




**Radiation Baseline  
Trekopje, Namibia**

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# *URAMIN INC*

## Radiation Baseline Survey Trekopje, Namibia

ACTION	SIGNATURE	DATE
Compiled & approved by: MJ Lalkhan Radiation Protection Specialist		

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## 1. INTRODUCTION

### 1.1 Background

UraMin Inc has acquired mining rights on properties in Botswana, Mozambique, the Central African Republic and Namibia. The project in Namibia, based at the Trekopje site, has been extensively drilled and prospected. UraMin has used both Diamond Drilling and Reverse Circulation Drilling methods to determine the extent and grade of the ore body.

ChemRad Services was originally commissioned to conduct a preliminary radiation assessment for the positioning of the prospecting camp at Trekopje. The drilling and sampling programme, which is being undertaken at the Trekopje uranium deposit, is required to establish the Definitive Feasibility Study. A baseline radiation level in the surrounding areas and on undisturbed areas of the ore body is required to determine a rehabilitation standard following prospecting and ultimately mining operations.

### 1.2 Purpose

The purpose of the survey is to establish a baseline radiation level for the prospect and surrounding areas.

### 1.3 Scope

The scope of the document is confined to the exploration operations of the Trekopje, Namibia.

## 2. SITE DESCRIPTION

The Trekopje prospect lies approximately 65 kilometres northeast of Swakopmund and was acquired by UraMin in 2005 (See Figure 1).

A radiation survey of the potential prospecting camps was undertaken in 2005 to identify a low background area for the main camp and contractors' camp. The main camp is now well established with accommodation, kitchen and mess. A small number of samples are stored in the camp area prior to shipping to the assay laboratories along with some cores but the majority of samples are stored in a designated sample storage area (see Figures 2 and 3).

The site has been extensively drilled using diamond drills and percussion drills. Several trenching trials have been conducted and the areas around the trenches and holes are well secured and managed (see Figures 4, 5 and 6). Construction of heap leach pads has commenced and trial mining will begin soon.



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**Figure 1 - Location of Trekkopje site in Namibia**



**Figure 2 - Samples stored at camp prior to dispatch**



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**Figure 3 - Sample Storage Area**



**Figure 4 - Fenced Trial Trench**





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**Figure 5 - Ore Sample from Trench**



**Figure 6 - Drill Collar**

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### 3. NUCLEAR LEGISLATION

Prior to Namibia's independence the uranium industry in Namibia applied the South African legislated standards on Radiation Protection. Following independence Namibia has continued applying these standards pending the promulgation of the Atomic Energy and Radiation Protection Bill. The Bill provides for the establishment of a Namibian Atomic Energy Board and a National Radiation Protection Authority. The Bill was tabled in the National Assembly of Namibia in February 2005. However until the Board and the Authority are established and operational it is likely that a combination of the International Atomic Energy Agency (IAEA) standards and the South African legislation will be applied.

Namibia, as a signatory of the United Nations Charter, is obligated to comply with the IAEA regulations pertaining to radiation protection. However signatories can apply more rigid standards if deemed to be necessary. The current IAEA regulations are contained in the Basic Safety Standard (BSS-115) entitled "International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources"

In terms of the IAEA regulations Radiation Protection measures are implemented when the specific activity of the ore exceeds the Exemption Levels as outlined in Schedule 1 of the BSS. For uranium and its daughter nuclides the exemption level is 1Bq/g, which is approximately equivalent to a uranium grade of 95ppm (as  $U_3O_8$ ).


The uranium grades in the Trekopje deposits are expected to be on average 100ppm with a maximum concentration of 1 000ppm and as such the operation requires radiological protection measures in terms of the IAEA Basic Safety Standards. In the Standards dose limits are laid down for workers and for the public as follows:-

- 1 milliSievert per annum (mSv/a) for a member of the public
- 20mSv/a for a worker
  - averaged over 5 years with a maximum of 50mSv in any one year

Recently Namibia has implemented a moratorium on new uranium exploration licences in an attempt to bring order to the sector.

Rehabilitation limits have not yet been set for Namibia for prospects or for mining activities, however it is expected that International standards will be followed.

