | 225509  | 8508421  | GM3        | 382                           | 0.20                        | 0.20                        | 0.01                       |                        |
| GPS2                           | 56        | 225496  | 8508415  | GM3        | 436                           | 0.25                        | 0.23                        | 0.01                       |                        |
| GPS2                           | 57        | 225480  | 8508408  | GM3        | 433                           | 0.25                        | 0.23                        | 0.01                       |                        |
| GPS2                           | 58        | 225464  | 8508402  | GM3        | 430                           | 0.25                        | 0.23                        | 0.01                       |                        |
| GPS2                           | 59        | 225450  | 8508398  | GM3        | 624                           | 0.35                        | 0.34                        | 0.01                       |                        |
| GPS2                           | 60        | 225434  | 8508389  | GM3        | 1455                          | 1.00                        | 0.80                        | 0.02                       |                        |
| GPS2                           | 61        | 225415  | 8508379  | GM3        | 650                           | 0.40                        | 0.35                        | 0.01                       |                        |
| GPS2                           | 62        | 225401  | 8508374  | GM3        | 281                           | 0.15                        | 0.15                        | 0.01                       | On old road            |
| GPS2                           | 63        | 225378  | 8508360  | GM3        | 293                           | 0.15                        | 0.15                        | 0.01                       | Other side of old road |
| GPS2                           | 64        | 225568  | 8508409  | GM3        | 269                           | 0.15                        | 0.14                        | 0.01                       | Creek on new road      |
| GPS2                           | 65        | 225554  | 8508407  | GM3        | 260                           | 0.175                       | 0.13                        | 0.01                       |                        |
| GPS2                           | 66        | 225537  | 8508401  | GM3        | 340                           | 0.20                        | 0.18                        | 0.01                       |                        |
| GPS2                           | 67        | 225525  | 8508396  | GM3        | 436                           | 0.30                        | 0.23                        | 0.01                       |                        |
| GPS2                           | 68        | 225507  | 8508387  | GM3        | 642                           | 0.40                        | 0.35                        | 0.01                       |                        |
| GPS2                           | 69        | 225490  | 8508385  | GM3        | 541                           | 0.30                        | 0.29                        | 0.01                       |                        |
| GPS2                           | 70        | 225474  | 8508380  | GM3        | 622                           | 0.35                        | 0.34                        | 0.01                       |                        |
| GPS2                           | 71        | 225459  | 8508372  | GM3        | 1068                          | 0.70                        | 0.59                        | 0.02                       |                        |
| GPS2                           | 72        | 225447  | 8508359  | GM3        | 650                           | 0.35                        | 0.35                        | 0.01                       |                        |
| GPS2                           | 73        | 225431  | 8508354  | GM3        | 445                           | 0.30                        | 0.24                        | 0.01                       |                        |
| GPS2                           | 74        | 225419  | 8508347  | GM3        | 278                           | 0.15                        | 0.14                        | 0.01                       |                        |
| GPS2                           | 75        | 225409  | 8508338  | GM3        | 266                           | 0.15                        | 0.14                        | 0.01                       |                        |
| GPS2                           | 76        | 225415  | 8508318  | GM3        | 286                           | 0.175                       | 0.15                        | 0.01                       |                        |
| GPS2                           | 77        | 225429  | 8508325  | GM3        | 298                           | 0.175                       | 0.15                        | 0.01                       |                        |
| GPS2                           | 78        | 225445  | 8508336  | GM3        | 298                           | 0.20                        | 0.15                        | 0.01                       |                        |
| GPS2                           | 79        | 225457  | 8508341  | GM3        | 561                           | 0.40                        | 0.30                        | 0.01                       |                        |
| GPS2                           | 80        | 225475  | 8508349  | GM3        | 1884                          | 1.40                        | 1.04                        | 0.02                       |                        |
| GPS2                           | 81        | 225488  | 8508357  | GM3        | 969                           | 0.60                        | 0.53                        | 0.02                       |                        |
| GPS2                           | 82        | 225504  | 8508362  | GM3        | 755                           | 0.45                        | 0.41                        | 0.01                       |                        |
| GPS2                           | 83        | 225521  | 8508367  | GM3        | 537                           | 0.30                        | 0.29                        | 0.01                       |                        |
| GPS2                           | 84        | 225542  | 8508376  | GM3        | 275                           | 0.20                        | 0.14                        | 0.01                       |                        |
| GPS2                           | 85        | 225560  | 8508381  | GM3        | 258                           | 0.175                       | 0.13                        | 0.01                       |                        |



| GPS                                         | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments         |
|---------------------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|------------------|
| Gamma dose rate survey results              |           |         |          |            |                               |                             |                             |                            |                  |
| GPS2                                        | 86        | 225572  | 8508388  | GM3        | 256                           | 0.175                       | 0.13                        | 0.01                       | Edge of new road |
