









## Analysis of Aerial Radiological Data of the District of Columbia

The enclosed file contains aerial radiological data that were collected with a twin-engine Bell 412 helicopter covering approximately 70 square miles over the District of Columbia from 31 December 2012 through 10 January 2013. The data were collected with an array of thallium activated sodium iodide (NaI(Tl)) crystals. The array was comprised of twelve 2"x4"x16" crystals (2 liters).

This KMZ file contains the gamma exposure rate derived from the total gross count rate measured at helicopter flight altitude of approximately 150 feet (45.72 meters) above ground level. Corrections were applied to the total gross count rate to remove non-terrestrial background, air attenuation, and to convert the resulting net counts to a nominal ground-level exposure rate. The data have been colored based exposure rate ranges. The ranges for the different colors are indicated below.

Gross Counts in Exposure	
	$\mu\text{R/hr}$
	<1.5
	1.5 - 3.0
	3.0 - 4.5
	4.5 - 6.0
	6.0 - 7.5
	7.5 - 9.0
	9.0 - 10.5
	10.5 - 12.0

The radiation background survey carried out over downtown District of Columbia shows variations in the data typical of natural background radiation. The measured values varied from 0 to 12  $\mu\text{R/hr}$  with radon and cosmic contributions removed.

## Exposure Rate Derived from Measured Gross Counts

The estimated gamma wide-area exposure rate was derived from the total gross count rate measured at helicopter flight altitude.

Adjustments were applied for an altitude correction based on the actual aircraft height above ground. This number is multiplied by the Gross Count Rate minus the average flight Background. A conversion is then applied to convert the adjusted Gross Counts to an exposure rate at 3.28 feet (1 meter). The conversion number is obtained by averaging multiple ground measurements from the survey area and correlating the ground to the aerial measurements. This equation is applied to each measured point.

Mathematically, the exposure rate relation may be written as:

$$E = \frac{1}{\alpha} (G - B) e^{\mu(z - z_0)}$$

Where we have:

$E [\mu R / hr]$   $\equiv$  Estimated exposure rate at 3.28 feet (1 meter) AGL

$G [cps]$   $\equiv$  Gross count rate measured at flight altitude

$B [cps]$   $\equiv$  Background count rate from aircraft, radon, and cosmic radiation

$z [ft]$   $\equiv$  Instantaneous aircraft altitude AGL measured by radar altimeter

$z_0 [ft]$   $\equiv$  Nominal survey altitude

$\mu [ft^{-1}]$   $\equiv$  Mean air attenuation (altitude correction) coefficient

$\alpha \left[ \frac{cps}{\mu R / hr} \right]$   $\equiv$  Conversion coefficient used to convert from gross counts at the nominal flight altitude to exposure rate at 3.28 feet (1 meter) AGL