The Canadian guidelines recommend that drill sites be cleaned to 1 $\mu$ Sv/h at a height of 1m. However, previous surveys have indicated that there are undisturbed areas with doses in the order of, or higher than, this level. The guideline also recommends that cores that have a uranium content in excess of 0.05%  $U_3O_8$  be disposed of down the hole.

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## 4. RADIATION ASSESSMENT

### 4.1 Methodology

#### 4.1.1 Survey

The baseline for the ore body has been laid out by a surveyor and was used to determine the drilling grid. A gamma survey along the road from the gate to the camp was taken to identify any “hot spots” off the prospect area. Gamma surveys were then conducted along the base line adjacent to the drill collars.

Due to the large area of the prospect and the length (35km) of the baseline the assessment was conducted using an Exploranium GR-130 hand-portable surveying gamma ray spectrometer mounted on a four wheel drive ATV. The GR-130 is manufactured by Exploranium Detection Systems of Canada and comprises a 74cm<sup>3</sup> sodium iodide volume detector with an integral photo-multiplier tube and provides the following functions:

- Locates radioactive materials, recording the activity in counts per second (cps).
  - A count rate of 340cps approximates with the legislated activity limit for South Africa of 0.5Bq/g (on large samples of ca. 200kg on a semi-infinite source)
- Identifies the radionuclides present
- Measures the external dose received by exposure to a radioactive material.

## 5. RESULTS

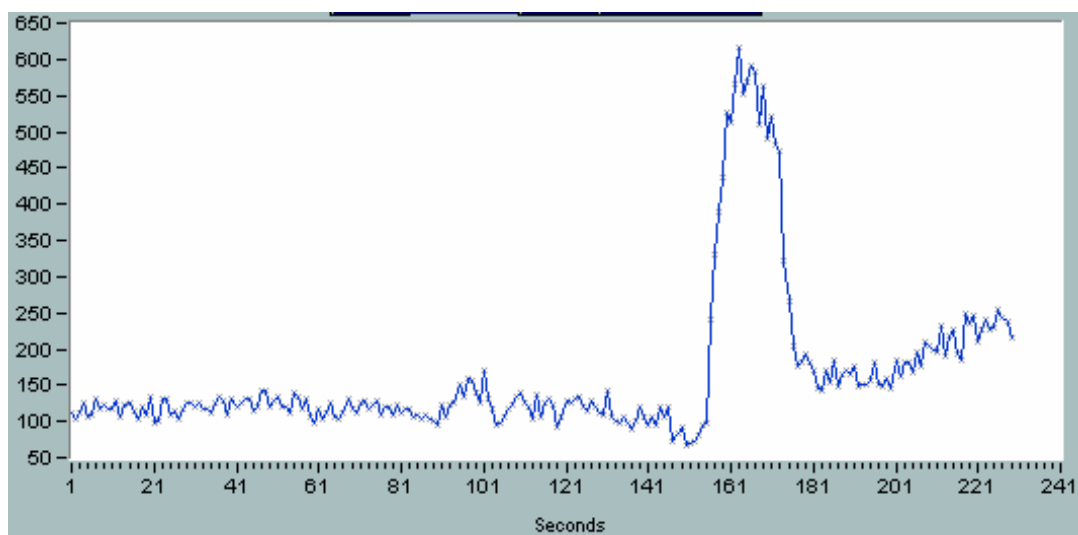
### 5.1 External Gamma Ray Survey

The Exploranium Gamma spectrometer was set to measure gamma ray levels in counts per second (cps). During the survey several high gamma readings were obtained. The gamma radiation levels at these high points were measured to determine the variation in the radiation levels both on and off the prospect