| Trace of visual boundary of remediated area |           |         |          |            |                               |                             |                             |                            |                  |
| GPS2                                        | 87        | 225520  | 8508449  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 88        | 225530  | 8508437  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 89        | 225533  | 8508430  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 90        | 225530  | 8508427  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 91        | 225528  | 8508424  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 92        | 225527  | 8508418  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 93        | 225522  | 8508416  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 94        | 225519  | 8508412  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 95        | 225520  | 8508397  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 96        | 225531  | 8508396  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 97        | 225536  | 8508395  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 98        | 225549  | 8508387  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 99        | 225556  | 8508375  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 100       | 225565  | 8508365  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 101       | 225561  | 8508358  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 102       | 225552  | 8508356  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 103       | 225540  | 8508366  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 104       | 225531  | 8508369  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 105       | 225519  | 8508363  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 106       | 225516  | 8508350  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 107       | 225510  | 8508349  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 108       | 225499  | 8508359  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 109       | 225488  | 8508364  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 110       | 225476  | 8508362  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 111       | 225470  | 8508367  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 112       | 225461  | 8508374  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 113       | 225452  | 8508383  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 114       | 225449  | 8508390  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 115       | 225443  | 8508396  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 116       | 225439  | 8508402  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 117       | 225429  | 8508407  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 118       | 225422  | 8508396  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 119       | 225418  | 8508387  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 120       | 225412  | 8508388  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 121       | 225401  | 8508387  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 122       | 225412  | 8508356  |            |                               |                             |                             |                            |                  |
| GPS2                                        | 123       | 225399  | 8508373  |            |                               |                             |                             |                            |                  |

| GPS                                         | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments |
|---------------------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|----------|
| Trace of visual boundary of remediated area |           |         |          |            |                               |                             |                             |                            |          |
| GPS2                                        | 124       | 225393  | 8508386  |            |                               |                             |                             |                            |          |
| GPS2                                        | 125       | 225388  | 8508396  |            |                               |                             |                             |                            |          |
| GPS2                                        | 126       | 225383  | 8508408  |            |                               |                             |                             |                            |          |
| GPS2                                        | 127       | 225379  | 8508424  |            |                               |                             |                             |                            |          |
| GPS2                                        | 128       | 225374  | 8508436  |            |                               |                             |                             |                            |          |
| GPS2                                        | 129       | 225369  | 8508450  |            |                               |                             |                             |                            |          |
| GPS2                                        | 130       | 225366  | 8508461  |            |                               |                             |                             |                            |          |
| GPS2                                        | 131       | 225364  | 8508482  |            |                               |                             |                             |                            |          |
| GPS2                                        | 132       | 225363  | 8508504  |            |                               |                             |                             |                            |          |
| GPS3                                        | 1         | 225521  | 8508447  |            |                               |                             |                             |                            |          |
| GPS3                                        | 2         | 225506  | 8508458  |            |                               |                             |                             |                            |          |
| GPS3                                        | 3         | 225498  | 8508470  |            |                               |                             |                             |                            |          |
| GPS3                                        | 4         | 225499  | 8508477  |            |                               |                             |                             |                            |          |
| GPS3                                        | 5         | 225486  | 8508483  |            |                               |                             |                             |                            |          |
| GPS3                                        | 6         | 225486  | 8508473  |            |                               |                             |                             |                            |          |