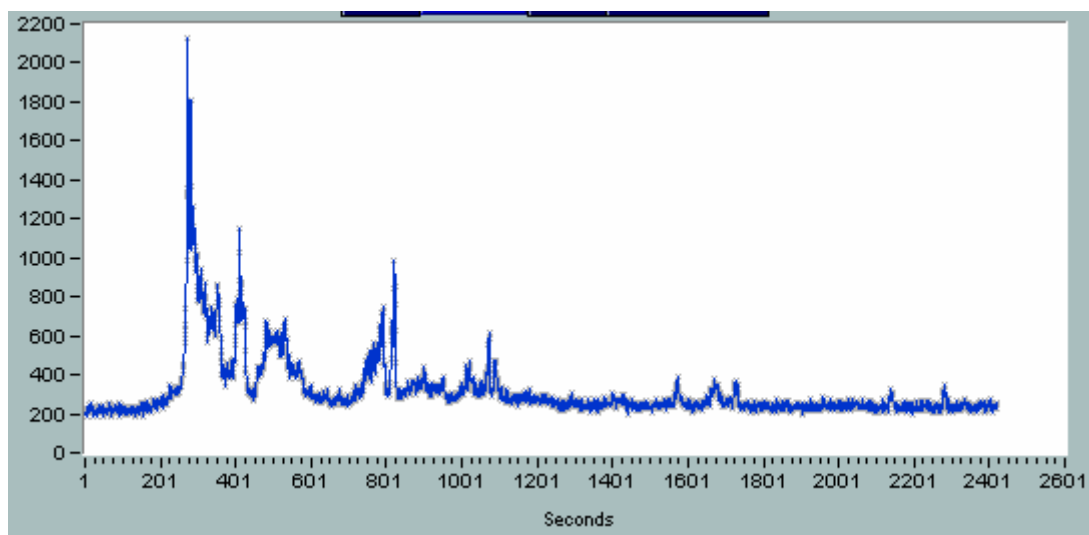
Gamma dose rate measurements taken at the camp are all still consistent with background (in the order of 0.08μSv/h). No contamination appears to have occurred within the camp, however, some of the samples exhibit radiation doses above the IAEA Public Dose Limit. All UraMin workers are classified as Occupationally Exposed Persons and as such are monitored using ThermoLuminescent Dosimeters (TLDs). No doses have been recorded above the minimum detection limit of 0.15mSv for the TLDs during the monitoring period which commenced in July 2006.

The background gamma ray levels were measured at the gate to the Trekopje site. A count rate in counts per second (cps) of between 80 and 120 was measured and is consistent with the normal background of the instrument. However, a few metres from the gate along the fence line a hot spot was found where the ground had been disturbed for the fence poles. The highest measured count rate of around 625cps equates to a specific activity of uranium of about 1Bq/g (the IAEA exemption level for Uranium). The waypoint for the gate is S22.28329° / E15.09469° on a dd.ddddd° grid and using the WGS 84 datum.

The road was then driven slowly (between 5 and 10kph) and the gamma ray levels measured between the gate and the camp. The average count rate along the road was between 200cps and 250cps; however, several high spots were measured ranging between 800cps and 2100cps. Where the high spots were measured on the road, gamma ray measurements were taken off the road on undisturbed ground and in almost all cases the high readings extended into the undisturbed ground (see Figure 7 and 8).