| GPS3                                        | 7         | 225476  | 8508471  |            |                               |                             |                             |                            |          |
| GPS3                                        | 8         | 225468  | 8508475  |            |                               |                             |                             |                            |          |
| GPS3                                        | 9         | 225465  | 8508483  |            |                               |                             |                             |                            |          |
| GPS3                                        | 10        | 225455  | 8508482  |            |                               |                             |                             |                            |          |
| GPS3                                        | 11        | 225452  | 8508475  |            |                               |                             |                             |                            |          |
| GPS3                                        | 12        | 225438  | 8508481  |            |                               |                             |                             |                            |          |
| GPS3                                        | 13        | 225425  | 8508494  |            |                               |                             |                             |                            |          |
| GPS3                                        | 14        | 225417  | 8508505  |            |                               |                             |                             |                            |          |
| GPS3                                        | 15        | 225410  | 8508516  |            |                               |                             |                             |                            |          |
| GPS3                                        | 16        | 225399  | 8508530  |            |                               |                             |                             |                            |          |
| GPS3                                        | 17        | 225388  | 8508541  |            |                               |                             |                             |                            |          |
| GPS3                                        | 18        | 225380  | 8508548  |            |                               |                             |                             |                            |          |
| GPS3                                        | 19        | 225380  | 8508566  |            |                               |                             |                             |                            |          |
| GPS3                                        | 20        | 225377  | 8508584  |            |                               |                             |                             |                            |          |
| GPS3                                        | 21        | 225373  | 8508599  |            |                               |                             |                             |                            |          |
| GPS3                                        | 22        | 225379  | 8508622  |            |                               |                             |                             |                            |          |
| GPS3                                        | 23        | 225363  | 8508634  |            |                               |                             |                             |                            |          |
| GPS3                                        | 24        | 225350  | 8508644  |            |                               |                             |                             |                            |          |
| GPS3                                        | 25        | 225331  | 8508654  |            |                               |                             |                             |                            |          |
| GPS3                                        | 26        | 225321  | 8508658  |            |                               |                             |                             |                            |          |
| GPS3                                        | 27        | 225308  | 8508668  |            |                               |                             |                             |                            |          |
| GPS3                                        | 28        | 225294  | 8508652  |            |                               |                             |                             |                            |          |
| GPS3                                        | 29        | 225302  | 8508636  |            |                               |                             |                             |                            |          |
| GPS3                                        | 30        | 225312  | 8508624  |            |                               |                             |                             |                            |          |

| GPS                                         | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments |
|---------------------------------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|----------|
| Trace of visual boundary of remediated area |           |         |          |            |                               |                             |                             |                            |          |
| GPS3                                        | 31        | 225323  | 8508619  |            |                               |                             |                             |                            |          |
| GPS3                                        | 32        | 225327  | 8508600  |            |                               |                             |                             |                            |          |
| GPS3                                        | 33        | 225318  | 8508591  |            |                               |                             |                             |                            |          |
| GPS3                                        | 34        | 225305  | 8508594  |            |                               |                             |                             |                            |          |
| GPS3                                        | 35        | 225293  | 8508593  |            |                               |                             |                             |                            |          |
| GPS3                                        | 36        | 225298  | 8508586  |            |                               |                             |                             |                            |          |
| GPS3                                        | 37        | 225310  | 8508583  |            |                               |                             |                             |                            |          |
| GPS3                                        | 38        | 225324  | 8508582  |            |                               |                             |                             |                            |          |
| GPS3                                        | 39        | 225335  | 8508579  |            |                               |                             |                             |                            |          |
| GPS3                                        | 40        | 225342  | 8508563  |            |                               |                             |                             |                            |          |
| GPS3                                        | 41        | 225349  | 8508548  |            |                               |                             |                             |                            |          |
| GPS3                                        | 42        | 225356  | 8508531  |            |                               |                             |                             |                            |          |
| GPS3                                        | 43        | 225363  | 8508517  |            |                               |                             |                             |                            |          |
| GPS3                                        | 44        | 225363  | 8508504  |            |                               |                             |                             |                            |          |

## Appendix 3 Tabulated gamma survey results for Palette

**Table A3** Eastings, northings, gamma survey instrument (GM tube) used, counts per 100 seconds, measured and calculated absorbed gamma dose rates, uncertainty in calculated dose rates and comments recorded on fieldsheets

| GPS       | Way pt | Eastings | Northings | GM tube | Counts 100 s <sup>-1</sup> | Meas $\mu\text{Gy h}^{-1}$ | Calc $\mu\text{Gy h}^{-1}$ | +/- $\mu\text{Gy h}^{-1}$ | Comments |
|-----------|--------|----------|-----------|---------|----------------------------|----------------------------|----------------------------|---------------------------|----------|
| Top bench |        |          |           |         |                            |                            |                            |                           |          |
| GPS1      | 98     | 236211   | 8502432   | GM1     | 631                        | 0.40                       | 0.34                       | 0.01                      |          |
| GPS1      | 99     | 236217   | 8502426   | GM1     | 1879                       | 1.00                       | 1.04                       | 0.02                      |          |
| GPS1      | 100    | 236218   | 8502422   | GM1     | 1556                       | 0.90                       | 0.86                       | 0.02                      |          |
| GPS1      | 101    | 236221   | 8502417   | GM1     | 1184                       | 0.70                       | 0.65                       | 0.02                      |          |
| GPS1      | 102    | 236223   | 8502414   | GM1     | 1345                       | 0.80                       | 0.74                       | 0.02                      |          |
| GPS1      | 103    | 236224   | 8502409   | GM1     | 1061                       | 0.60                       | 0.58                       | 0.02                      |          |
| GPS1      | 104    | 236227   | 8502400   | GM1     | 1700                       | 0.90                       | 0.94                       | 0.02                      |          |
| GPS1      | 105    | 236228   | 8502391   | GM1     | 1327                       | 0.70                       | 0.73                       | 0.02                      |          |
| GPS1      | 106    | 236229   | 8502387   | GM1     | 1543                       | 0.90                       | 0.85                       | 0.02                      |          |
| GPS1      | 107    | 236234   | 8502381   | GM1     | 1593                       | 0.90                       | 0.88                       | 0.02                      |          |
| GPS1      | 108    | 236235   | 8502376   | GM1     | 1700                       | 1.00                       | 0.94                       | 0.02                      |          |
| GPS1      | 109    | 236233   | 8502372   | GM1     | 1677                       | 1.00                       | 0.93                       | 0.02                      |          |
| GPS1      | 110    | 236233   | 8502367   | GM1     | 1791                       | 1.00                       | 0.99                       | 0.02                      |          |
| GPS1      | 111    | 236223   | 8502365   | GM1     | 1536                       | 0.90                       | 0.85                       | 0.02                      |          |
| GPS1      | 112    | 236218   | 8502373   | GM1     | 1492                       | 0.80                       | 0.82                       | 0.02                      |          |
| GPS1      | 113    | 236215   | 8502375   | GM1     | 1345                       | 0.70                       | 0.74                       | 0.02                      |          |
| GPS1      | 114    | 236215   | 8502389   | GM1     | 1521                       | 0.90                       | 0.84                       | 0.02                      |          |
| GPS1      | 115    | 236219   | 8502396   | GM1     | 2697                       | 1.50                       | 1.50                       | 0.03                      |          |
| GPS1      | 116    | 236218   | 8502401   | GM1     | 1427                       | 0.80                       | 0.79                       | 0.02                      |          |
| GPS1      | 117    | 236218   | 8502408   | GM1     | 1027                       | 0.60                       | 0.56                       | 0.02                      |          |
| GPS1      | 118    | 236214   | 8502415   | GM1     | 1146                       | 0.70                       | 0.63                       | 0.02                      |          |
| GPS2      | 163    | 236208   | 8502428   | GM3     | 388                        | 0.25                       | 0.21                       | 0.01                      |          |
| GPS2      | 164    | 236213   | 8502424   | GM3     | 596                        | 0.30                       | 0.32                       | 0.01                      |          |
| GPS2      | 165    | 236213   | 8502421   | GM3     | 1129                       | 0.70                       | 0.62                       | 0.02                      |          |
| GPS2      | 166    | 236217   | 8502415   | GM3     | 1006                       | 0.55                       | 0.55                       | 0.02                      |          |
| GPS2      | 167    | 236220   | 8502410   | GM3     | 1390                       | 0.90                       | 0.77                       | 0.02                      |          |
| GPS2      | 168    | 236222   | 8502407   | GM3     | 1102                       | 0.70                       | 0.61                       | 0.02                      |          |
| GPS2      | 169    | 236223   | 8502403   | GM3     | 1415                       | 0.75                       | 0.78                       | 0.02                      |          |
| GPS2      | 170    | 236223   | 8502403   | GM3     | 1414                       | 0.80                       | 0.78                       | 0.02                      |          |