**Figure 7 - Gamma Ray levels at the Gate**

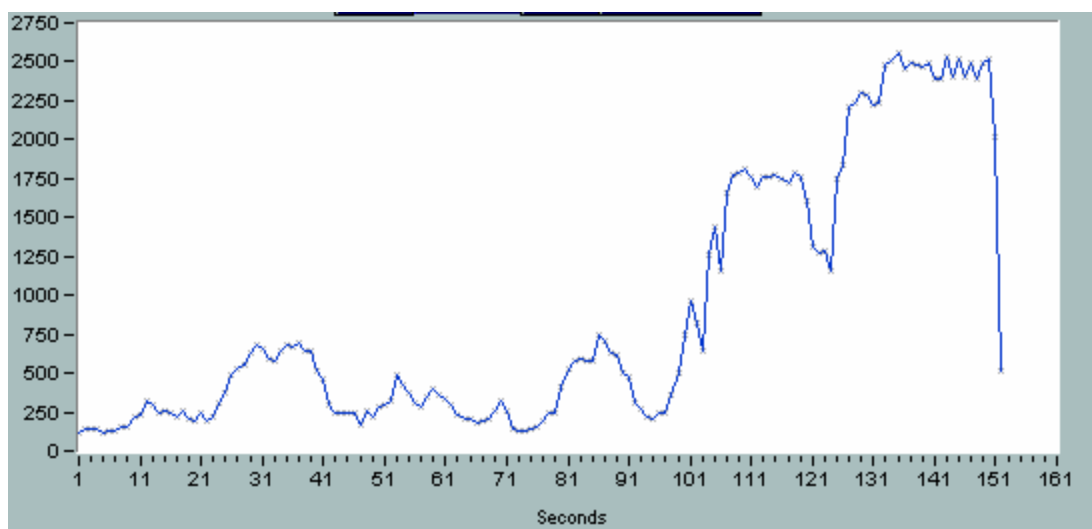


**Figure 8 - Gamma Ray Levels from the Gate to the camp**

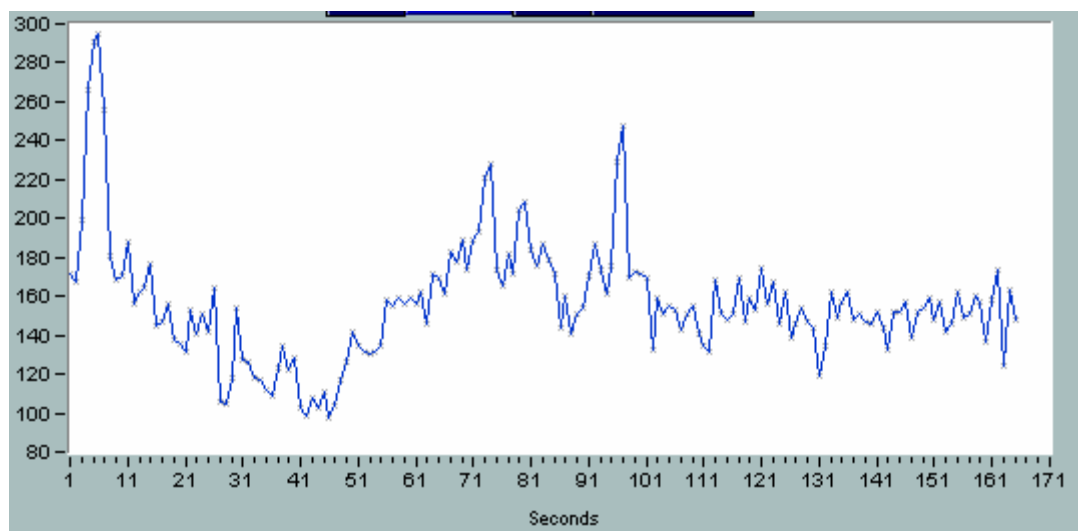


Gamma ray levels measured around the camp were generally low as indicated in the survey conducted in 2005. Some samples are stored in the camp and elevated gamma ray readings were measured around the samples with the highest reading being on being on Sample TP2-0451- 0456 at 2500cps. Some chip samples are stored in a container on the site and although the gamma ray levels are low this may present a radon hazard.

Gamma radiation on the cores that are stored in the camp are low with count rates in the range of 100cps to 300cps (See Figures 9 and 10).

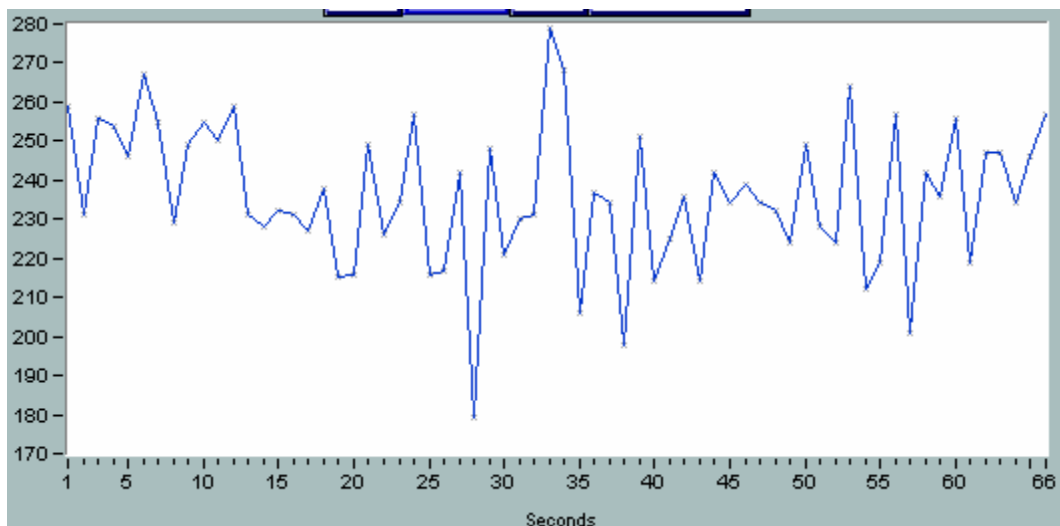


**Figure 9 -Gamma ray Levels on Samples in the Camp**



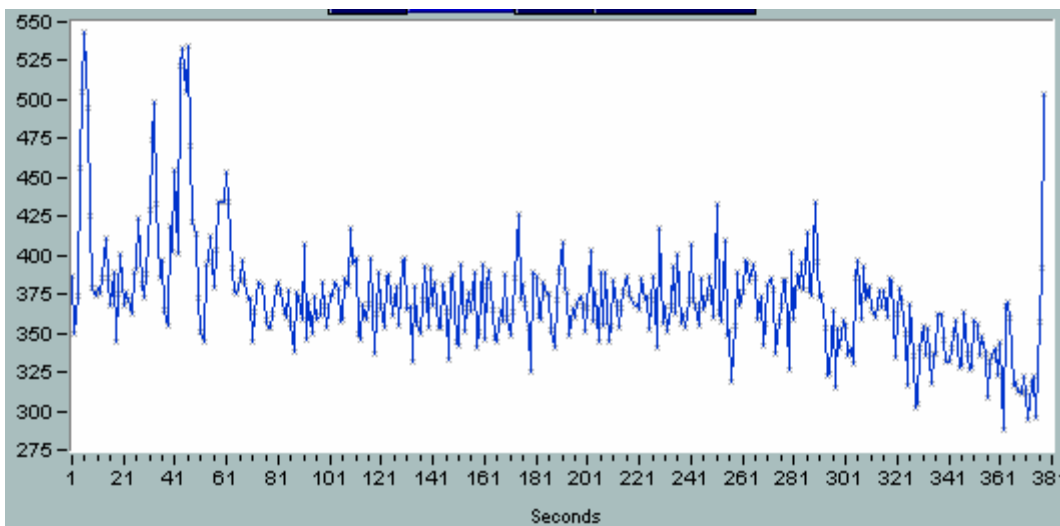
**Figure 10 - Gamma ray levels on Diamond Drilling Cores**

Gamma ray levels around the borehole collars indicate that no surface contamination has occurred as a result of the prospecting activities (see Figure 11).



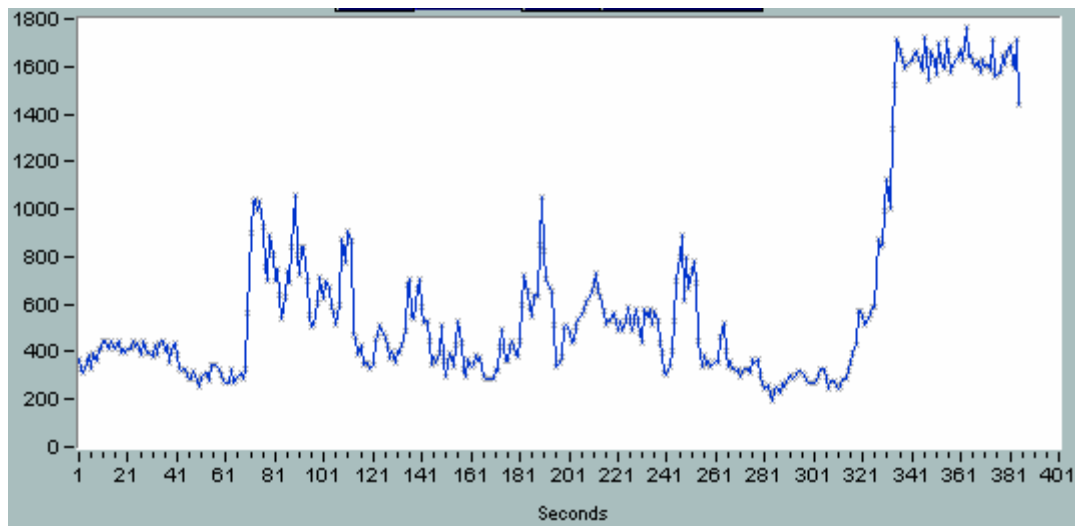
**Figure 11 - Gamma Ray Levels around Borehole**

Where trenching has been done and the ore body has been exposed and ore deposited on the surface higher activity levels are measured. The controls in place, however are extremely good and the areas are fenced and access is limited (see Figure 12).