| GPS2      | 171    | 236223   | 8502393   | GM3     | 1178                       | 0.70                       | 0.65                       | 0.02                      |          |
| GPS2      | 172    | 236227   | 8502387   | GM3     | 1092                       | 0.65                       | 0.60                       | 0.02                      |          |
| GPS2      | 173    | 236227   | 8502383   | GM3     | 1110                       | 0.55                       | 0.61                       | 0.02                      |          |
| GPS2      | 174    | 236228   | 8502378   | GM3     | 1230                       | 0.70                       | 0.68                       | 0.02                      |          |
| GPS2      | 175    | 236228   | 8502374   | GM3     | 1656                       | 1.00                       | 0.92                       | 0.02                      |          |

| GPS       | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments |
|-----------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|----------|
| Top bench |           |         |          |            |                               |                             |                             |                            |          |
| GPS2      | 176       | 236226  | 8502369  | GM3        | 1812                          | 1.00                        | 1.00                        | 0.02                       |          |
| GPS2      | 177       | 236230  | 8502367  | GM3        | 1187                          | 0.65                        | 0.65                        | 0.02                       |          |
| GPS2      | 178       | 236206  | 8502377  | GM3        | 1647                          | 1.00                        | 0.91                        | 0.02                       |          |
| GPS2      | 179       | 236215  | 8502378  | GM3        | 2260                          | 1.50                        | 1.25                        | 0.03                       |          |
| GPS2      | 180       | 236210  | 8502386  | GM3        | 1742                          | 1.00                        | 0.96                        | 0.02                       |          |
| GPS2      | 181       | 236210  | 8502386  | GM3        | 2246                          | 1.25                        | 1.25                        | 0.03                       |          |
| GPS2      | 182       | 236211  | 8502387  | GM3        | 5001                          | 3.00                        | 2.79                        | 0.04                       |          |
| GPS2      | 183       | 236211  | 8502388  | GM3        | 1894                          | 1.25                        | 1.05                        | 0.02                       |          |
| GPS2      | 184       | 236214  | 8502381  | GM3        | 1353                          | 0.70                        | 0.75                        | 0.02                       |          |
| GPS2      | 185       | 236215  | 8502380  | GM3        | 1369                          | 0.90                        | 0.75                        | 0.02                       |          |
| GPS2      | 186       | 236214  | 8502378  | GM3        | 1509                          | 0.90                        | 0.83                        | 0.02                       |          |

## Appendix 4 Tabulated gamma survey results for El Sherana

**Table A4** Eastings, northings, gamma survey instrument (GM tube) used, counts per 100 seconds, measured and calculated absorbed gamma dose rates, uncertainty in calculated dose rates and comments recorded on fieldsheets

| GPS                   | Way pt | Eastings | Northings | GM tube | Counts 100 s <sup>-1</sup> | Meas $\mu\text{Gy h}^{-1}$ | Calc $\mu\text{Gy h}^{-1}$ | +/- $\mu\text{Gy h}^{-1}$ | Comments                 |
|-----------------------|--------|----------|-----------|---------|----------------------------|----------------------------|----------------------------|---------------------------|--------------------------|
| Pit and access tracks |        |          |           |         |                            |                            |                            |                           |                          |
| GPS2                  | 303    | 231614   | 8505204   | GM3     | 1628                       | 0.80                       | 0.90                       | 0.02                      |                          |
| GPS2                  | 304    | 231607   | 8505196   | GM3     | 1423                       | 0.80                       | 0.78                       | 0.02                      |                          |
| GPS2                  | 305    | 231624   | 8505210   | GM3     | 1277                       | 0.60                       | 0.70                       | 0.02                      |                          |
| GPS2                  | 306    | 231629   | 8505206   | GM3     | 1355                       | 0.70                       | 0.75                       | 0.02                      |                          |
| GPS2                  | 307    | 231627   | 8505200   | GM3     | 1592                       | 0.80                       | 0.88                       | 0.02                      |                          |
| GPS2                  | 308    | 231628   | 8505192   | GM3     | 2228                       | 1.00                       | 1.24                       | 0.03                      |                          |
| GPS2                  | 309    | 231631   | 8505188   | GM3     | 2896                       | 1.25                       | 1.61                       | 0.03                      |                          |
| GPS2                  | 310    | 231634   | 8505184   | GM3     | 3222                       | 1.50                       | 1.79                       | 0.03                      |                          |
| GPS2                  | 311    | 231637   | 8505181   | GM3     | 3456                       | 1.75                       | 1.92                       | 0.03                      |                          |
| GPS2                  | 312    | 231640   | 8505176   | GM3     | 2978                       | 1.50                       | 1.66                       | 0.03                      |                          |
| GPS2                  | 313    | 231643   | 8505174   | GM3     | 2426                       | 1.25                       | 1.35                       | 0.03                      |                          |
| GPS2                  | 314    | 231647   | 8505172   | GM3     | 2271                       | 1.00                       | 1.26                       | 0.03                      |                          |
| GPS2                  | 315    | 231649   | 8505165   | GM3     | 2313                       | 1.00                       | 1.28                       | 0.03                      |                          |
| GPS2                  | 316    | 231654   | 8505162   | GM3     | 2389                       | 1.25                       | 1.33                       | 0.03                      |                          |
| GPS2                  | 317    | 231657   | 8505157   | GM3     | 2201                       | 1.00                       | 1.22                       | 0.03                      |                          |
| GPS2                  | 318    | 231661   | 8505157   | GM3     | 1927                       | 0.90                       | 1.07                       | 0.02                      |                          |
| GPS2                  | 319    | 231667   | 8505156   | GM3     | 1545                       | 0.80                       | 0.85                       | 0.02                      |                          |
| GPS2                  | 320    | 231673   | 8505157   | GM3     | 1530                       | 0.70                       | 0.84                       | 0.02                      |                          |
| GPS2                  | 321    | 231675   | 8505156   | GM3     | 1669                       | 0.80                       | 0.92                       | 0.02                      |                          |
| GPS2                  | 322    | 231675   | 8505153   | GM3     | 1411                       | 0.70                       | 0.78                       | 0.02                      |                          |
| GPS2                  | 323    | 231673   | 8505152   | GM3     | 1747                       | 0.80                       | 0.97                       | 0.02                      | Second level (untouched) |
| GPS2                  | 324    | 231671   | 8505153   | GM3     | 2880                       | 1.25                       | 1.60                       | 0.03                      | Second level (untouched) |
| GPS2                  | 325    | 231664   | 8505145   | GM3     | 3586                       | 1.50                       | 2.00                       | 0.03                      | Second level (untouched) |
| GPS2                  | 326    | 231667   | 8505148   | GM3     | 5308                       | 2.50                       | 2.96                       | 0.04                      | Second level (untouched) |
| GPS2                  | 327    | 231670   | 8505141   | GM3     | 7287                       | 3.50                       | 4.07                       | 0.05                      | Second level (untouched) |
| GPS2                  | 328    | 231682   | 8505151   | GM3     | 2049                       | 1.00                       | 1.14                       | 0.03                      | Third level (untouched)  |
| GPS2                  | 339    | 231632   | 8505170   | GM3     | 1548                       | 0.70                       | 0.85                       | 0.02                      | Inlet                    |
| GPS2                  | 340    | 231621   | 8505167   | GM3     | 1540                       | 0.70                       | 0.85                       | 0.02                      | Inlet                    |
| GPS2                  | 341    | 231607   | 8505165   | GM3     | 1312                       | 0.50                       | 0.72                       | 0.02                      | Inlet                    |
| GPS2                  | 342    | 231588   | 8505167   | GM3     | 1542                       | 0.70                       | 0.85                       | 0.02                      | Inlet                    |
| GPS3                  | 161    | 231615   | 8505198   | GM1     | 2370                       | 1.30                       | 1.32                       | 0.03                      | Pit access               |
| GPS3                  | 162    | 231597   | 8505192   | GM1     | 1279                       | 1.00                       | 0.70                       | 0.02                      |                          |
| GPS3                  | 163    | 231621   | 8505207   | GM1     | 2118                       | 1.20                       | 1.17                       | 0.03                      | Base of pit              |
| GPS3                  | 164    | 231623   | 8505202   | GM1     | 1481                       | 1.20                       | 0.82                       | 0.02                      | Base of pit              |

| GPS                   | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments           |
|-----------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|--------------------|
| Pit and access tracks |           |         |          |            |                               |                             |                             |                            |                    |
| GPS3                  | 165       | 231623  | 8505202  | GM1        | 2021                          | 1.20                        | 1.12                        | 0.02                       | Base of pit        |
| GPS3                  | 166       | 231626  | 8505200  | GM1        | 2549                          | 1.50                        | 1.42                        | 0.03                       | Base of pit        |
| GPS3                  | 167       | 231629  | 8505196  | GM1        | 2888                          | 1.00                        | 1.61                        | 0.03                       | Base of pit        |
| GPS3                  | 168       | 231633  | 8505193  | GM1        | 2739                          | 1.80                        | 1.52                        | 0.03                       | Base of pit        |
| GPS3                  | 169       | 231637  | 8505187  | GM1        | 2420                          | 1.00                        | 1.34                        | 0.03                       | Base of pit        |
| GPS3                  | 170       | 231642  | 8505182  | GM1        | 2325                          | 1.00                        | 1.29                        | 0.03                       | Base of pit        |
| GPS3                  | 171       | 231643  | 8505182  | GM1        | 2261                          | 1.10                        | 1.25                        | 0.03                       | Base of pit        |
| GPS3                  | 172       | 231647  | 8505178  | GM1        | 2332                          | 1.50                        | 1.29                        | 0.03                       | Base of pit        |
| GPS3                  | 173       | 231651  | 8505176  | GM1        | 2769                          | 1.50                        | 1.54                        | 0.03                       | Base of pit        |
| GPS3                  | 174       | 231658  | 8505167  | GM1        | 2165                          | 1.50                        | 1.20                        | 0.03                       | Base of pit        |
| GPS3                  | 175       | 231658  | 8505160  | GM1        | 3480                          | 2.00                        | 1.94                        | 0.03                       | Washout 0.5 m deep |
| GPS3                  | 176       | 231666  | 8505157  | GM1        | 2635                          | 1.50                        | 1.46                        | 0.03                       | Washout 1 m deep   |
| GPS3                  | 177       | 231666  | 8505156  | GM1        | 2472                          | 1.50                        | 1.37                        | 0.03                       | Upper pit          |
| GPS3                  | 178       | 231670  | 8505152  | GM1        | 2283                          | 1.50                        | 1.27                        | 0.03                       | Upper pit          |
| GPS3                  | 179       | 231657  | 8505160  | GM1        | 3738                          | 2.00                        | 2.08                        | 0.03                       | Upper access       |