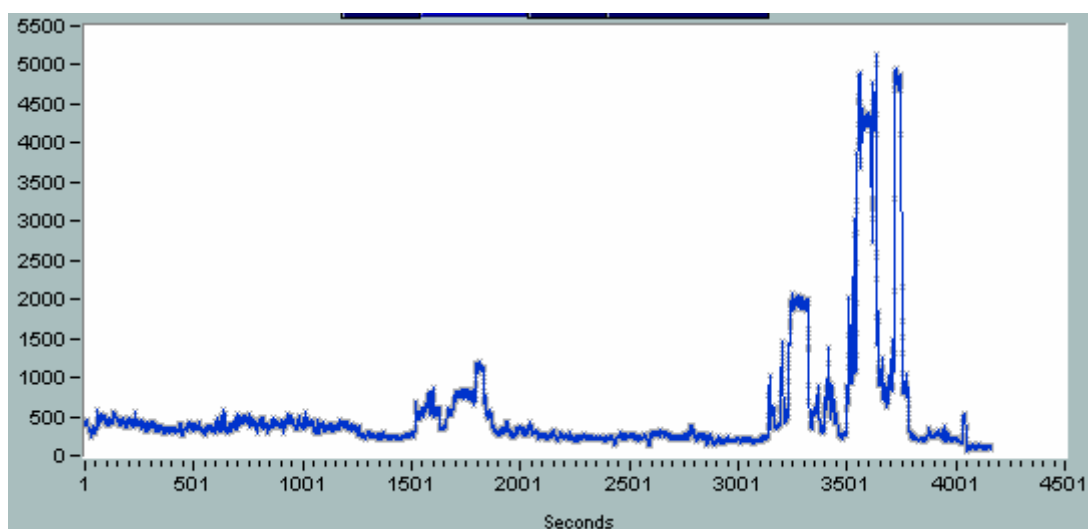
**Figure 12 - Gamma Ray levels around Trench and excavated material**

The sample storage area is well controlled and older samples are covered with tarpaulin. The gamma ray levels around the sample store area are elevated but the area is remote from the camp and is a low occupancy area. Several of the recent samples exhibit high gamma ray activity and radiation dose of 0.93 $\mu$ Sv/h which exceeds the IAEA dose limit for members of the public. All workers in contact with these samples are designated as occupationally exposed persons and are monitored using TLDs (see Figure 13).



**Figure 13 - Gamma ray Levels around Sample Store**

A gamma survey adjacent to the drill baseline indicates that the general background is in the order of 300cps to 400cps apart from areas where trenching has taken place where much higher gamma ray levels are seen on the exposed ore body (see Figures 14 to 17). The exposed material is well controlled and physical security is in place around each of the trenched areas.



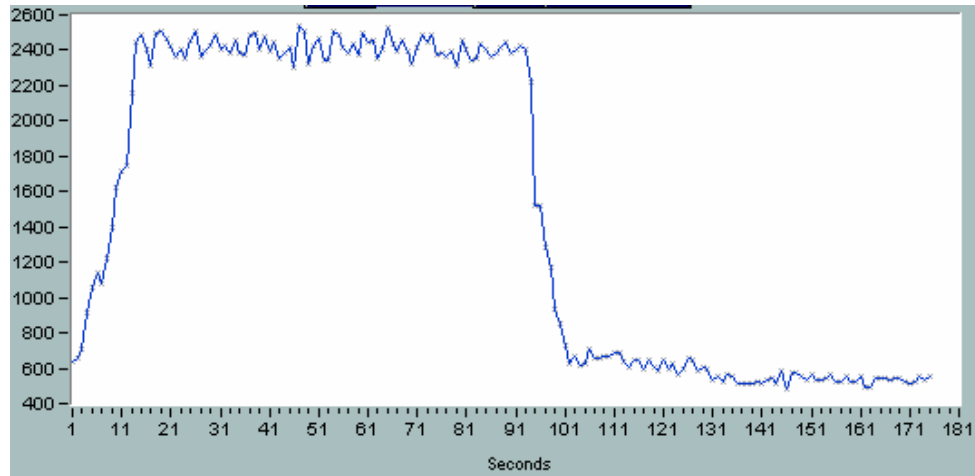
**Figure 14 - Gamma Ray Levels Adjacent to Baseline WP 001 to WP 028**



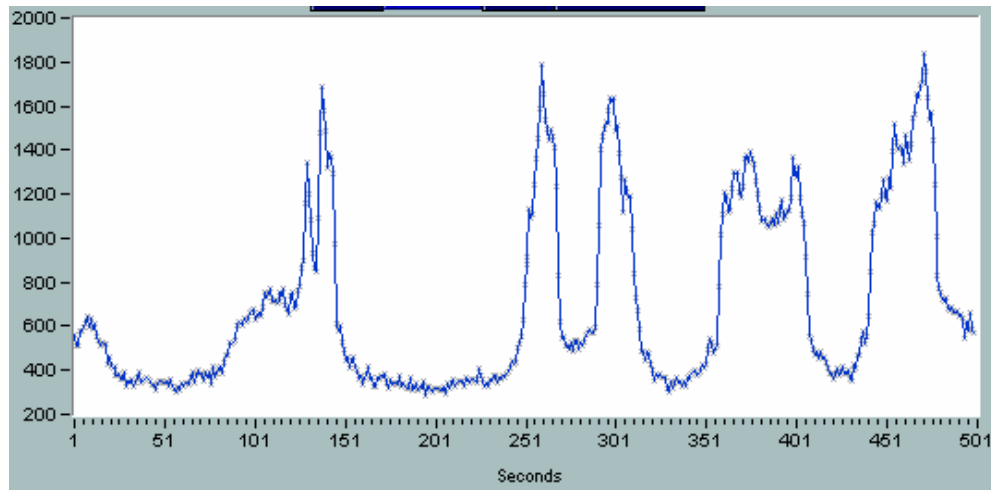
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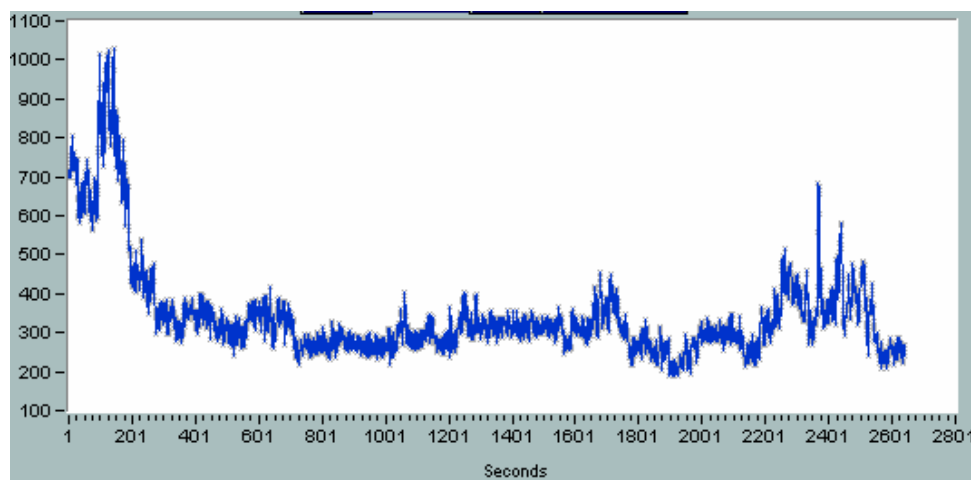
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**Figure 15 - Gamma Ray Levels on Large Trench Trial**




**Figure 16 - Gamma Ray Levels around Open Trench**



**Figure 17 -Gamma Ray Levels along Baseline WP049 to WP078**



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## 6. DISCUSSION & CONCLUSIONS

Gamma ray measurements on undisturbed areas of the prospect were found to be naturally elevated compared with normal background radiation levels. In several areas, which are considered to be off the ore body, radiation levels were found that exceeded the levels found on the prospect.

Rehabilitation criteria for the site would be to return the site to natural background levels for the area however, following mining it is likely that the rehabilitation will reduce the ambient gamma ray levels for the area. If mining does not go ahead all trenches should be filled and covered with low activity material from the adjacent area so as to give a gamma dose level of less than 1 $\mu$ Sv/h. All cores remaining on-site must be disposed of down the holes.