| GPS3                  | 180       | 231648  | 8505154  | GM1        | 5192                          | 3.40                        | 2.90                        | 0.04                       | Upper access       |
| GPS3                  | 181       | 231646  | 8505155  | GM1        | 3696                          | 2.00                        | 2.06                        | 0.03                       | Upper access       |
| GPS3                  | 182       | 231638  | 8505153  | GM1        | 4190                          | 2.30                        | 2.33                        | 0.04                       | Fence corner       |
| GPS3                  | 183       | 231632  | 8505152  | GM1        | 4963                          | 3.00                        | 2.77                        | 0.04                       |                    |
| GPS3                  | 184       | 231623  | 8505155  | GM1        | 3479                          | 2.00                        | 1.94                        | 0.03                       |                    |
| GPS3                  | 185       | 231614  | 8505151  | GM1        | 3169                          | 2.00                        | 1.76                        | 0.03                       | Fence corner       |
| GPS3                  | 186       | 231607  | 8505154  | GM1        | 2291                          | 1.50                        | 1.27                        | 0.03                       |                    |
| GPS3                  | 194       | 231632  | 8505175  | GM1        | 1985                          | 1.30                        | 1.10                        | 0.02                       | Pit entry          |
| GPS3                  | 195       | 231622  | 8505168  | GM1        | 1710                          | 1.10                        | 0.95                        | 0.02                       |                    |
| GPS3                  | 196       | 231608  | 8505164  | GM1        | 1310                          | 0.80                        | 0.72                        | 0.02                       |                    |
| GPS3                  | 197       | 231594  | 8505162  | GM1        | 1270                          | 0.70                        | 0.70                        | 0.02                       |                    |
| Top area north of pit |           |         |          |            |                               |                             |                             |                            |                    |
| GPS2                  | 346       | 231648  | 8505226  | GM3        | 883                           | 0.35                        | 0.48                        | 0.02                       | Top area           |
| GPS2                  | 347       | 231655  | 8505229  | GM3        | 908                           | 0.40                        | 0.50                        | 0.02                       |                    |
| GPS2                  | 348       | 231656  | 8505231  | GM3        | 1332                          | 0.70                        | 0.73                        | 0.02                       |                    |
| GPS2                  | 349       | 231667  | 8505244  | GM3        | 1172                          | 0.60                        | 0.64                        | 0.02                       |                    |
| GPS2                  | 350       | 231667  | 8505247  | GM3        | 817                           | 0.40                        | 0.45                        | 0.02                       |                    |
| GPS2                  | 351       | 231673  | 8505253  | GM3        | 1223                          | 0.60                        | 0.67                        | 0.02                       |                    |
| GPS2                  | 352       | 231676  | 8505259  | GM3        | 1258                          | 0.50                        | 0.69                        | 0.02                       |                    |
| GPS2                  | 353       | 231682  | 8505247  | GM3        | 1331                          | 0.60                        | 0.73                        | 0.02                       | New line, top area |
| GPS2                  | 354       | 231670  | 8505243  | GM3        | 1078                          | 0.50                        | 0.59                        | 0.02                       |                    |
| GPS2                  | 355       | 231666  | 8505237  | GM3        | 932                           | 0.50                        | 0.51                        | 0.02                       |                    |
| GPS2                  | 356       | 231662  | 8505233  | GM3        | 1766                          | 0.90                        | 0.98                        | 0.02                       |                    |
| GPS2                  | 357       | 231658  | 8505227  | GM3        | 799                           | 0.35                        | 0.44                        | 0.02                       |                    |

| GPS                   | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments              |
|-----------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|-----------------------|
| Top area north of pit |           |         |          |            |                               |                             |                             |                            |                       |
| GPS2                  | 358       | 231653  | 8505222  | GM3        | 902                           | 0.45                        | 0.49                        | 0.02                       |                       |
| GPS2                  | 359       | 231607  | 8505242  | GM3        | 1183                          | 0.60                        | 0.65                        | 0.02                       | New line, top area    |
| GPS2                  | 360       | 231613  | 8505248  | GM3        | 1647                          | 0.80                        | 0.91                        | 0.02                       |                       |
| GPS2                  | 361       | 231622  | 8505254  | GM3        | 1539                          | 0.80                        | 0.85                        | 0.02                       |                       |
| GPS2                  | 362       | 231625  | 8505261  | GM3        | 2218                          | 1.00                        | 1.23                        | 0.03                       |                       |
| GPS2                  | 363       | 231626  | 8505268  | GM3        | 2226                          | 1.25                        | 1.23                        | 0.03                       |                       |
| GPS2                  | 364       | 231633  | 8505269  | GM3        | 1130                          | 0.60                        | 0.62                        | 0.02                       |                       |
| GPS2                  | 365       | 231639  | 8505275  | GM3        | 1514                          | 0.80                        | 0.84                        | 0.02                       |                       |
| GPS3                  | 201       | 231642  | 8505226  | GM1        | 974                           | 0.60                        | 0.53                        | 0.02                       | Upper pad             |
| GPS3                  | 202       | 231647  | 8505235  | GM1        | 1431                          | 0.80                        | 0.79                        | 0.02                       |                       |
| GPS3                  | 203       | 231649  | 8505238  | GM1        | 1559                          | 0.80                        | 0.86                        | 0.02                       |                       |
| GPS3                  | 204       | 231653  | 8505243  | GM1        | 1588                          | 0.80                        | 0.88                        | 0.02                       |                       |
| GPS3                  | 205       | 231657  | 8505249  | GM1        | 1843                          | 1.00                        | 1.02                        | 0.02                       |                       |
| GPS3                  | 206       | 231662  | 8505258  | GM1        | 1455                          | 0.80                        | 0.80                        | 0.02                       |                       |
| GPS3                  | 207       | 231661  | 8505266  | GM1        | 1542                          | 0.80                        | 0.85                        | 0.02                       |                       |
| GPS3                  | 208       | 231663  | 8505274  | GM1        | 1008                          | 0.60                        | 0.55                        | 0.02                       | End run 1             |
| GPS3                  | 209       | 231657  | 8505271  | GM1        | 1070                          | 0.60                        | 0.59                        | 0.02                       | Start run 2           |
| Top area south of pit |           |         |          |            |                               |                             |                             |                            |                       |
| GPS2                  | 329       | 231671  | 8505119  | GM3        | 834                           | 0.30                        | 0.46                        | 0.02                       | Second area (cleared) |
| GPS2                  | 330       | 231664  | 8505121  | GM3        | 868                           | 0.35                        | 0.47                        | 0.02                       | Second area (cleared) |
| GPS2                  | 331       | 231661  | 8505128  | GM3        | 901                           | 0.40                        | 0.49                        | 0.02                       | Second area (cleared) |
| GPS2                  | 332       | 231658  | 8505132  | GM3        | 1191                          | 0.50                        | 0.65                        | 0.02                       | Second area (cleared) |
| GPS2                  | 333       | 231653  | 8505136  | GM3        | 986                           | 0.40                        | 0.54                        | 0.02                       | Second area (cleared) |
| GPS2                  | 334       | 231649  | 8505138  | GM3        | 1372                          | 0.60                        | 0.76                        | 0.02                       | Second area (cleared) |
| GPS2                  | 335       | 231644  | 8505134  | GM3        | 834                           | 0.40                        | 0.46                        | 0.02                       | Second area (cleared) |
| GPS2                  | 336       | 231640  | 8505134  | GM3        | 795                           | 0.35                        | 0.43                        | 0.02                       | Second area (cleared) |
| GPS2                  | 337       | 231635  | 8505135  | GM3        | 1097                          | 0.50                        | 0.60                        | 0.02                       | Second area (cleared) |
| GPS2                  | 338       | 231628  | 8505136  | GM3        | 1316                          | 0.60                        | 0.72                        | 0.02                       | Second area (cleared) |
| GPS3                  | 187       | 231667  | 8505117  | GM1        | 664                           | 0.40                        | 0.36                        | 0.01                       | Pad                   |
| GPS3                  | 188       | 231659  | 8505114  | GM1        | 599                           | 0.40                        | 0.32                        | 0.01                       |                       |
| GPS3                  | 189       | 231650  | 8505117  | GM1        | 619                           | 0.40                        | 0.33                        | 0.01                       |                       |
| GPS3                  | 190       | 231645  | 8505119  | GM1        | 619                           | 0.40                        | 0.33                        | 0.01                       |                       |
| GPS3                  | 191       | 231638  | 8505122  | GM1        | 642                           | 0.35                        | 0.35                        | 0.01                       |                       |
| GPS3                  | 192       | 231631  | 8505125  | GM1        | 677                           | 0.40                        | 0.37                        | 0.01                       |                       |
| GPS3                  | 193       | 231626  | 8505123  | GM1        | 751                           | 0.45                        | 0.41                        | 0.01                       |                       |
| Top area west of pit  |           |         |          |            |                               |                             |                             |                            |                       |
| GPS2                  | 343       | 231573  | 8505172  | GM3        | 734                           | 0.35                        | 0.40                        | 0.01                       | Pad                   |
| GPS2                  | 344       | 231572  | 8505178  | GM3        | 630                           | 0.25                        | 0.34                        | 0.01                       | Pad                   |
| GPS2                  | 345       | 231562  | 8505187  | GM3        | 680                           | 0.30                        | 0.37                        | 0.01                       | Pad                   |



| GPS                  | Way<br>pt | Easting | Northing | GM<br>tube | Counts<br>100 s <sup>-1</sup> | Meas<br>μGy h <sup>-1</sup> | Calc<br>μGy h <sup>-1</sup> | +/-<br>μGy h <sup>-1</sup> | Comments |
|----------------------|-----------|---------|----------|------------|-------------------------------|-----------------------------|-----------------------------|----------------------------|----------|
| Top area west of pit |           |         |          |            |                               |                             |                             |                            |          |
| GPS3                 | 198       | 231570  | 8505165  | GM1        | 662                           | 0.40                        | 0.36                        | 0.01                       | Pad      |
| GPS3                 | 199       | 231561  | 8505171  | GM1        | 631                           | 0.35                        | 0.34                        | 0.01                       |          |
| GPS3                 | 200       | 231554  | 8505175  | GM1        | 650                           | 0.35                        | 0.35                        | 0.01                       |          |